

# The ultrasonographic examination of the carpus

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Diagnostic Mindset



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## Objectives


High resolution US is available and has improved the possibility to scan distal MSK structures

Knowledge of anatomy and biomechanics forces increases the planning for treatment

A systematic approach is needed

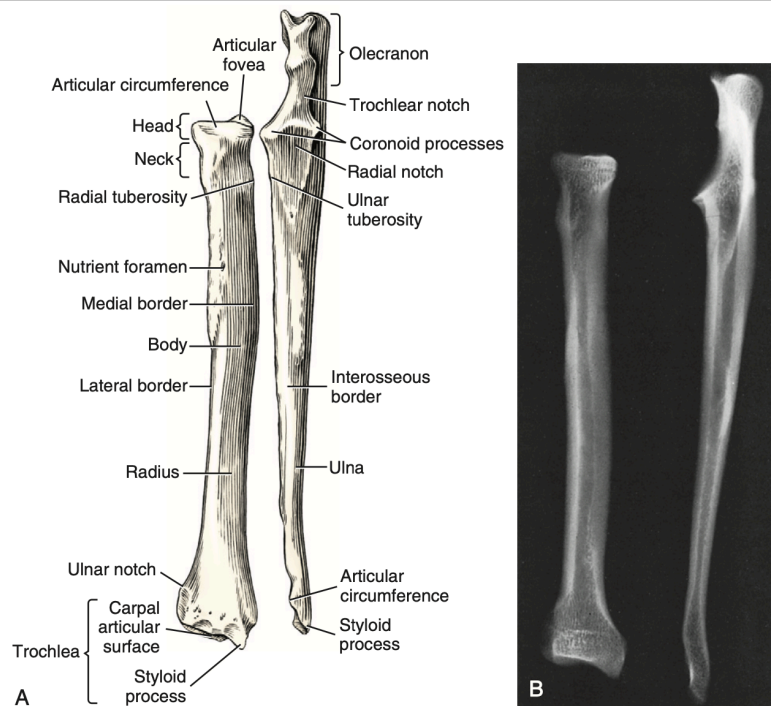


# High-Resolution Ultrasonographic Anatomy of the Carpal Tendons of Sporting Border Collies

Maria Grazia Entani <sup>1</sup>, Alessio Franini <sup>1</sup> , Gabriele Barella <sup>2</sup>, Roberta Saleri <sup>3</sup>, Fabio De Rensis <sup>3</sup> and Giliola Spattini <sup>4,\*</sup>

Canine sports are on the rise, and sport-related injuries have been increasingly noted. In a survey on **Racing Greyhounds**, the rate of **carpal injuries reached 17%**; in marathon sled dogs, shoulder and carpal injuries are commonly encountered [5,6]. In 2013, Cullen et al. provided data regarding the nature of the injuries in dogs involved in high-level agility competitions. They found that **7% of 1602 agility-related injuries** were located in the **carpus** [7]. The workload on forelimbs during sports activities and the number of carpal injuries described in canine athletes suggest that the carpal joint can undergo significant load stress during the athletic gesture.

Canine bodyweight is unequally distributed between the forelimbs and the hindlimbs during unimpeded walking, with approximately 60% of the vertical force exerted on the forelimbs. When trotting, more than the dog's entire body weight is carried by a single forelimb. It increases to over twice the body weight during a gallop. In fact, as reported in a previously published paper regarding ground reaction forces, a galloping Labrador Retriever sustains 2.6 times its body weight on the forelimbs while trotting at 27 km/h. Regarding agility activity, the literature suggests **that more than 4.5 times body weight is borne by the forelimbs in hurdle jumps landing during agility tracks** [8,9]. Diagnosing



**FIGURE 4-102** **A**, Left radius, caudal surface. Left ulna, cranial surface. **B**, Craniocaudal radiograph, left radius and ulna disarticulated.

## Ultrasonographic anatomy of the dorsal region of the carpus of the dog

Sonia González-Rellán<sup>1</sup> | Patricia Fdz-de-Trocóniz<sup>1</sup> | Andrés Barreiro<sup>1,2</sup>

## Ultrasonographic anatomy of the palmar region of the carpus of the dog

Sonia González-Rellán<sup>1</sup> | Patricia Fdz-de-Trocóniz<sup>1</sup> | Andrés Barreiro<sup>1,2</sup>



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Article

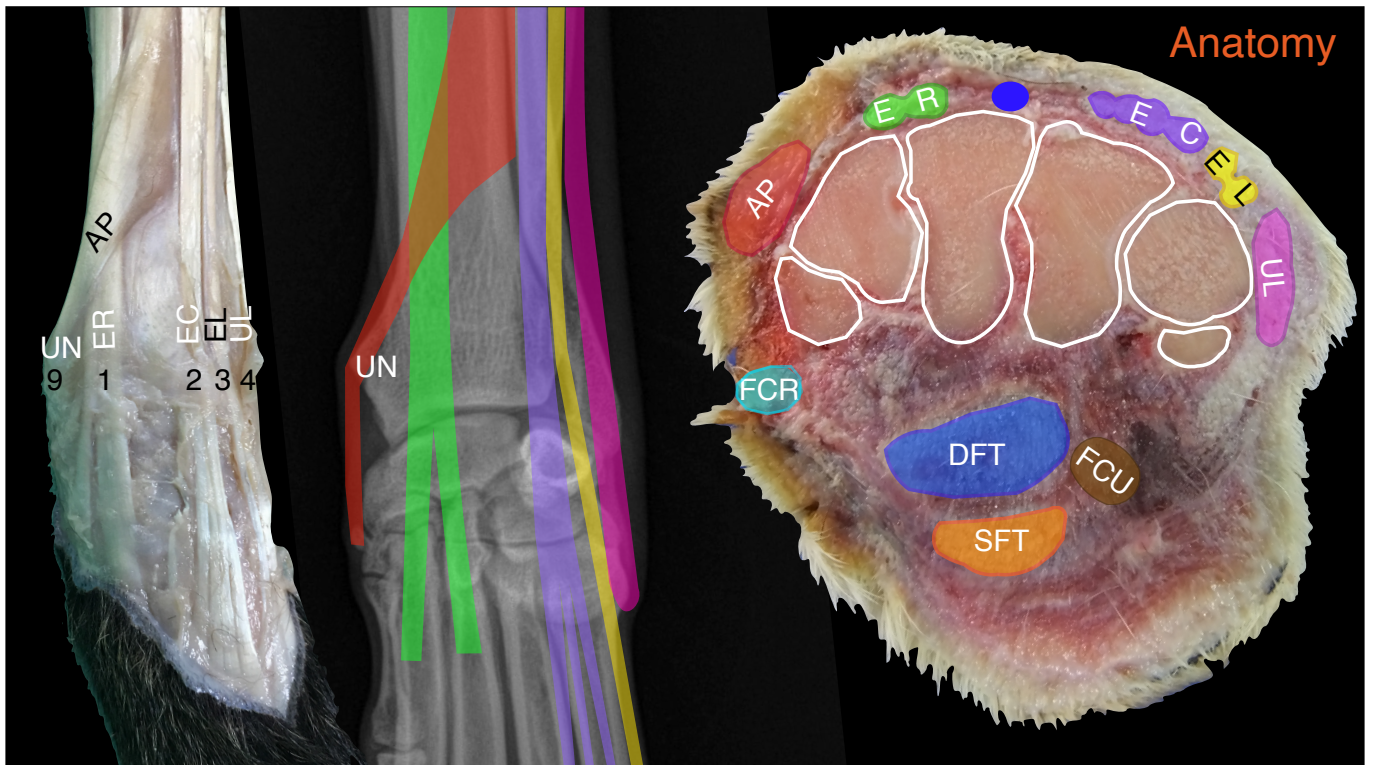
## Anatomy of the Palmar Region of the Carpus of the Dog

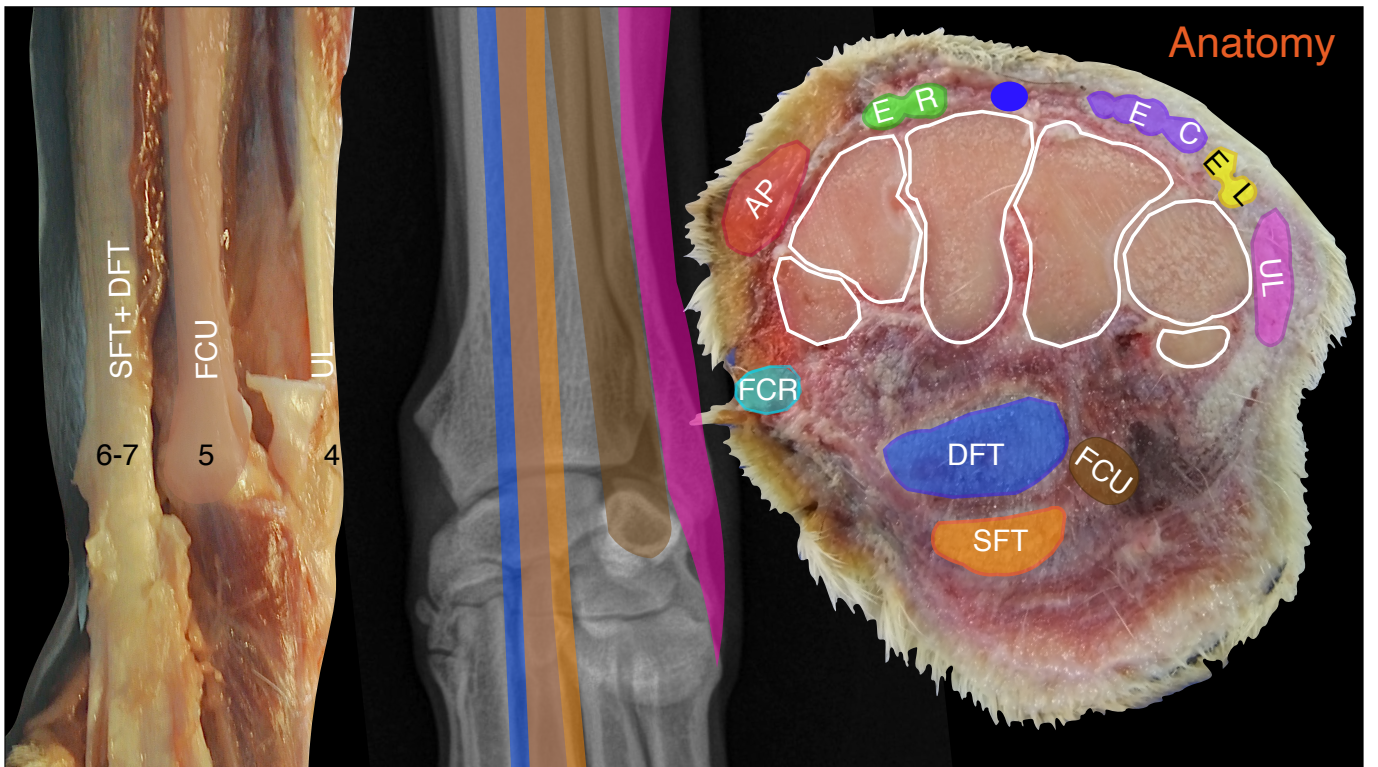
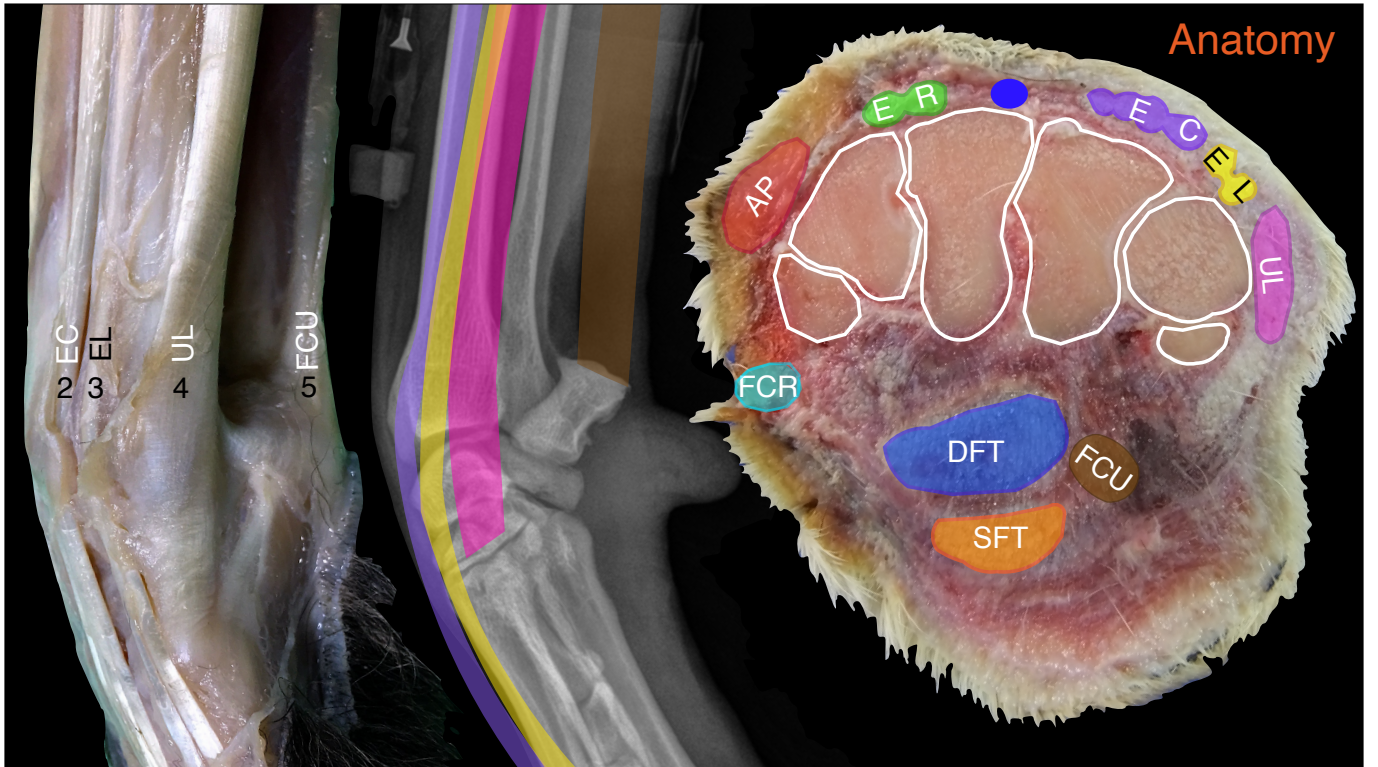
Sonia González-Rellán<sup>1,\*</sup>, Andrés Barreiro<sup>1,2</sup>, José Manuel Cifuentes<sup>1</sup> and Patricia Fdz-de-Trocóniz<sup>1</sup>

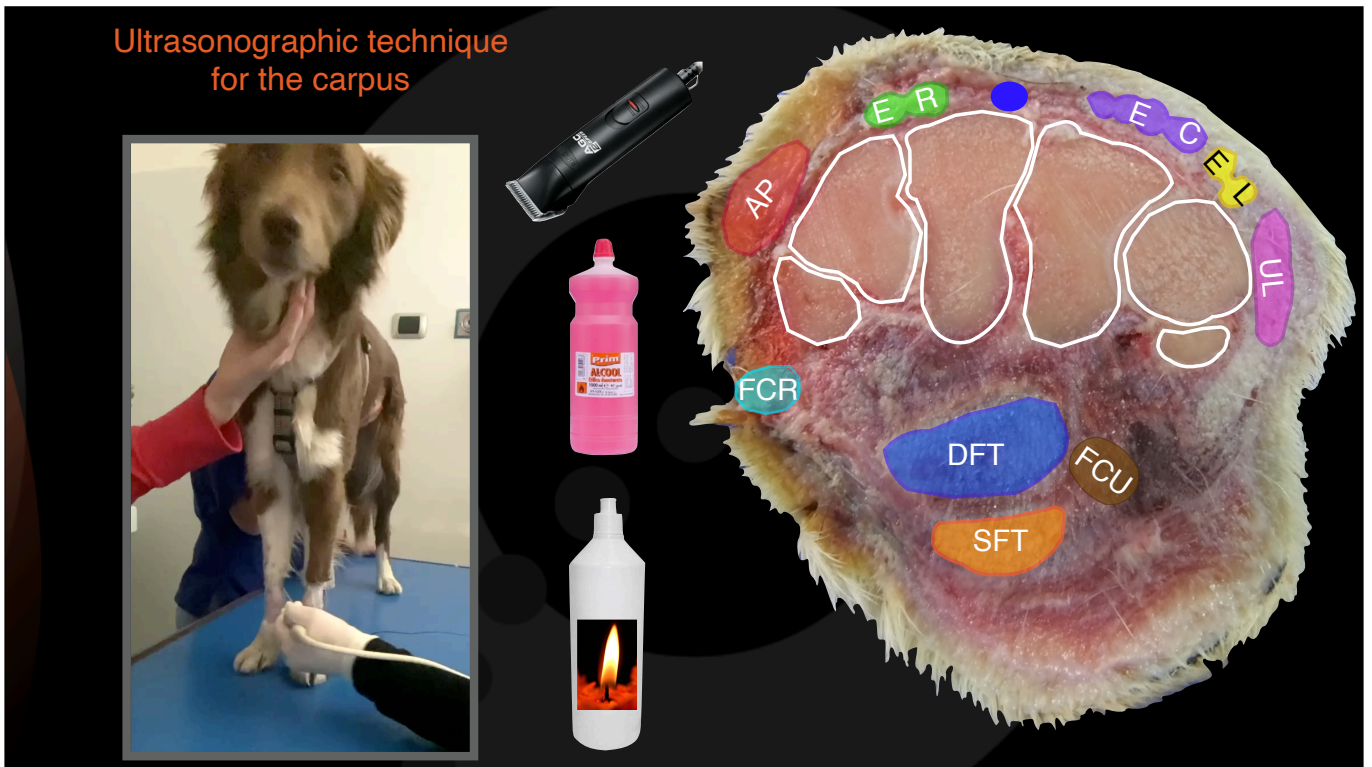
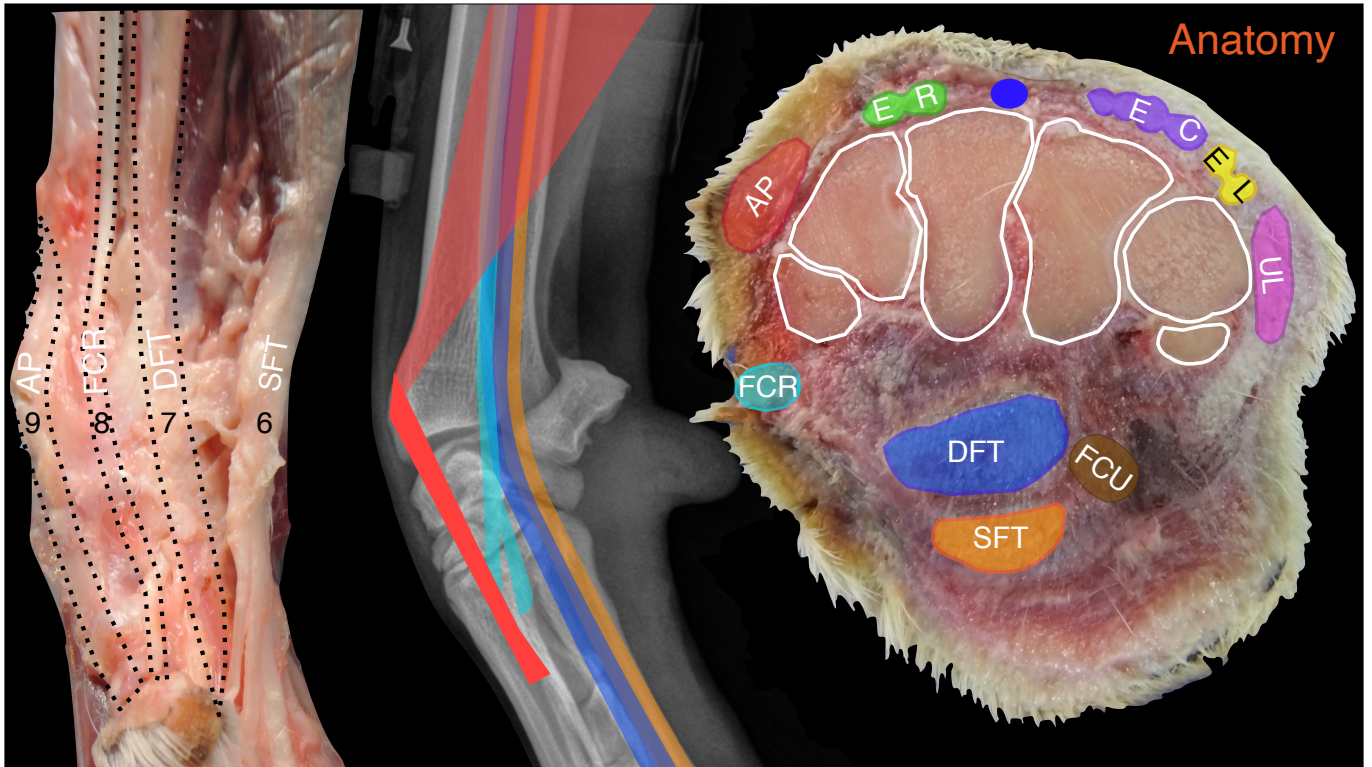
<sup>1</sup> Department of Anatomy, Animal Production and Clinical Veterinary Science, University of Santiago de Compostela, 27002 Lugo, Spain; andres.barreiro@usc.es (A.B.); m.cifuentes@usc.es (J.M.C.); patricia.troconiz@usc.es (P.F.-d.-T.)

<sup>2</sup> Rof Codina Veterinary University Hospital, 27002 Lugo, Spain

\* Correspondence: sonia.gonzalez.rellan@gmail.com

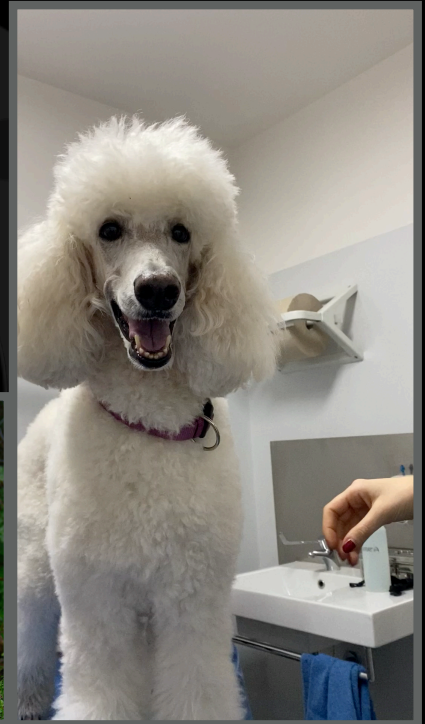






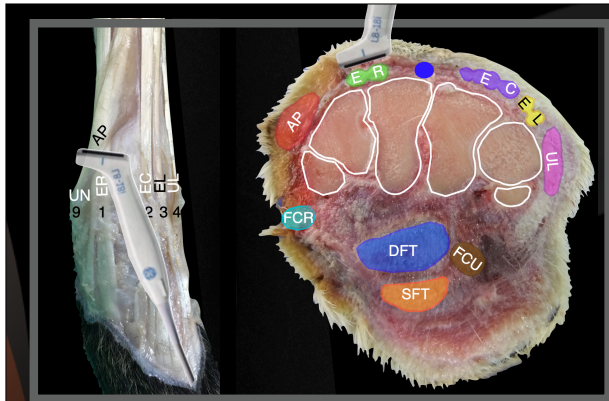
Maky, Giant poodle, FS, 6 years

- Acute NWB lameness and right carpus swelling after agility trauma
- Negative radiographs
- Getting better but still swollen later



Maky, FS, 6 years



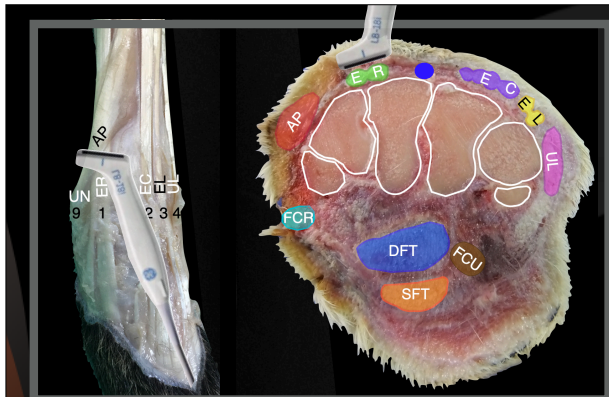
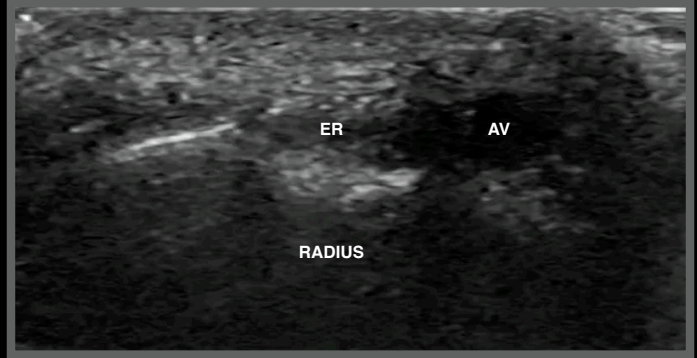


Maky, FS, 6 years

Left carpus

Extensor Carpi Radialis transverse scan

1

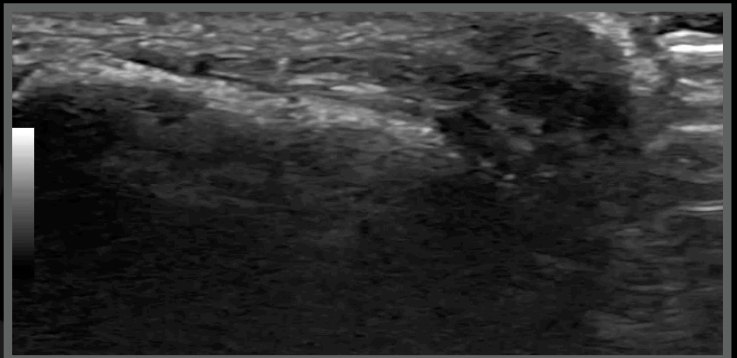


Maky, FS, 6 years

Right carpus

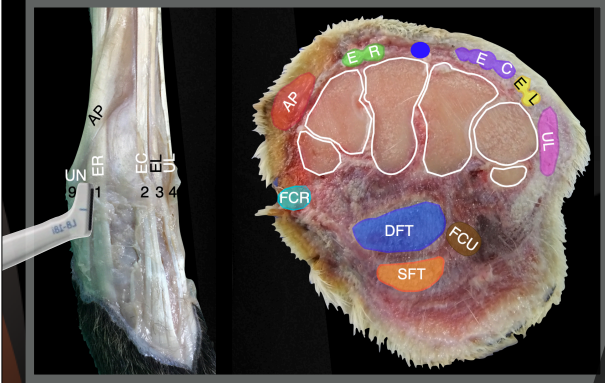
Extensor Carpi Radialis transverse scan

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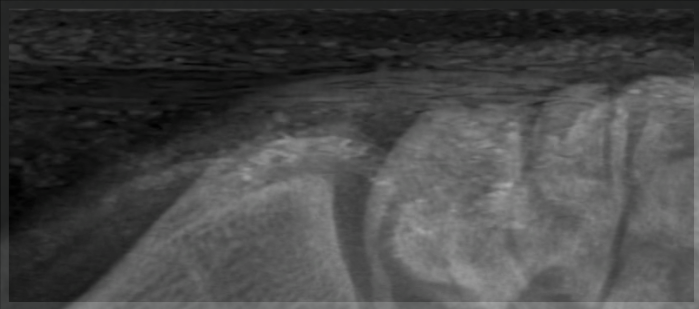
Maky, FS, 6 years

Left carpus



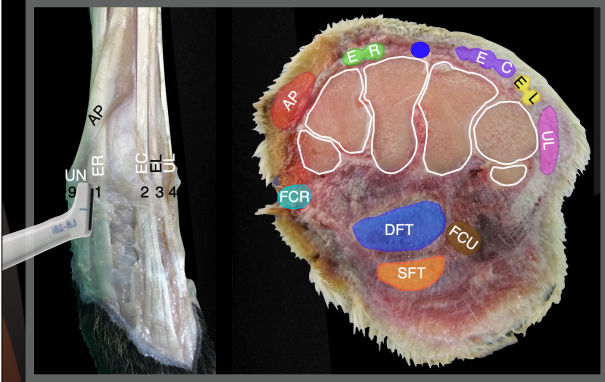
Extensor Carpi Radialis longitudinal scan

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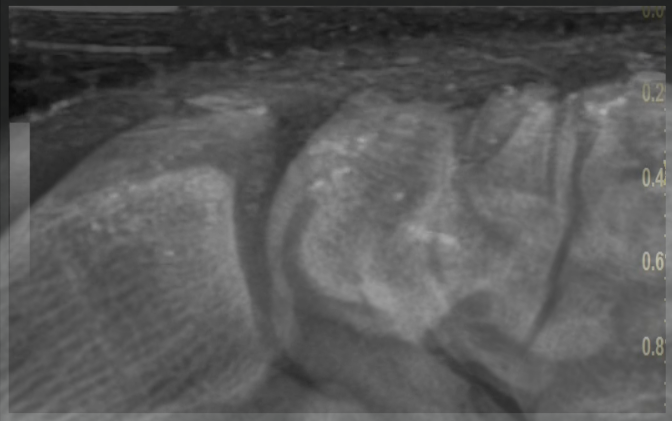
Maky, FS, 6 years

Right carpus



Extensor Carpi Radialis longitudinal scan

1





# Maky, Giant poodle, FS, 6 years

## Extensor Carpi Radialis

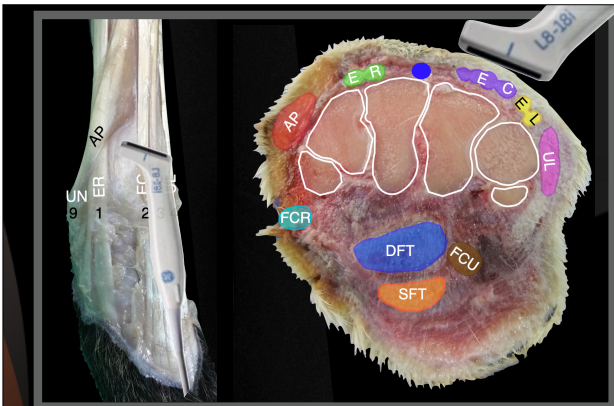
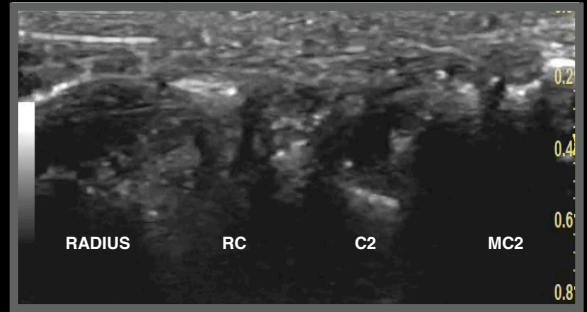
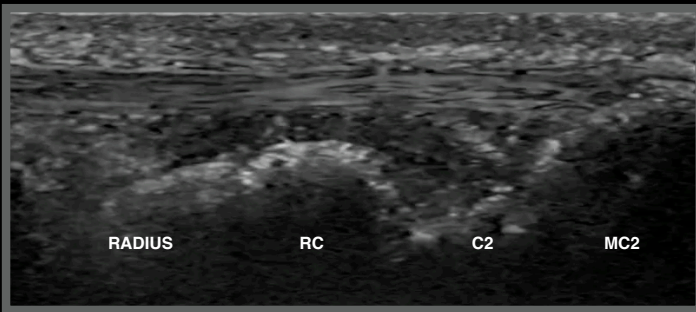


Left carpus

1

Right carpus

1

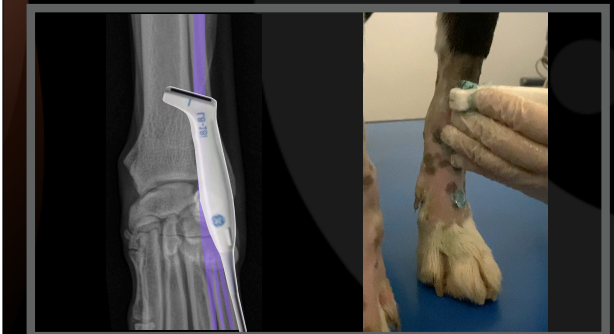
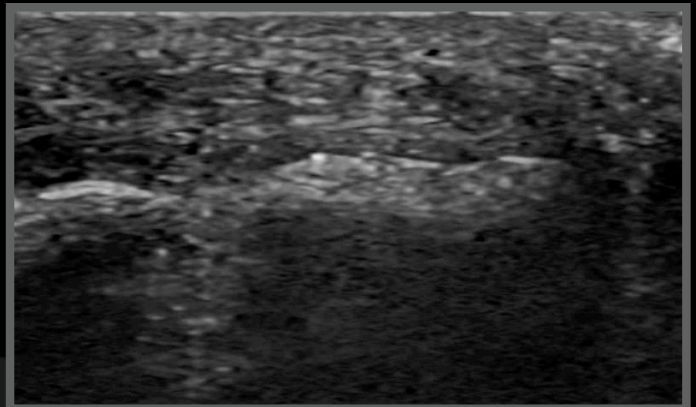


# Maky, FS, 6 years

## Left carpus

Extensor Digitorum Communis transverse scan

2

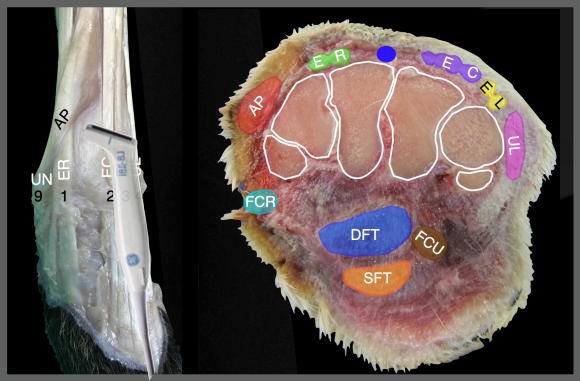
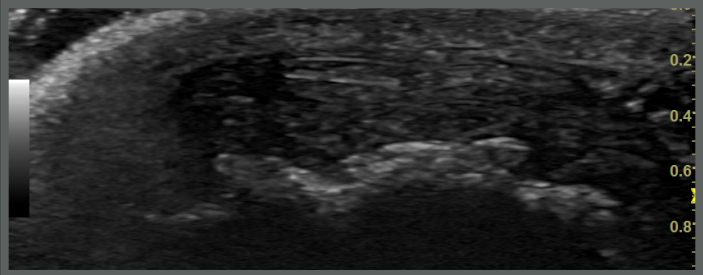


Maky, FS, 6 years

Right carpus

Extensor Digitorum Communis transverse scan

2

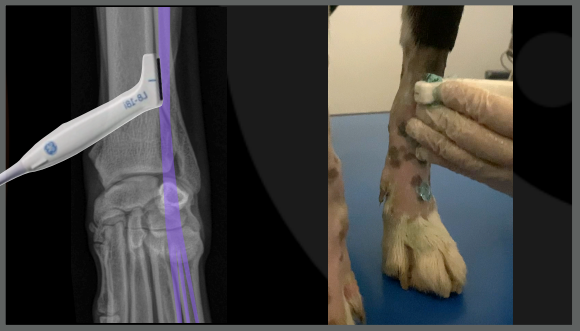
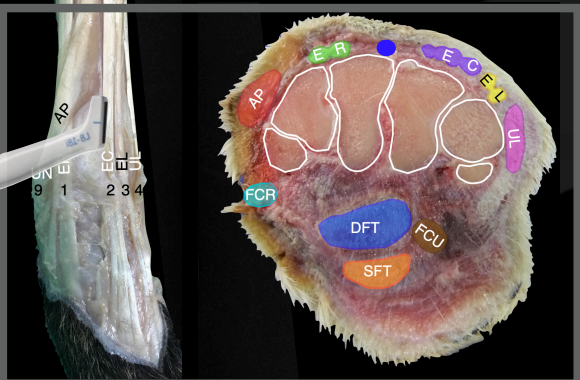
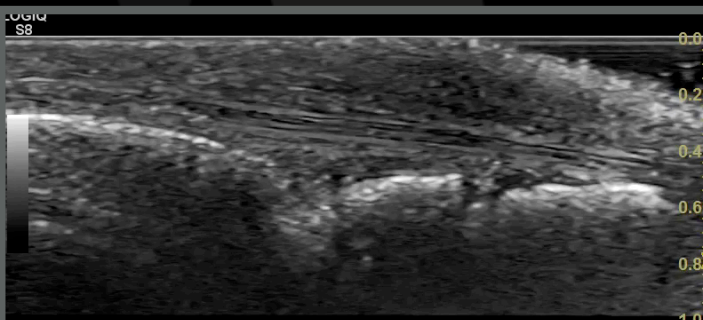


Maky, FS, 6 years

Left carpus

Extensor Digitorum Communis longitudinal scan

2

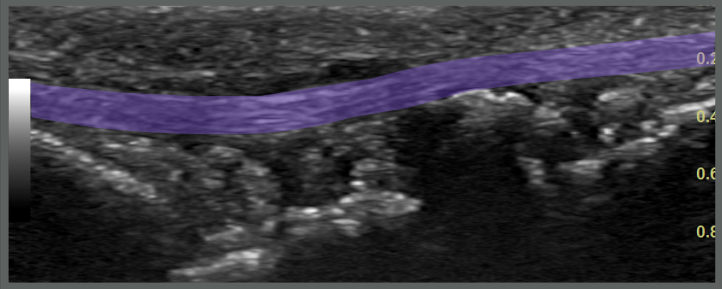
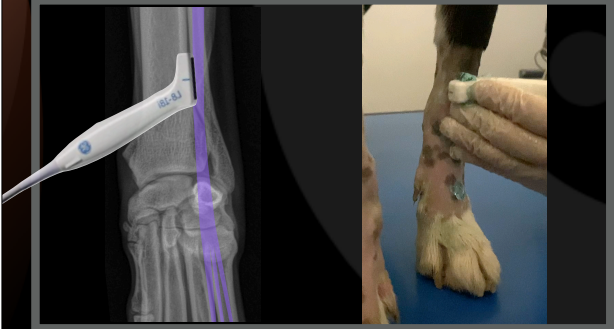
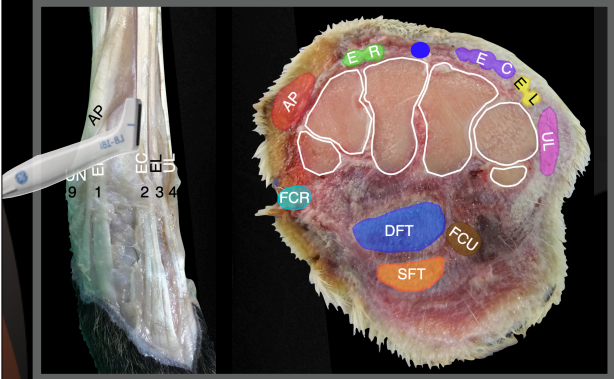


Maky, FS, 6 years

Right carpus

Extensor Digitorum Communis longitudinal scan

2



Maky, Giant poodle, FS, 6 years

Extensor Digitorum Communis

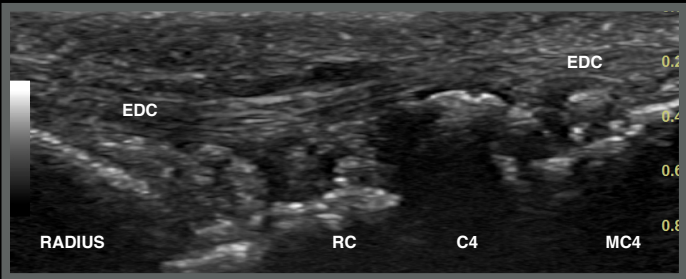
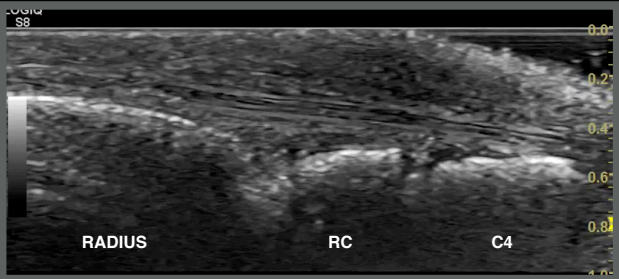


Left carpus

2

Right carpus

2

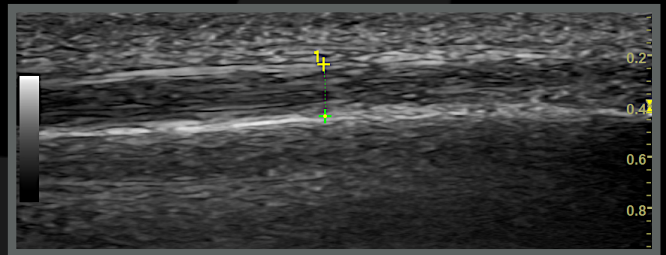
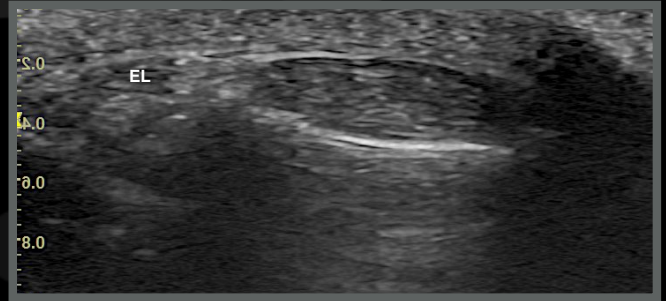
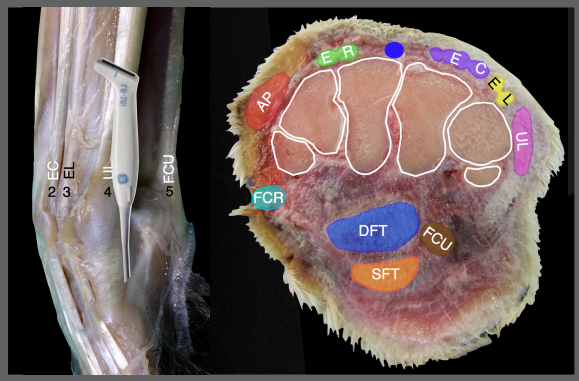


Maky, FS, 6 years

Left carpus

Ulnaris lateralis transverse and longitudinal scan

4

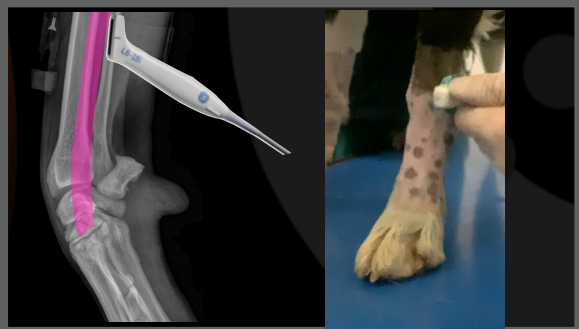
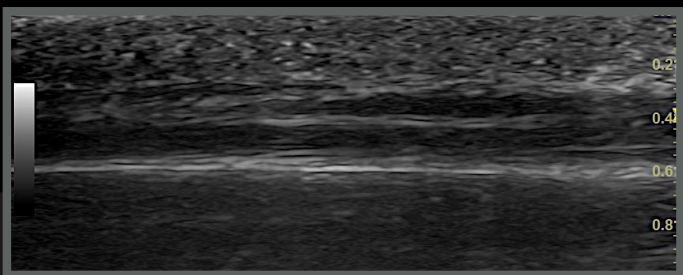
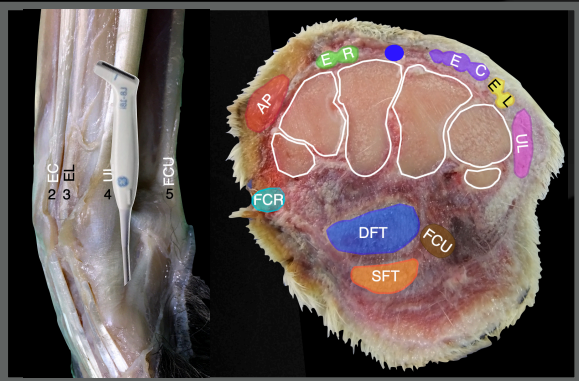


Maky, FS, 6 years

Right carpus

Ulnaris lateralis transverse and longitudinal scan

4





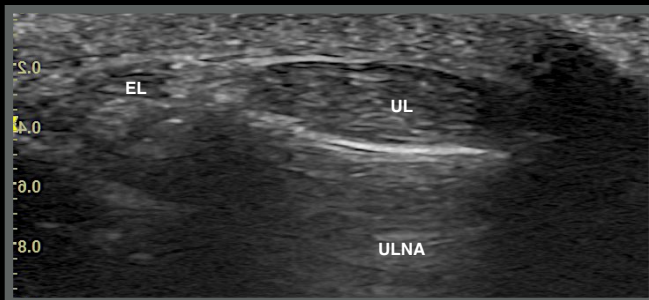
# Maky, Giant poodle, FS, 6 years

Ulnaris lateralis



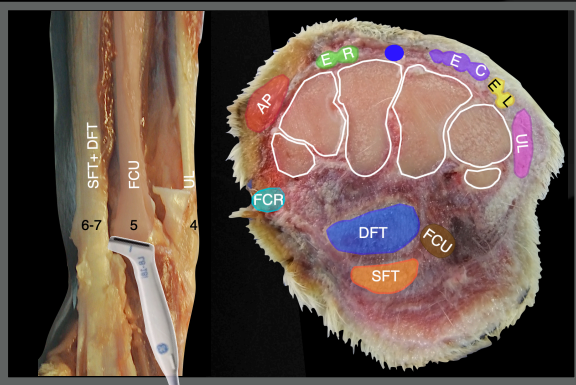
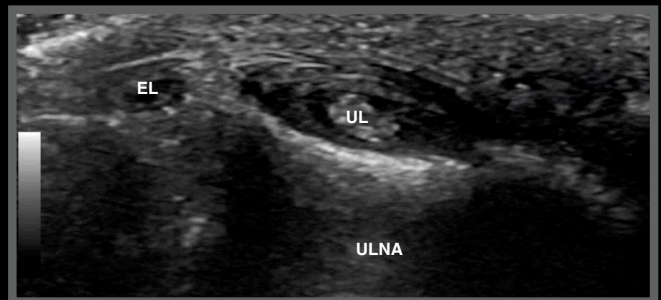
Left carpus

4



Right carpus

4

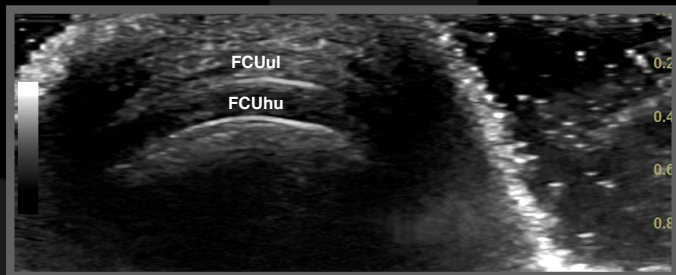
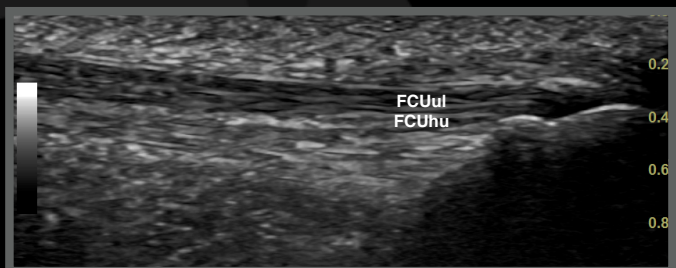


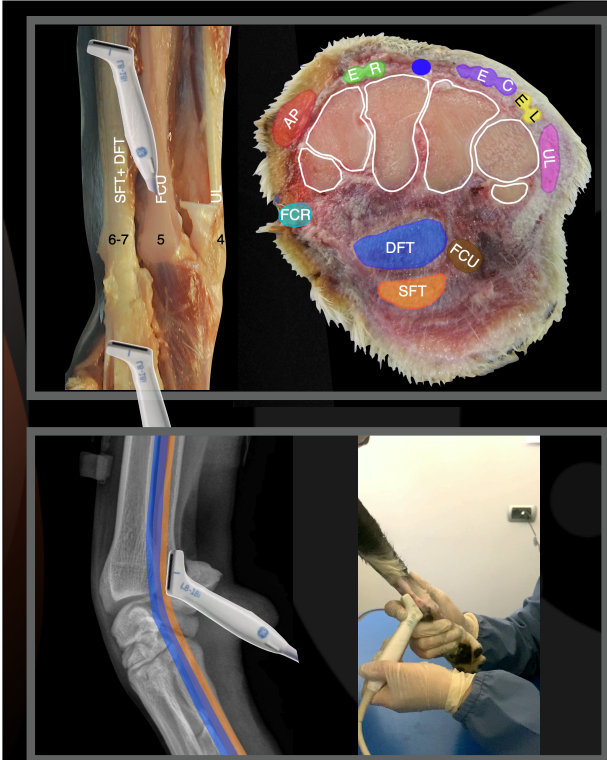
# Maky, FS, 6 years

Right and left carpus

Flexor Carpi Ulnaris transverse and longitudinal scan

5



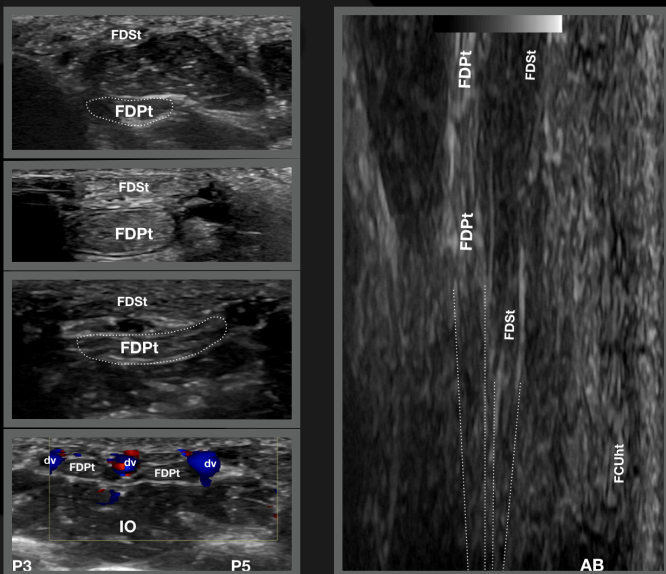


**Maky, FS, 6 years**

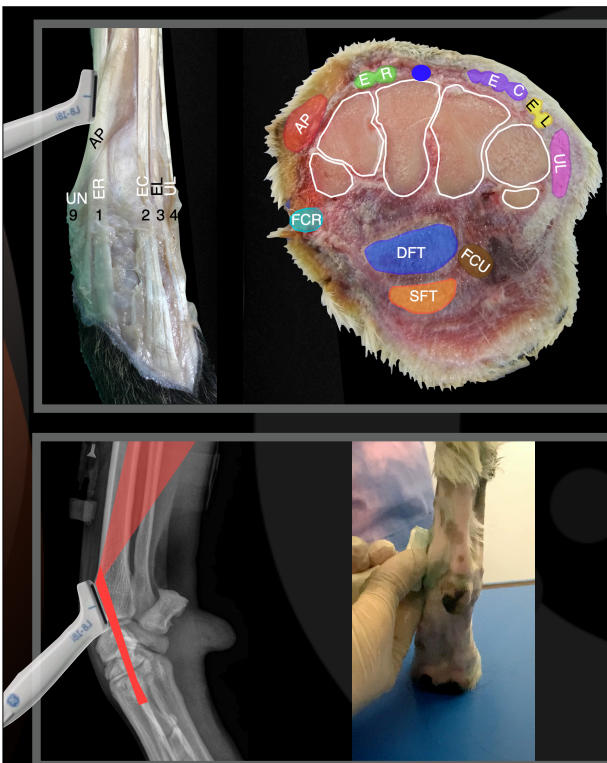
Right and left carpus

Superficial and Deep Flexor tendons, transverse and longitudinal scan

6-7



*Animals* 2022, 12, 2050. <https://doi.org/10.3390/ani12162050>

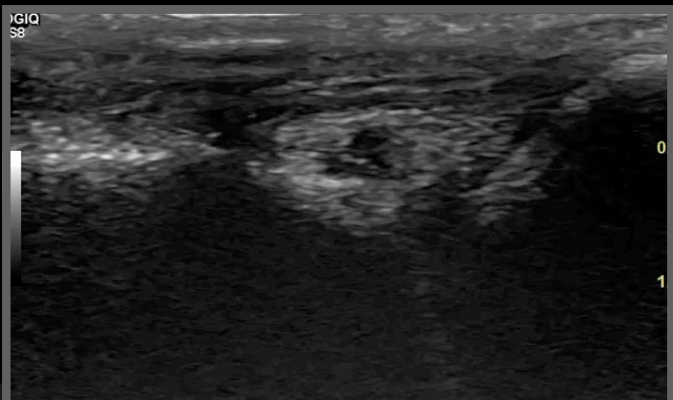


**Maky, FS, 6 years**

Left carpus

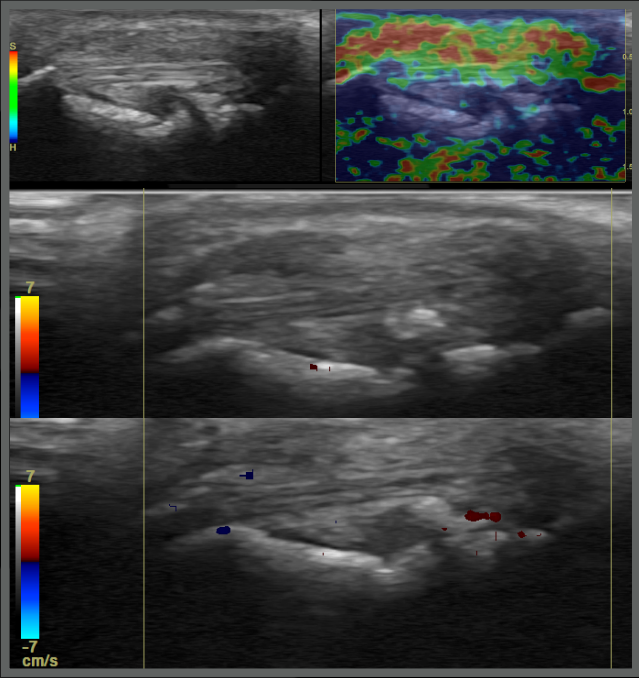
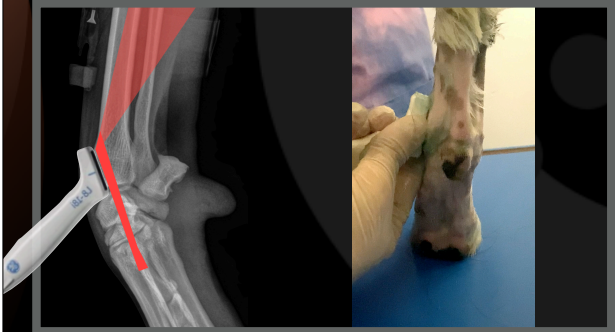
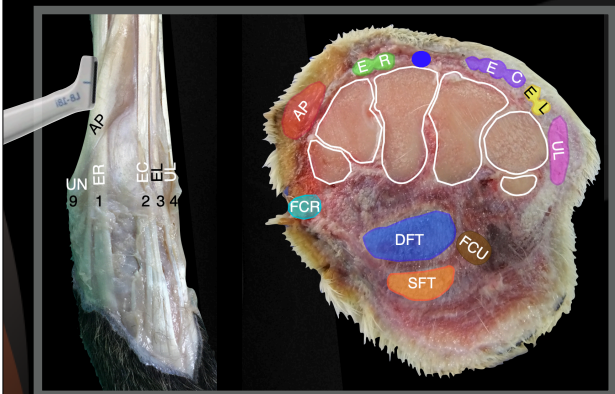
Abductor Pollicis Longus longitudinal scan

9



Make, FS, 6 years

Right carpus

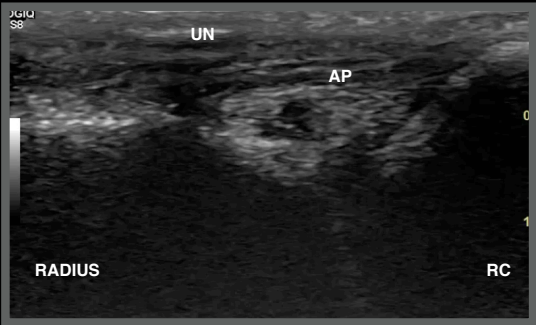


Maky, Giant poodle, FS, 6 years



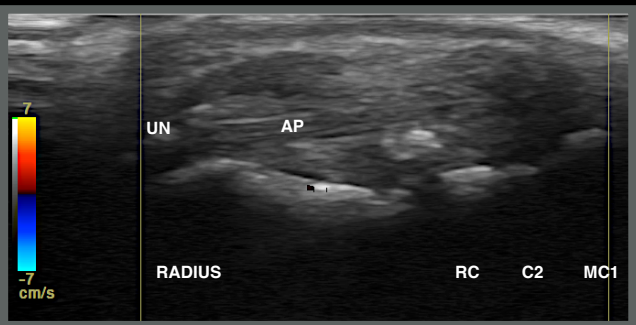
Left carpus

9



Right carpus

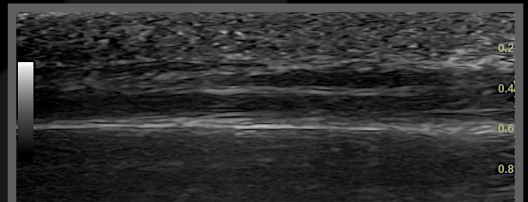
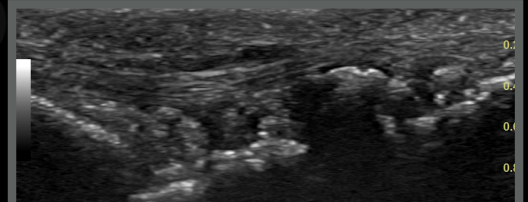
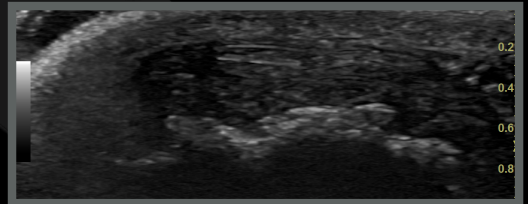
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## Maky, Giant poodle, FS, 6 years

### Ultrasonographic diagnoses:

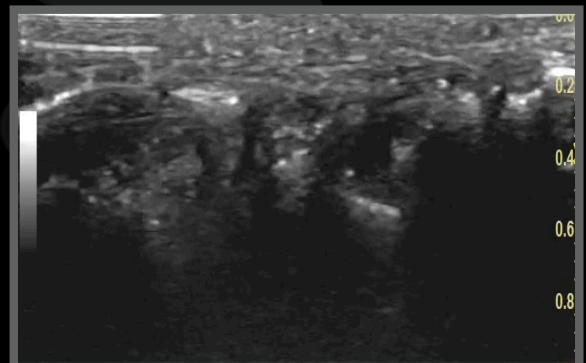
- Thickening right extensor retinaculum
- Severely remodelled right dorsolateral bone surfaces
- Right Ulnaris Lateralis and EC tendinopathy



## Maky, Giant poodle, FS, 6 years

### Conclusions:

- Severe progression of arthrosis with suspected increased inter-osseous movement
- Possible lateral instability of the right carpus
- Right Ulnaris Lateralis partial tear



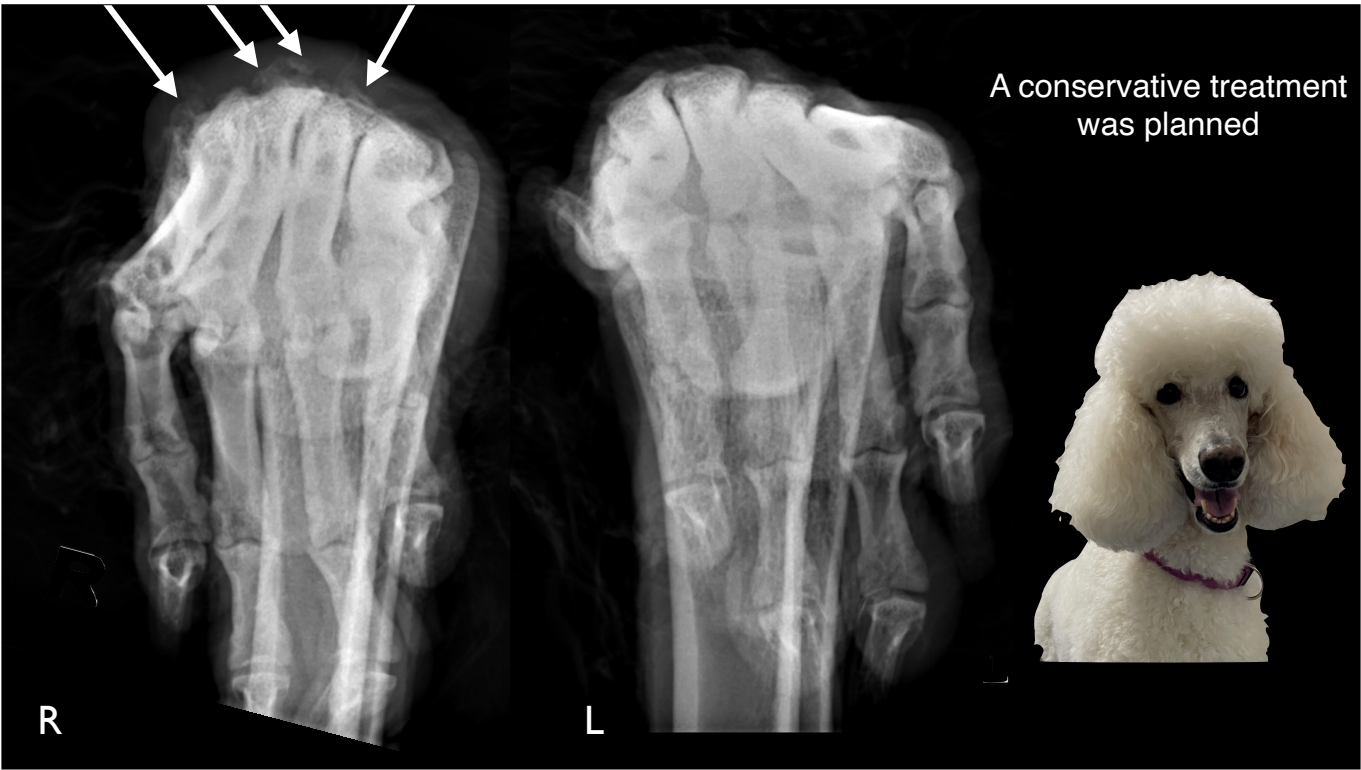
### Next step:

- Review the X-rays

Maky, FS, 6 years



A conservative treatment was planned



Five months later,  
Referring veterinarian  
follow up X-rays



The dog is sound



Maky, FS, 6 years



Olivia, Weimaraner, FS, 6 years

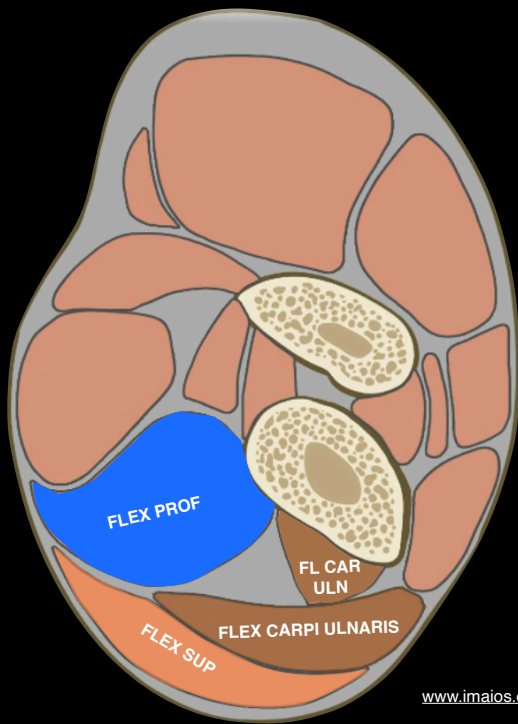
- Intermittent lameness of right front limb
- The owner noticed a swelling
- Phobic patient



Olivia, Weimaraner, FS, 6 years

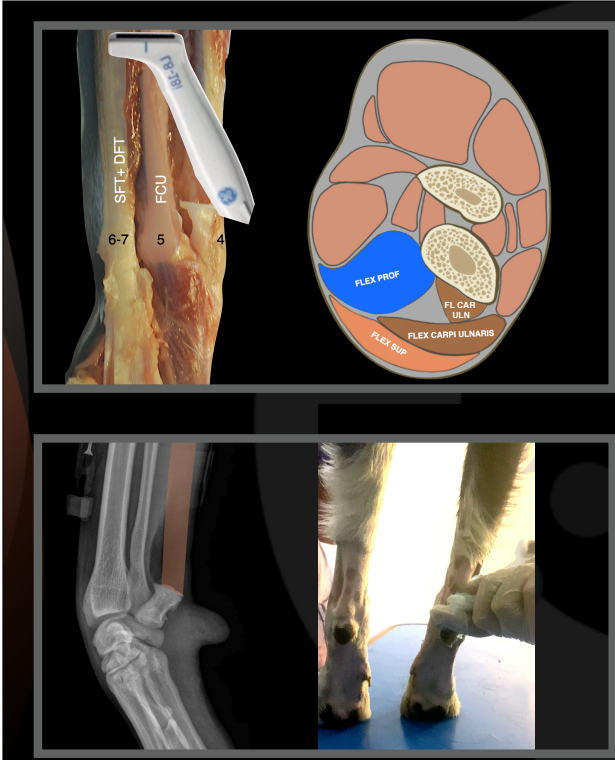


Anatomy of the caudal face of the ante brachium



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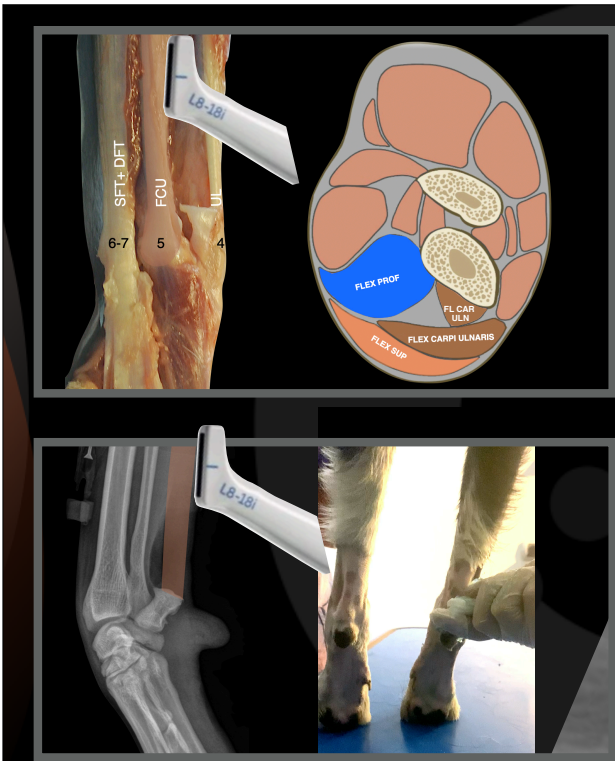
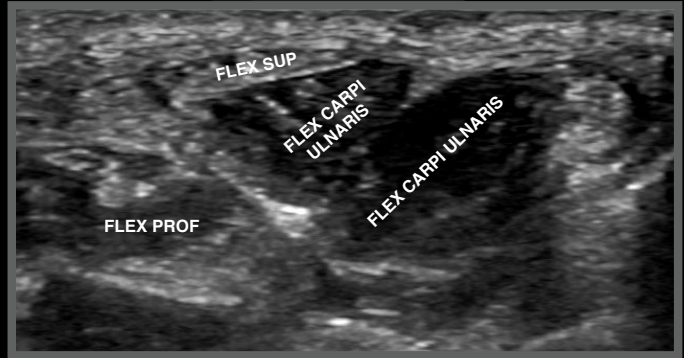


**Olivia, FS, 6 years**

Left carpus

Flexor Carpi Ulnaris transverse scan

5

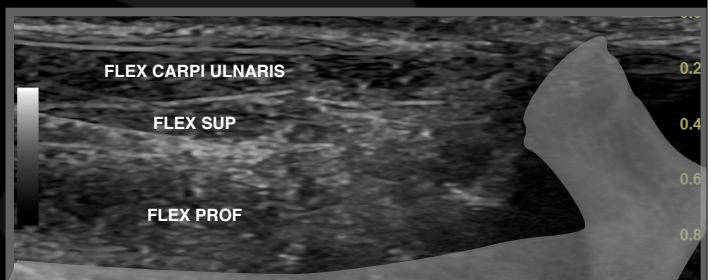


**Olivia, FS, 6 years**

Left carpus

Flexor Carpi Ulnaris longitudinal scan

5

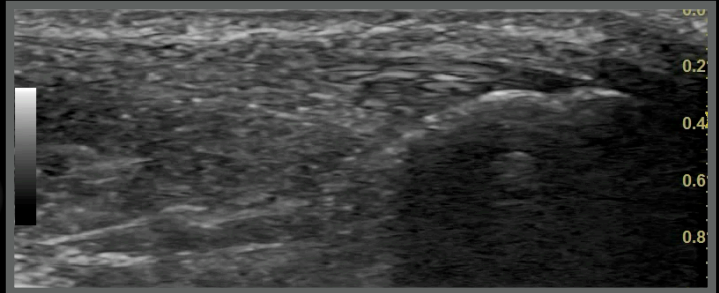
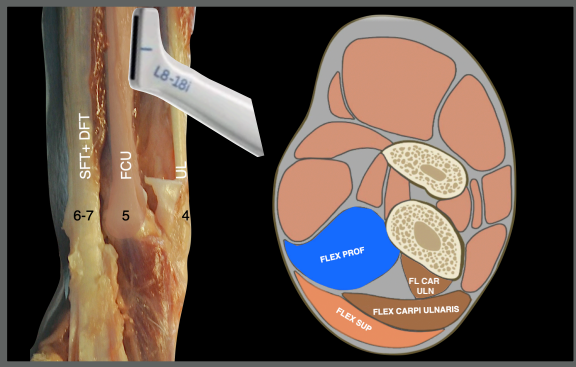


Olivia, FS, 6 years

Left carpus

Flexor Carpi Ulnaris longitudinal scan

5

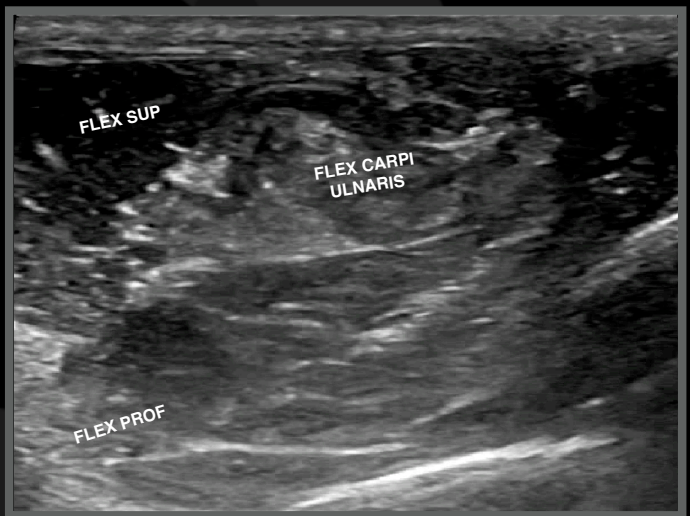
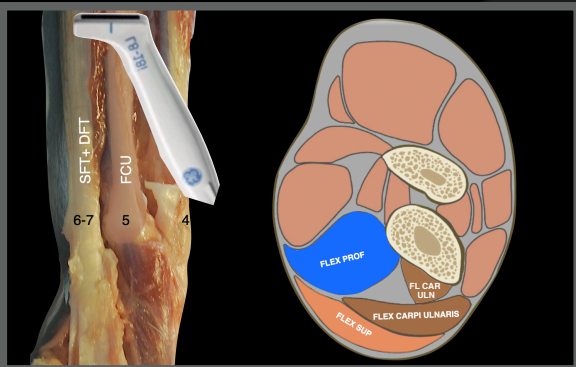


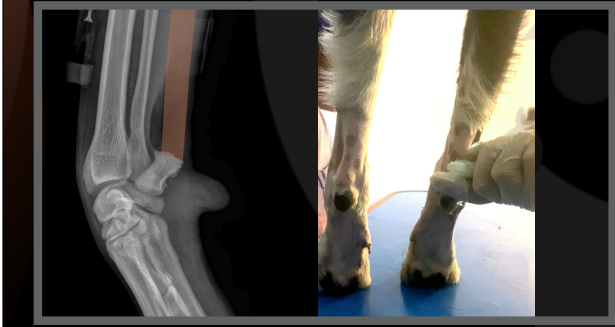
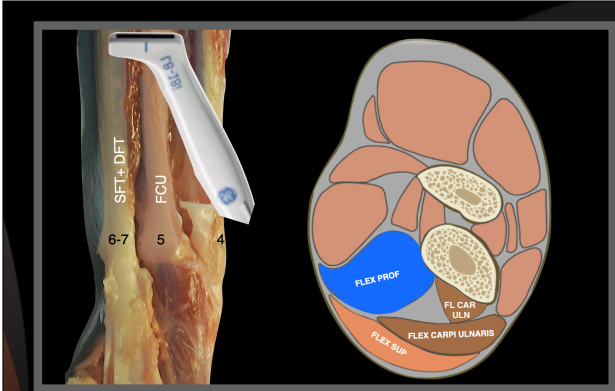
Olivia, FS, 6 years

Right carpus

Flexor Carpi Ulnaris transverse scan

5



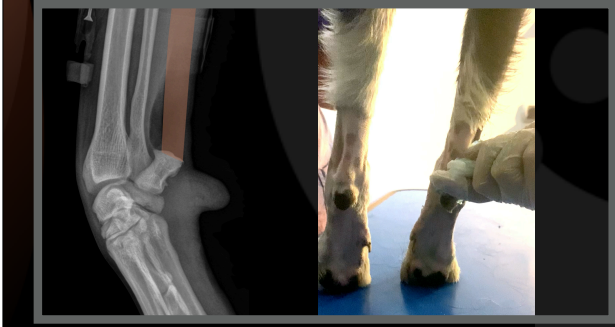
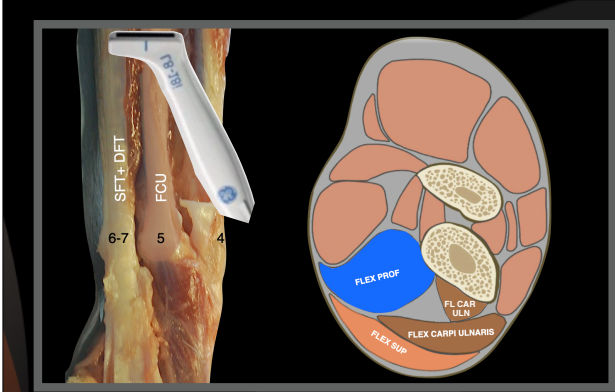
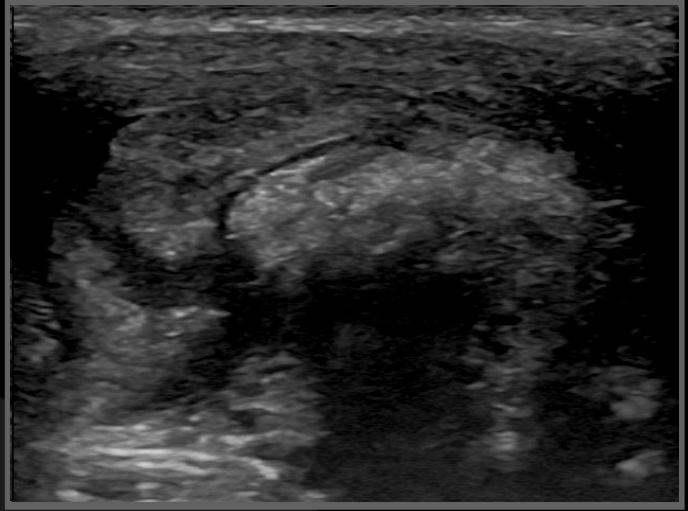


Olivia, FS, 6 years

Right carpus

Flexor Carpi Ulnaris transverse scan

5

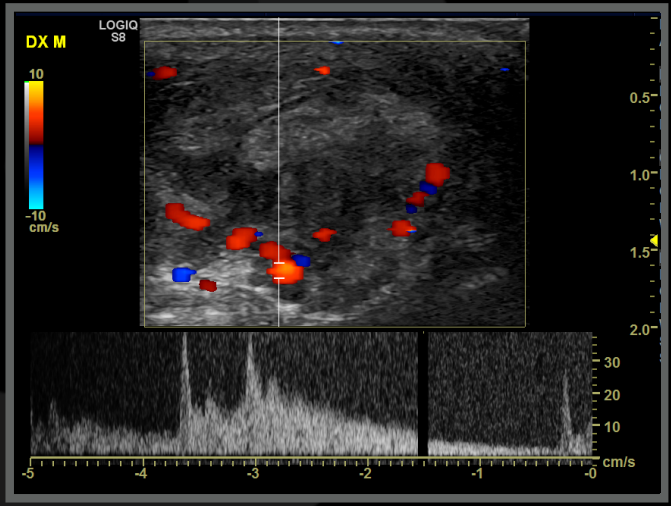


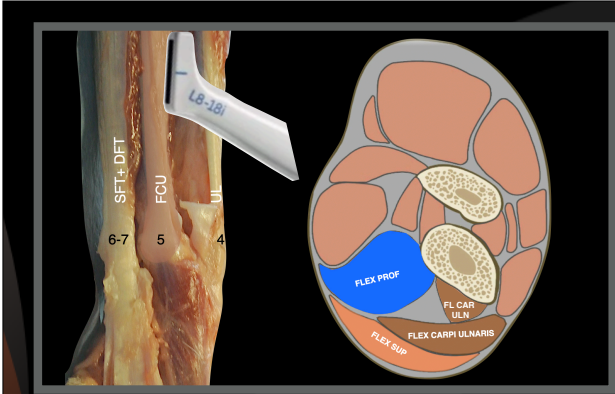
Olivia, FS, 6 years

Right carpus

Flexor Carpi Ulnaris transverse scan

5



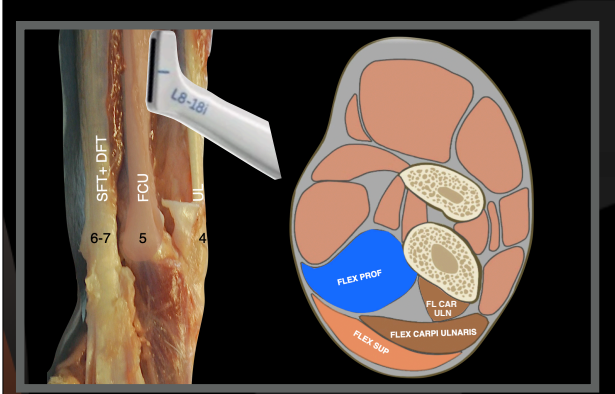
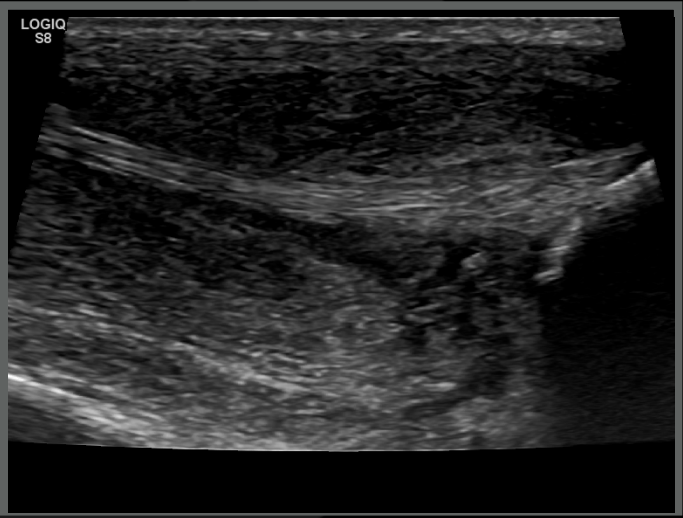


Olivia, FS, 6 years

Left carpus

Flexor Carpi Ulnaris longitudinal scan

5

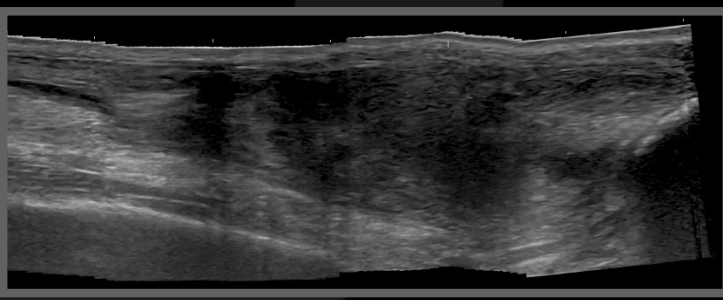
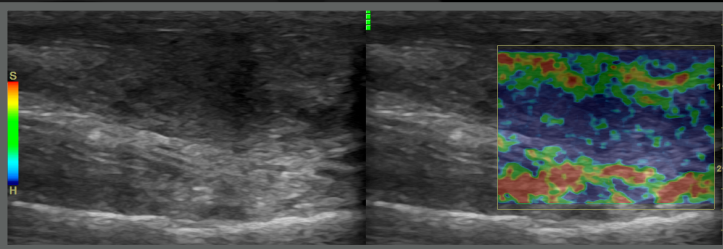


Olivia, FS, 6 years

Left carpus

Flexor Carpi Ulnaris longitudinal scan

5



Olivia, FS, 6 years



Olivia, Weimaraner, FS, 6 years

Ultrasonographic diagnoses:

- Thickening with loss of fibrillar pattern of the right Flexor Carpi Ulnaris tendon



## How to arrive to Conclusions:

- PE examination
- Blood works
- Ultrasonographic findings
- Literature



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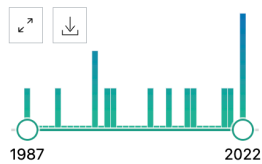
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RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

**Reconstruction of the flexor carpi ulnaris tendon with a fascia lata autograft in two dogs with carpal hyperextension.**  
1 Tani Y.  
Cite Vet Surg. 2022 Nov;51(8):1311-1318. doi: 10.1111/vsu.13890. Epub 2022 Sep 18.  
Share PMID: 36117264  
OBJECTIVE: To describe the outcome of two dogs treated with fascia lata autografts to repair carpal hyperextension caused by flexor carpi ulnaris (FCU) tendon injury. ANIMALS: Two dogs with traumatic carpal hyperextension. STUDY DESIGN: Case rep ...

**Flexor carpi ulnaris tendonopathy in a Weimaraner.**  
2 Kuan SY, Smith BA, Fearnside SM, Black AP, Allan GS.  
Cite Aust Vet J. 2007 Oct;85(10):401-4. doi: 10.1111/j.1751-0813.2007.00187.x.  
Share PMID: 17903127 No abstract available.

**Anatomy of the Palmar Region of the Carpus of the Dog.**  
3 González-Rellán S, Barreiro A, Cifuentes JM, Fdz-de-Trocóniz P.  
Cite Animals (Basel). 2022 Jun 18;12(12):1573. doi: 10.3390/ani12121573.  
PMID: 35739909 [Free PMC article.](#)

**Flexor carpi ulnaris (humeral head) muscle flap for reconstruction of distal forelimb injuries in two dogs.**

4

Cite Chambers JN, Purinton PT, Allen SW, Schneider TA, Smith JD.  
Vet Surg. 1998 Jul-Aug;27(4):342-7. doi: 10.1111/j.1532-950x.1998.tb00137.x.  
Share PMID: 9662777

OBJECTIVE: To describe the use of the humeral head of the **flexor carpi ulnaris** muscle as a rotational flap for reconstruction of distal antebrachial, carpal, and metacarpal injuries in two **dogs**.  
STUDY DESIGN: Description of clinical cases. RESULTS: Loc ...

**High-Resolution Ultrasonographic Anatomy of the Carpal Tendons of Sporting Border Collies.**

5

Cite Entani MG, Franini A, Barella G, Saleri R, De Rensis F, Spattini G.  
Animals (Basel). 2022 Aug 11;12(16):2050. doi: 10.3390/ani12162050.  
Share PMID: 36009639 **Free PMC article.**

On the lateral face, the tendon of the Extensor **Carpus Ulnaris** was recognised and followed. On the palmar face, the two heads of the **Flexor Carpi Ulnaris** tendon ending on the accessory carpal bone, the adjacent **Flexor Digitorum** & nbs ...

## CASE REPORT

Australian Veterinary Journal Volume 85, No 10, October 2007

# Flexor carpi ulnaris tendonopathy in a Weimaraner

SY KUAN,<sup>a</sup> BA SMITH,<sup>a</sup> SM FEARNSIDE,<sup>a</sup> AP BLACK<sup>a</sup> and GS ALLAN<sup>b</sup>



This case describes a flexor carpi ulnaris tendonopathy in a Weimaraner, with thickening of the tendon and disorganised fibrosis, most likely a result from chronic repeated stresses.

with repeated stresses. These repeated stresses lead to chronic strains with a thickened, fibrotic, and weakened tendon.<sup>7</sup> In racing Greyhound injuries, it is the humeral head that is strained.<sup>7</sup>

Chronically repeated strain injuries may lead to a fatigue rupture of the tendon, resulting in hyperflexion of the hock and weight-bearing on the plantar surface of the metatarsus.<sup>20,21</sup> Successful non-surgical treatment of Achilles tendon strains have been reported in various species,<sup>22-24</sup> and includes splinting or casting the hock in extension, and restricted activity.<sup>20</sup>

Strains can occur when the load is excessive, or when the yield point of the tendon is lowered.<sup>4</sup> High load trauma resulting in tendon injury is uncommon, because tendons can absorb energy more efficiently than muscle or bone, hence muscle tears or avulsion fractures are more likely to occur before complete failure of a tendon.<sup>5</sup> Lowering of the tendon yield point can occur as a result of disease or other degenerative conditions causing disruption and disorganisation of the collagen arrangement, or as a result of repeated high frequency loading events causing microfibre injury accumulation resulting in progressive weakening of the tendon.<sup>4,8,9</sup> An alternative hypothesis involves development of ischaemia when the tendon is under maximal tendon load, with reperfusion on relaxation generating oxygen free radicals, causing tendon damage.<sup>10</sup>

## Olivia, Weimaraner, FS, 6 years

### Follow up

- Impossible to rest
- Improving with physiotherapy



## Conclusions

- High resolution US can help in the management planning of carpal injuries
- Team working with orthopaedic and rehabilitation centres usually gain the best long term results



Steve Job tribute to Alan Turing

# Thank you



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