

# Ultrasound of the cranial aspect of the thigh and stifle



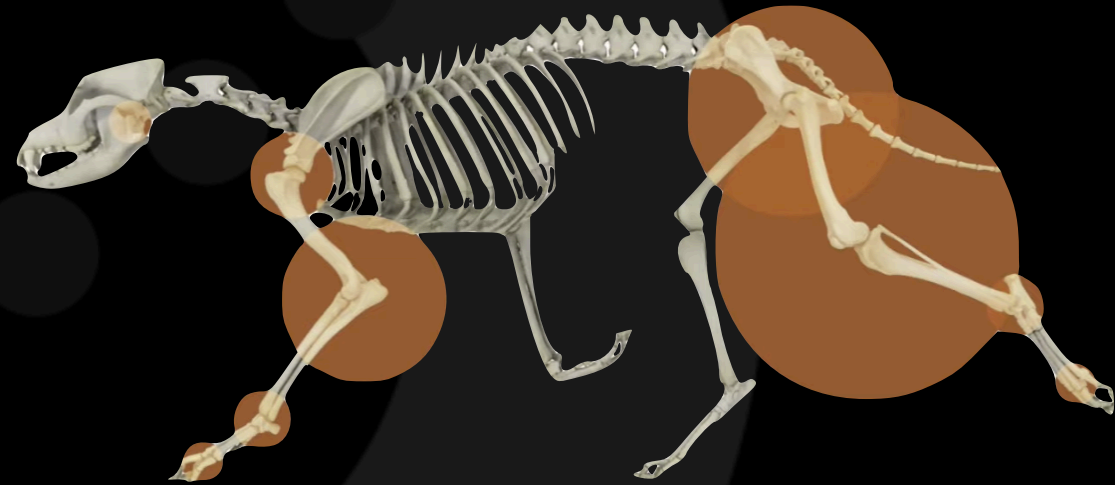
Diagnostic Mindset

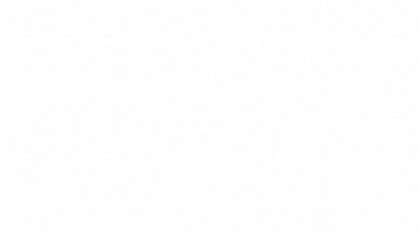


Giliola Spattini  
DVM, PhD, DECVDI

## Objectives

- Sport-related injuries have increased in rate and severity
- Highly trained patients often suffer from chronic tendinopathy and teno-muscular pain
- Ultrasound is gaining an essential role in canine hind limb lameness - low performance - pain management

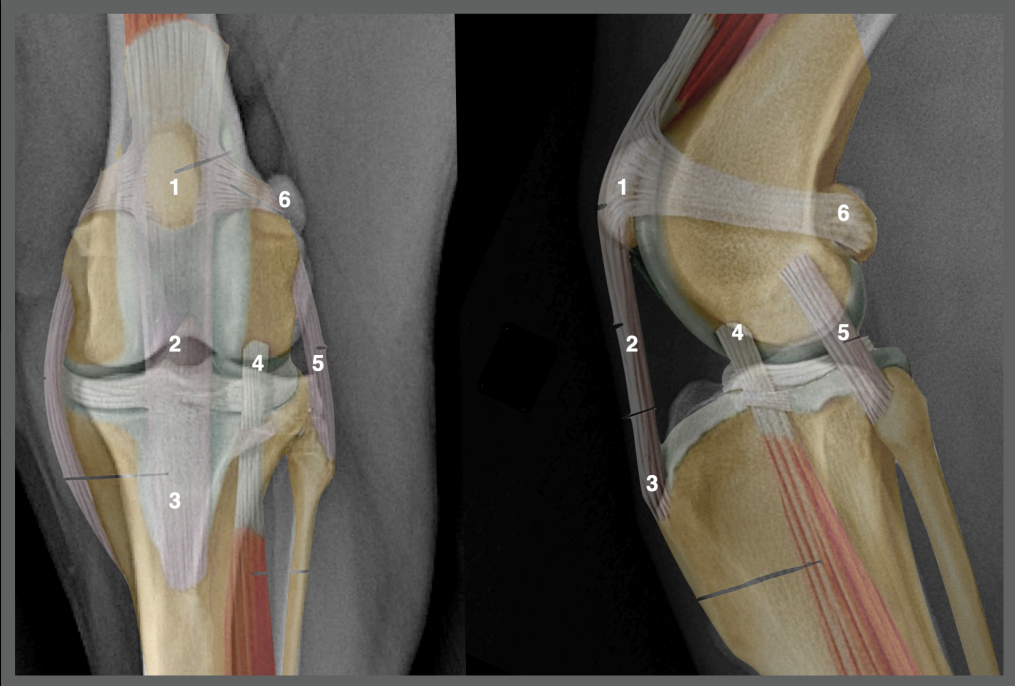




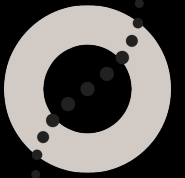
Pain in  
stifle  
region



# Ultrasonographic technique for the stifle



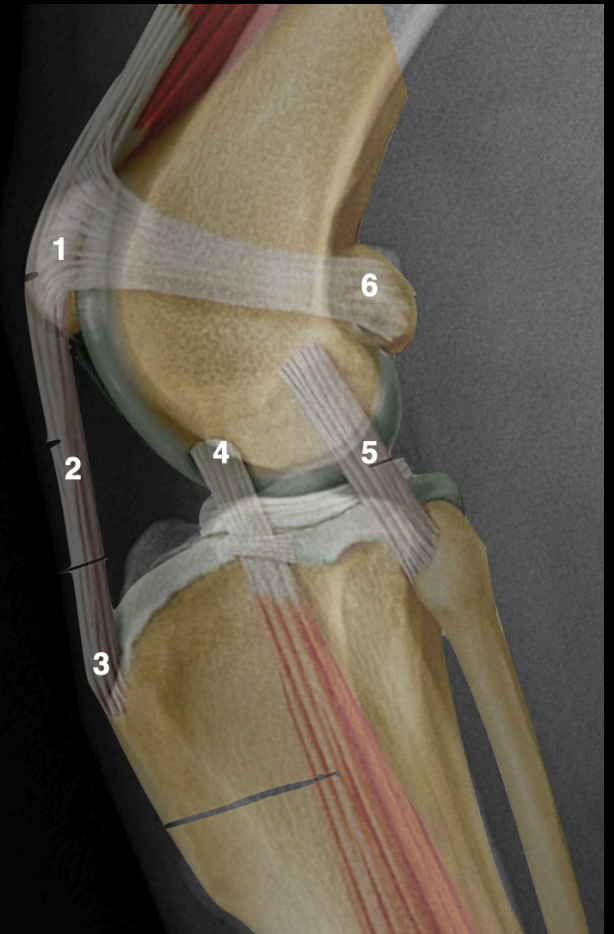
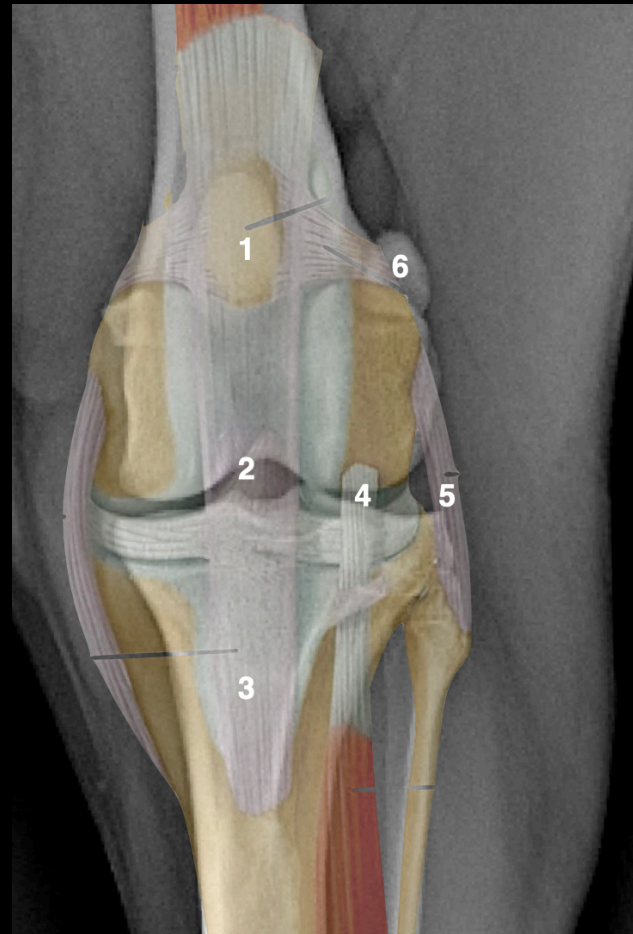
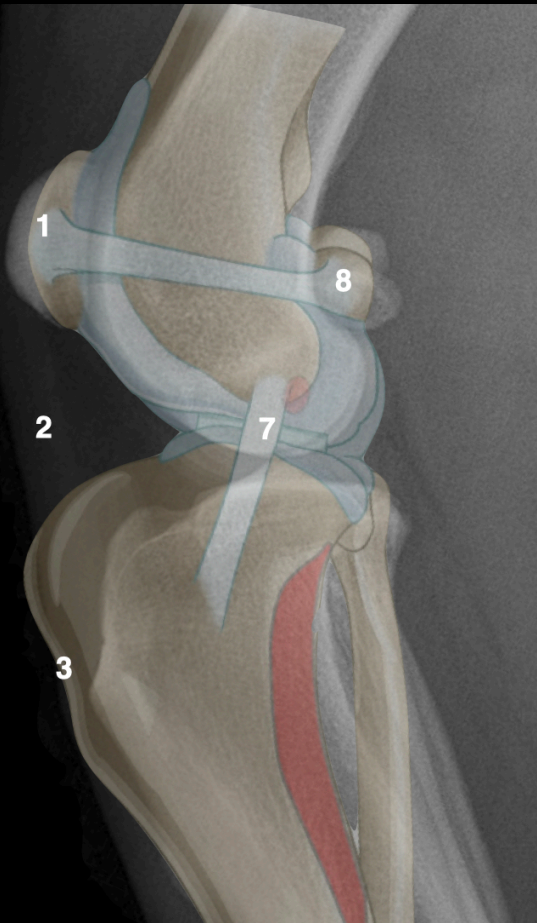
# Stifle joint: 1-8

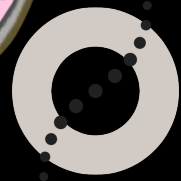
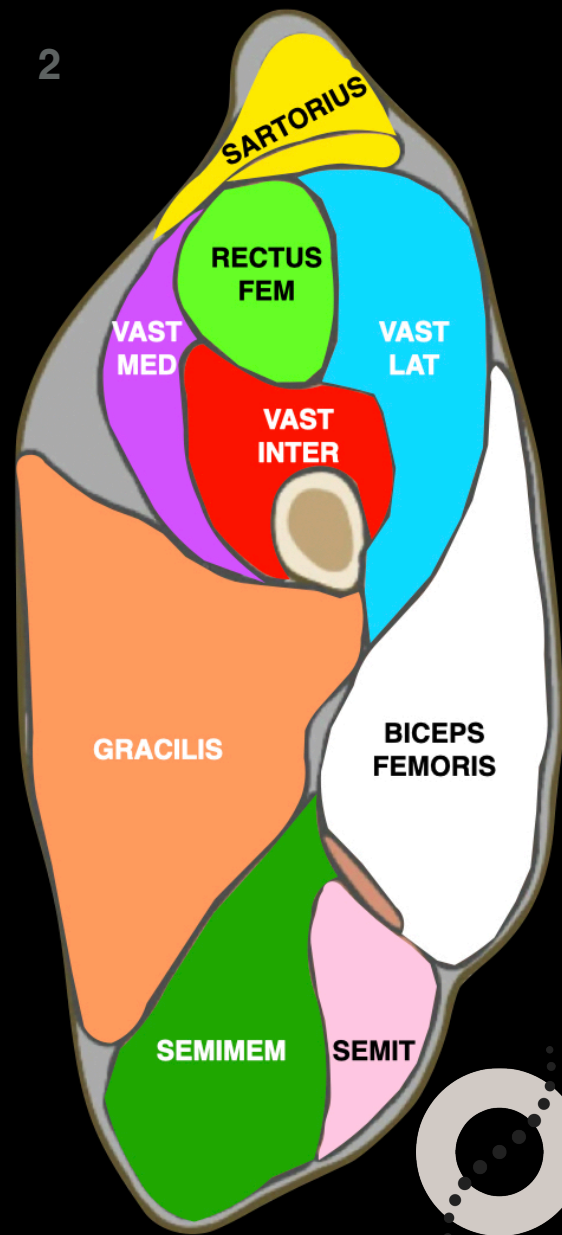
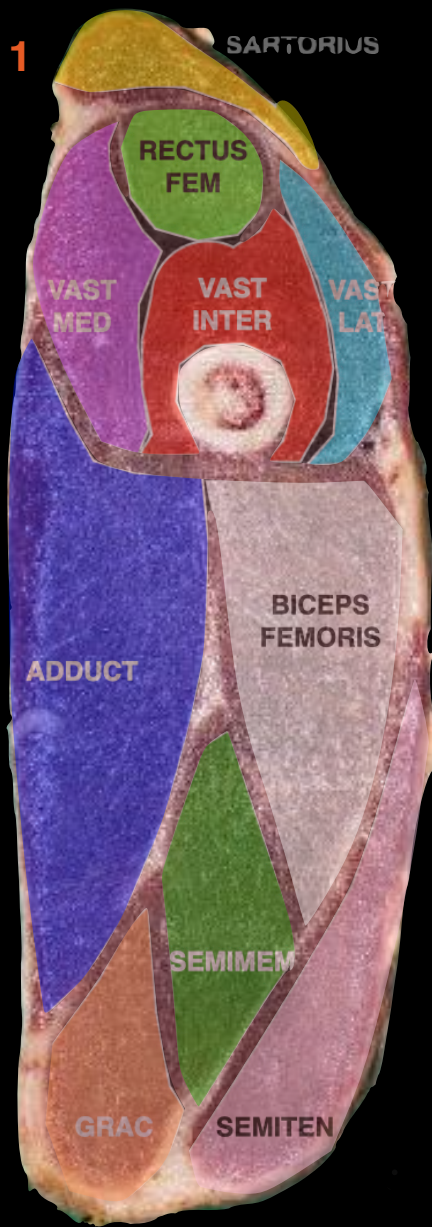
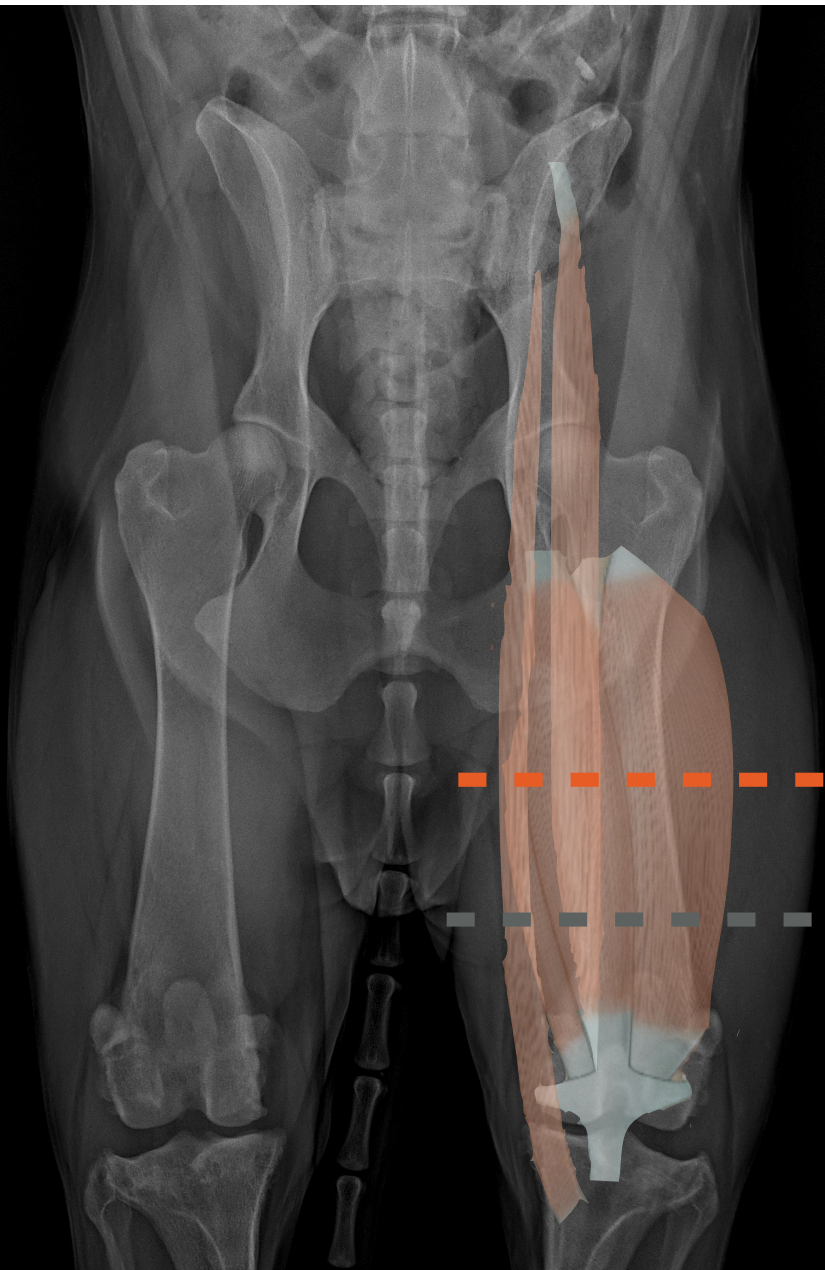


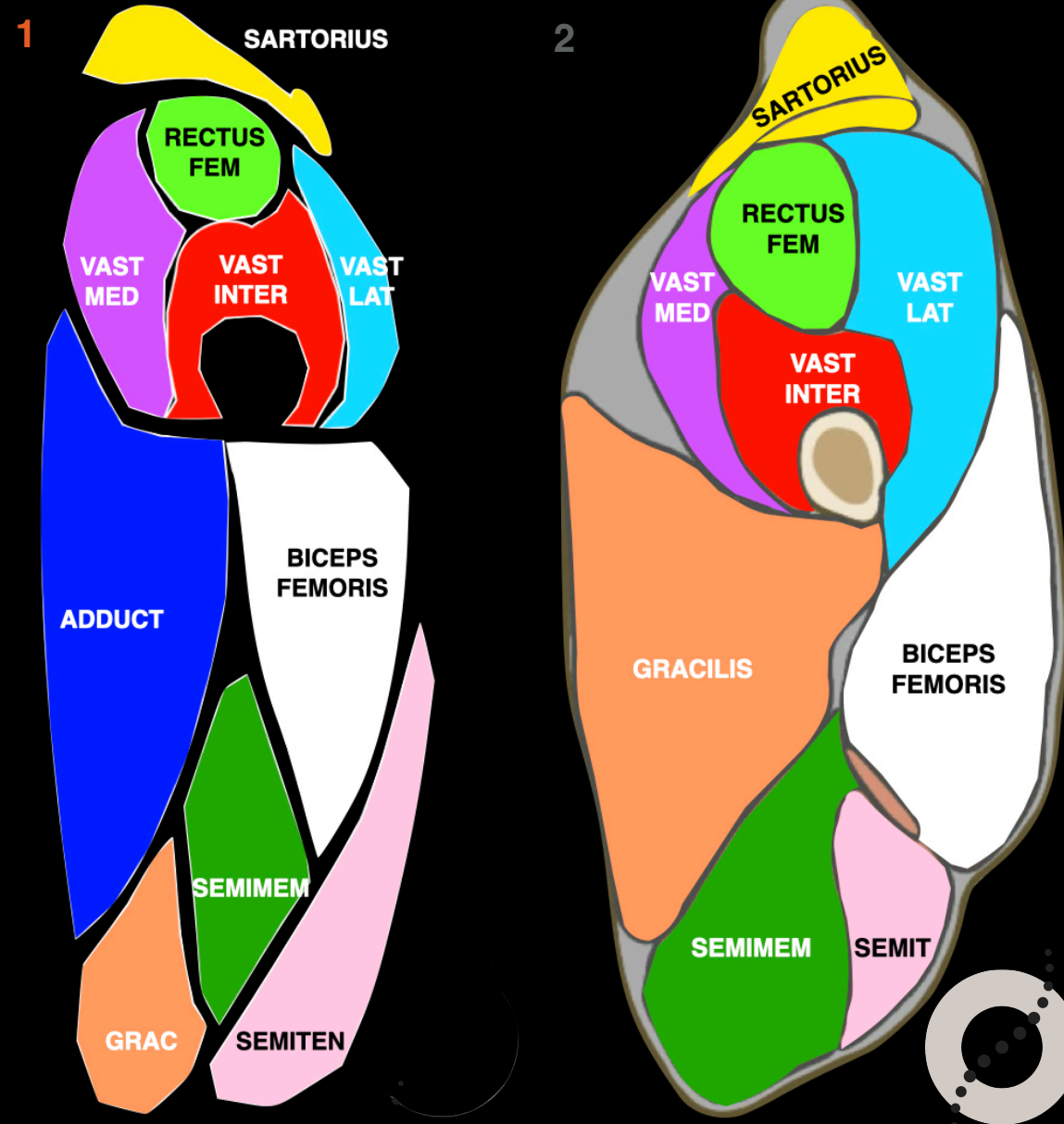
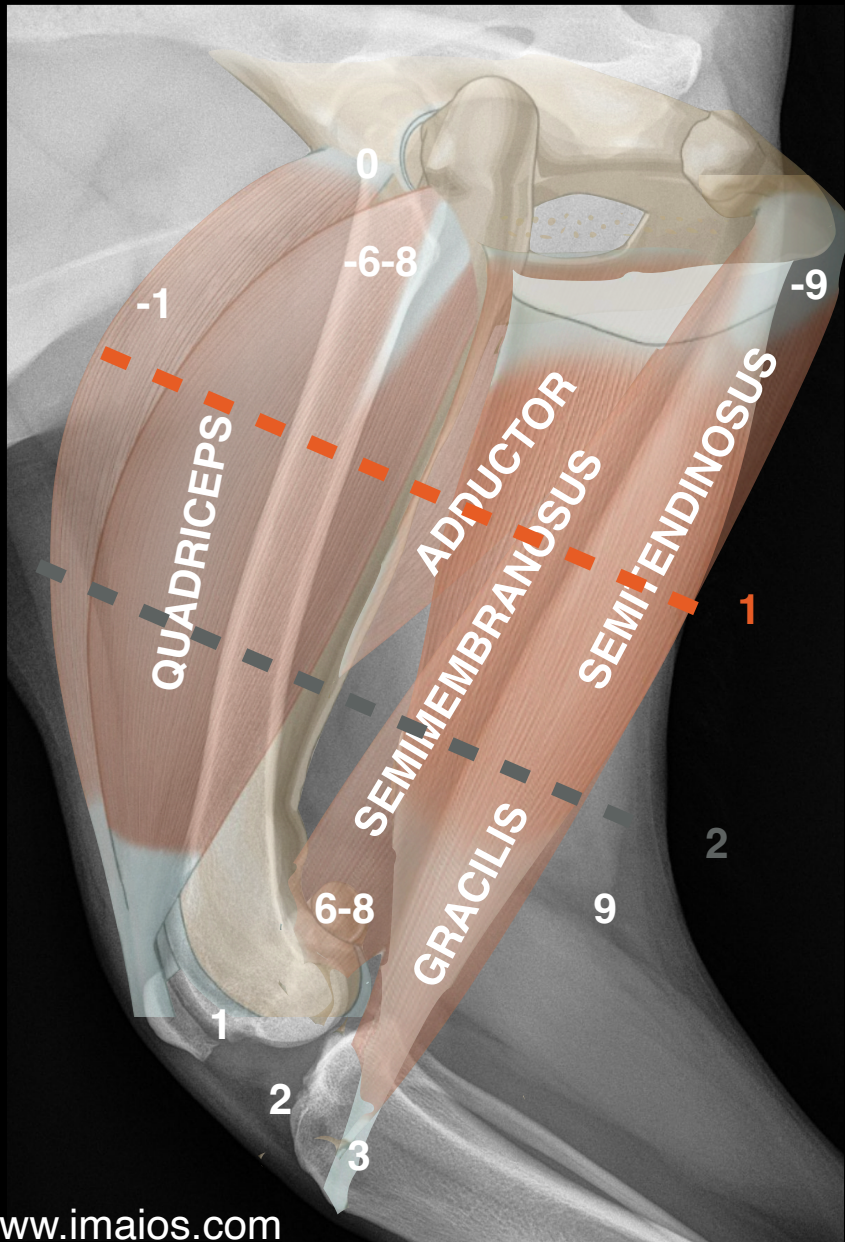
Medial face

Cranial face

Lateral face

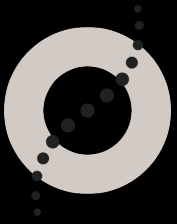






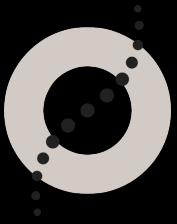
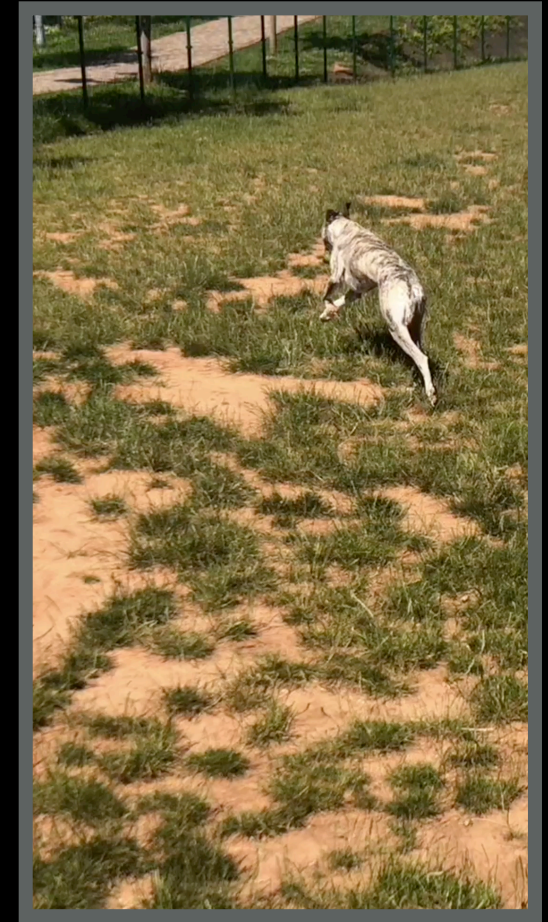
## Dante, Whippet, MI, 1 year

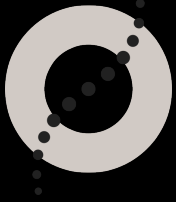
- After running cried and had fourth-degree lameness left hind limb
- He cries if touched
- Negative radiographs
- Impossible to locate the pain



## Dante, Whippet, MI, 1 year

- After two months: He is fine if He walks
- Recurrent second-degree lameness after running





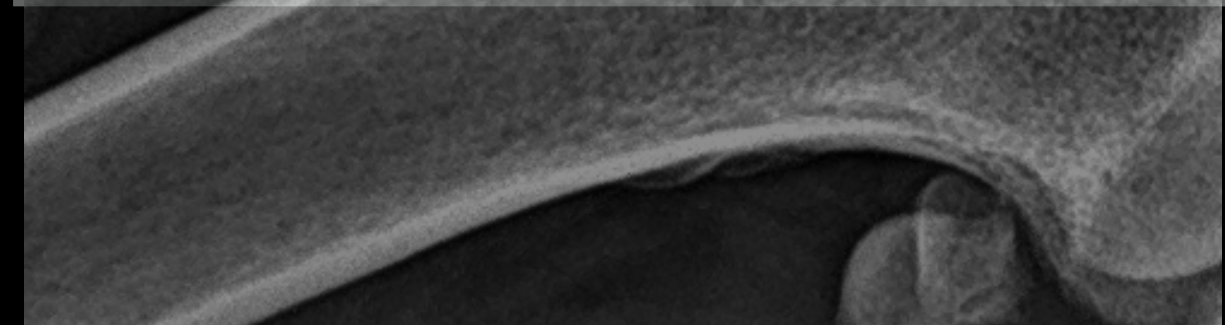
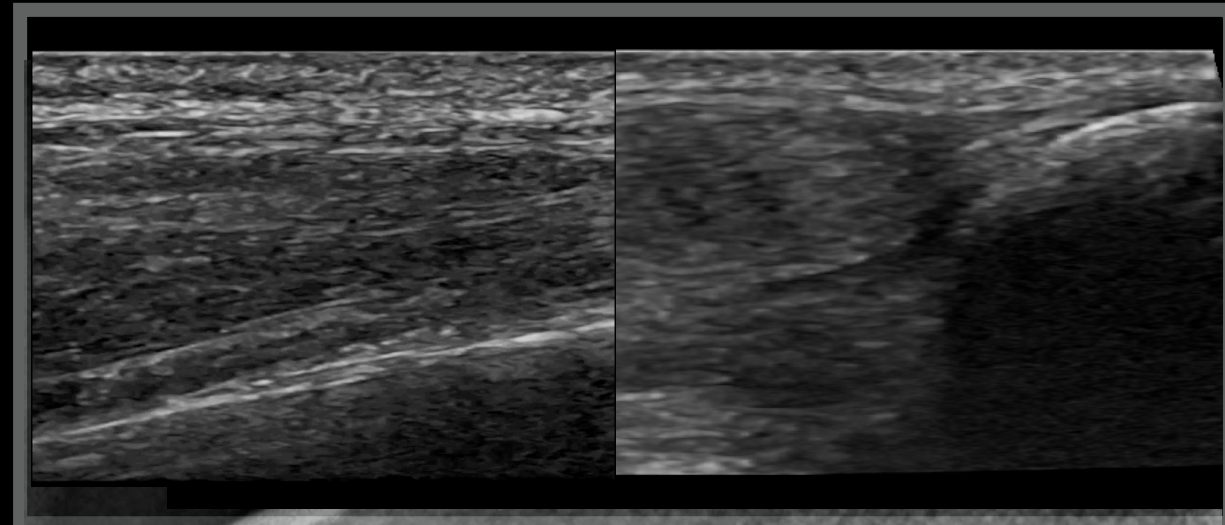
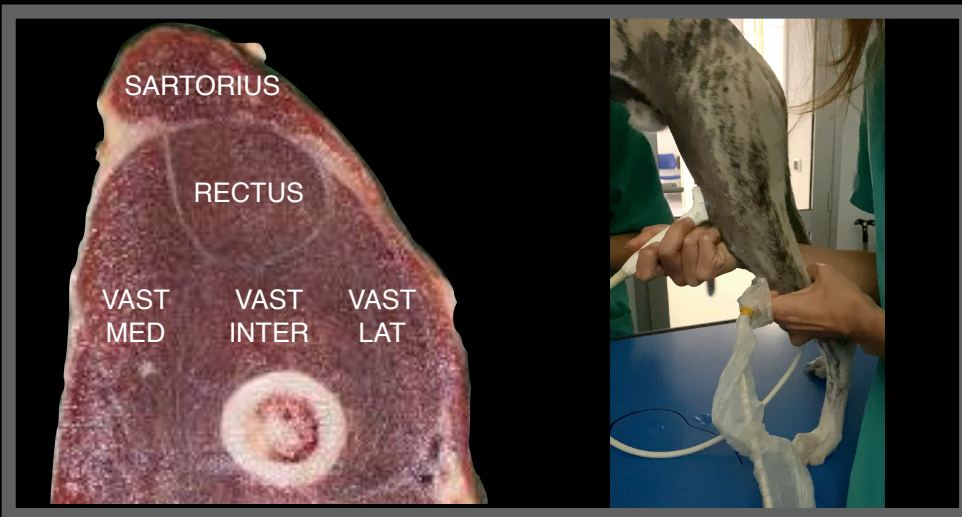
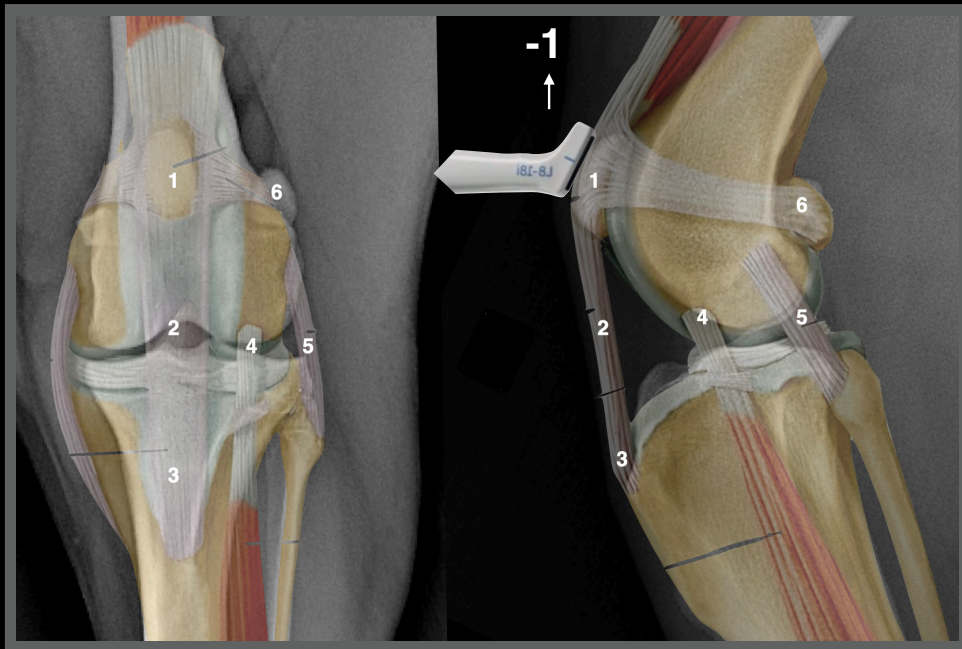
Dante, MI, 1 year

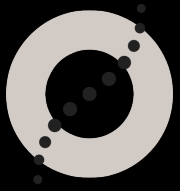
Right thigh

Sound limb

Cranial face longitudinal scan

1-1





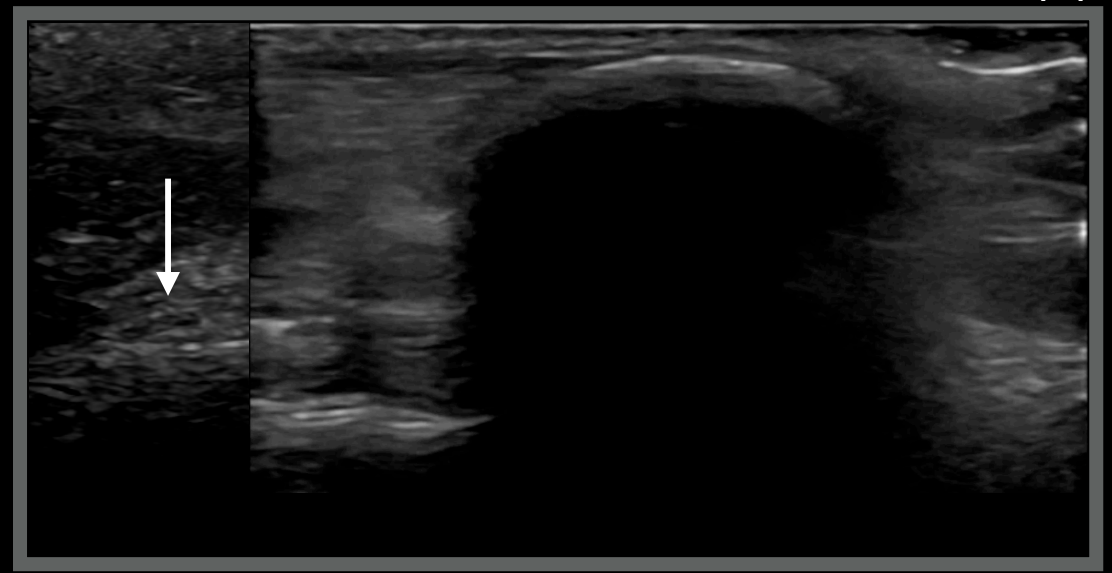
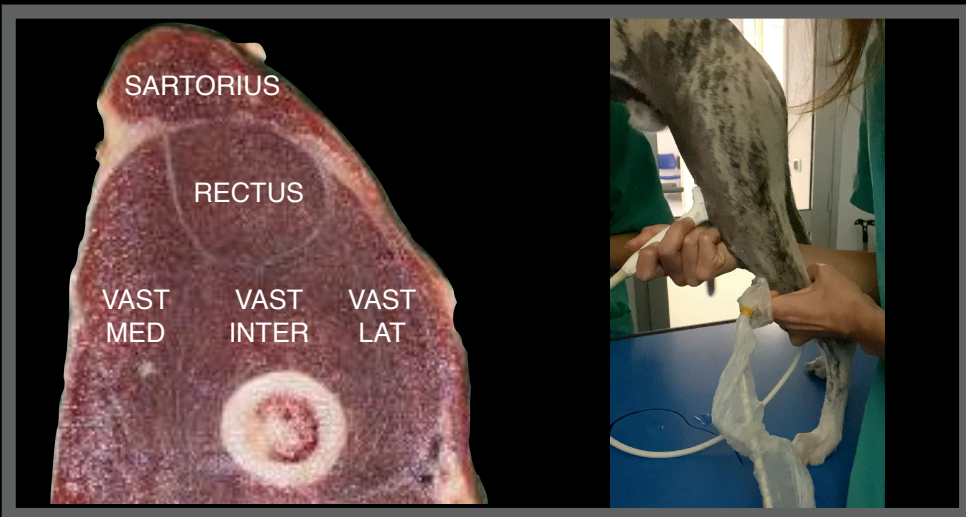
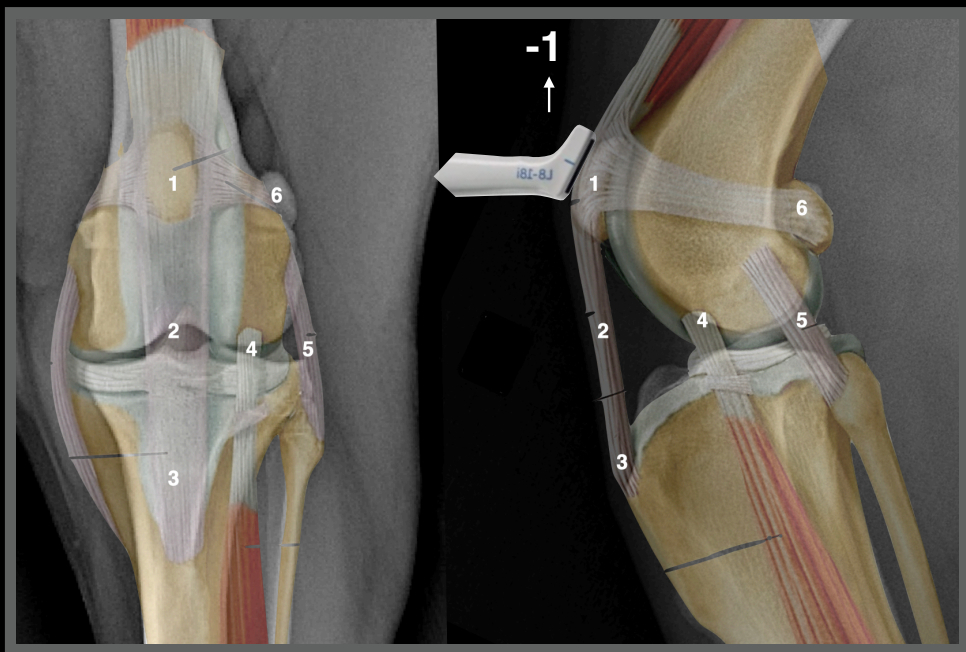
Dante, MI, 1 year

Left thigh

Affected limb

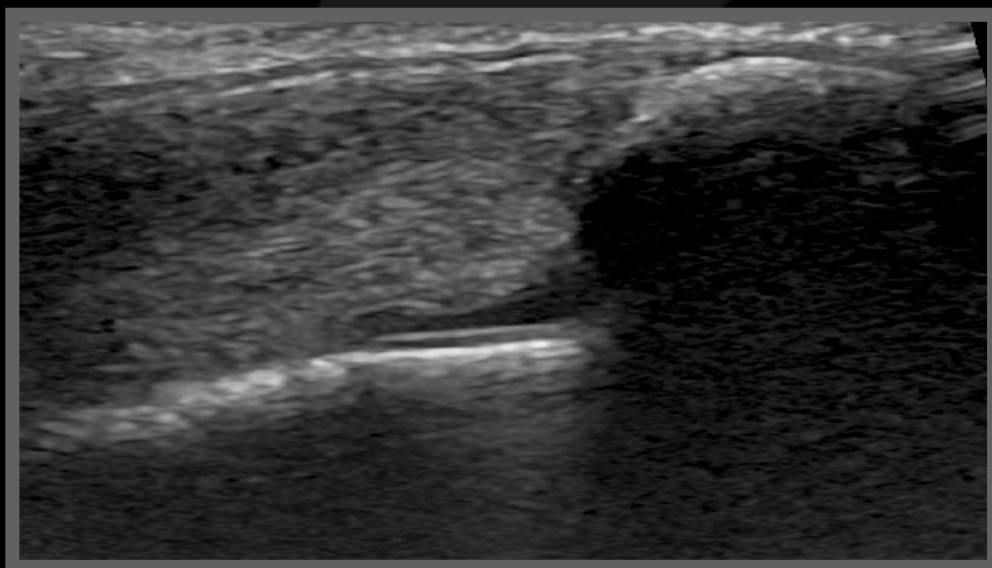
Cranial face longitudinal scan

1-1

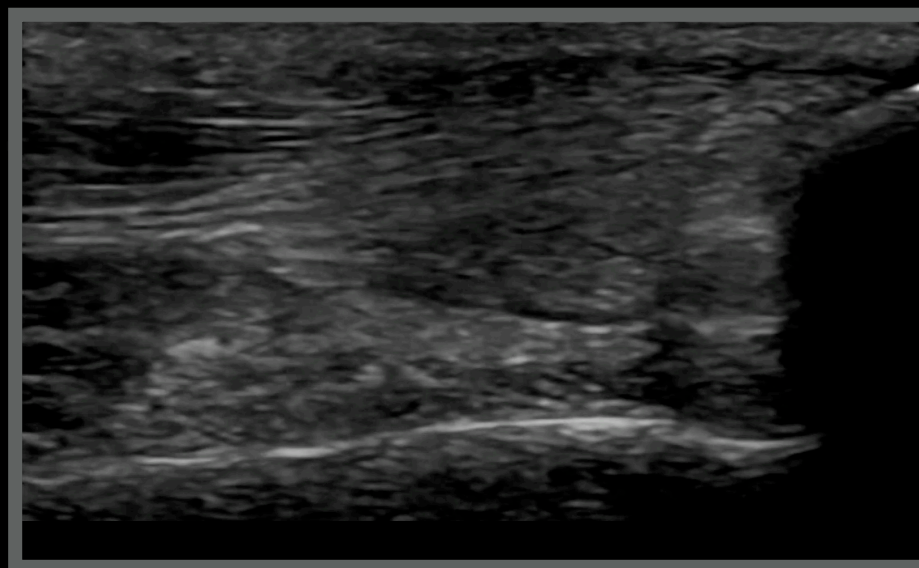


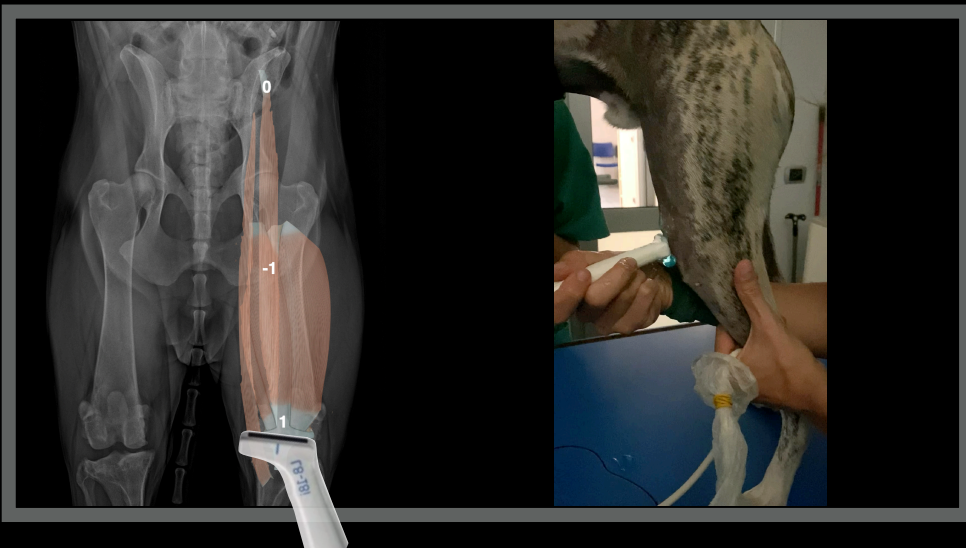
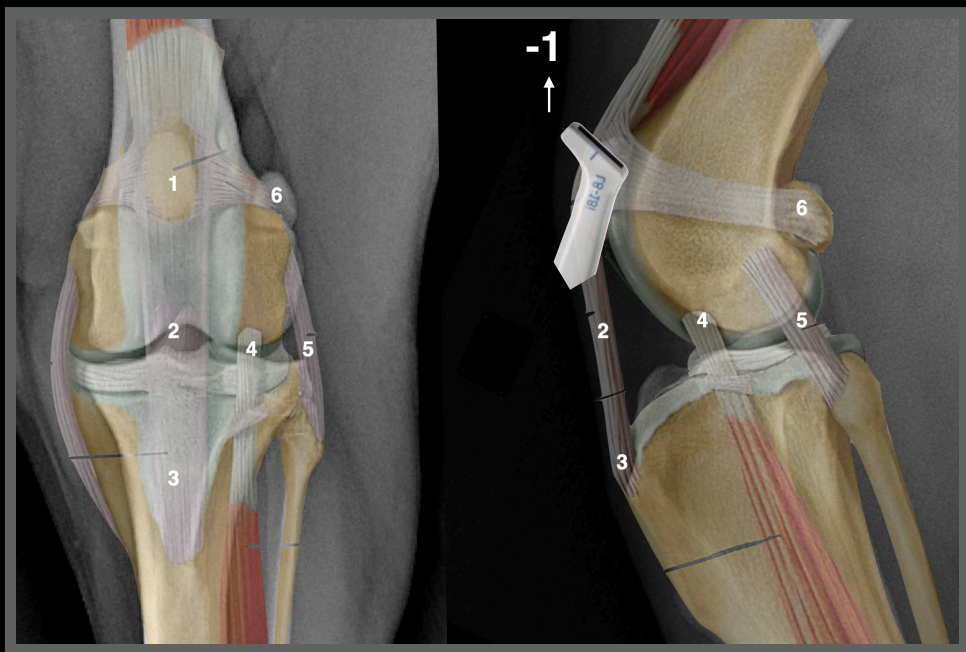
Dante, MI, 1 year

Right thigh



Left thigh

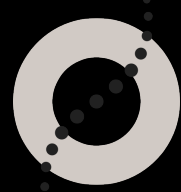




Dante, MI, 1 year

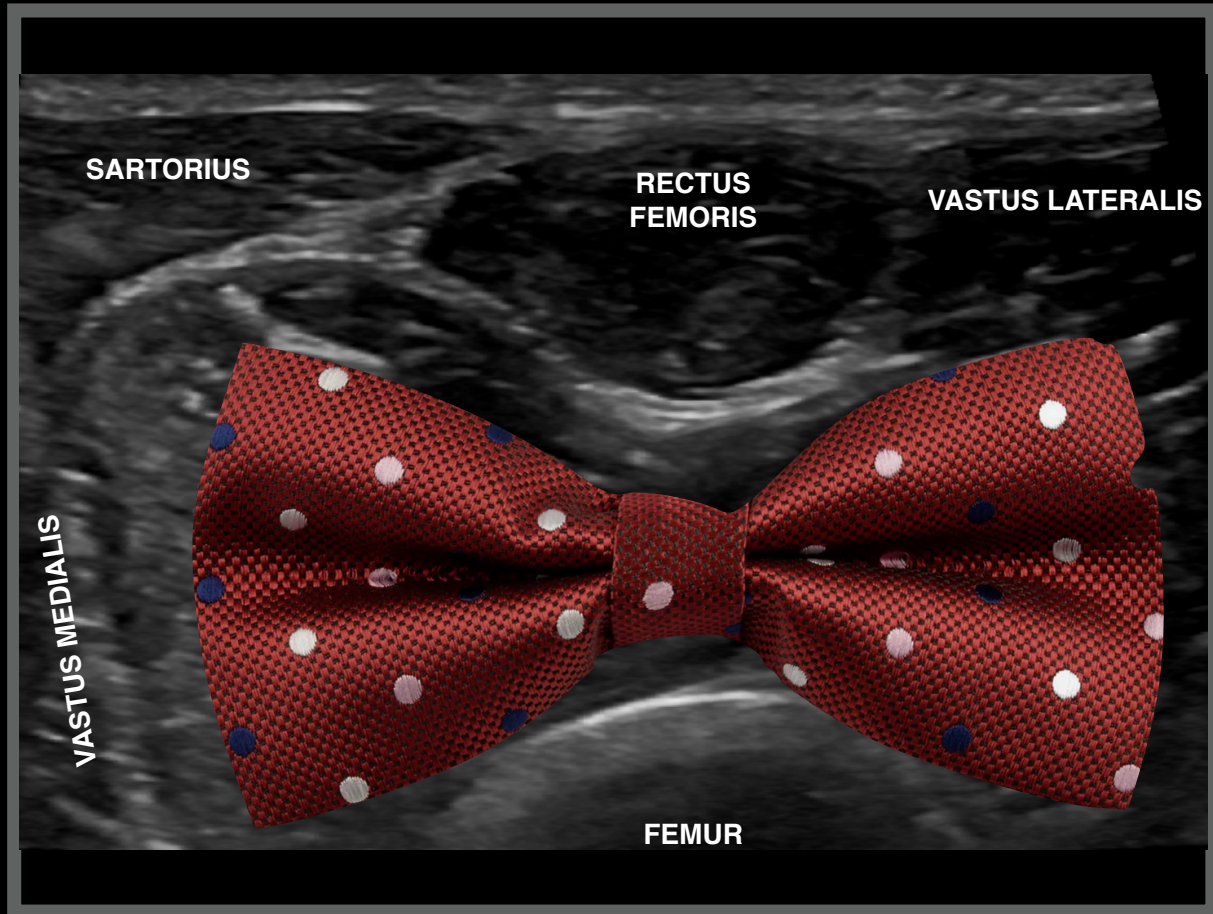
Right thigh

Sound limb



Cranial face transverse scan

1-1



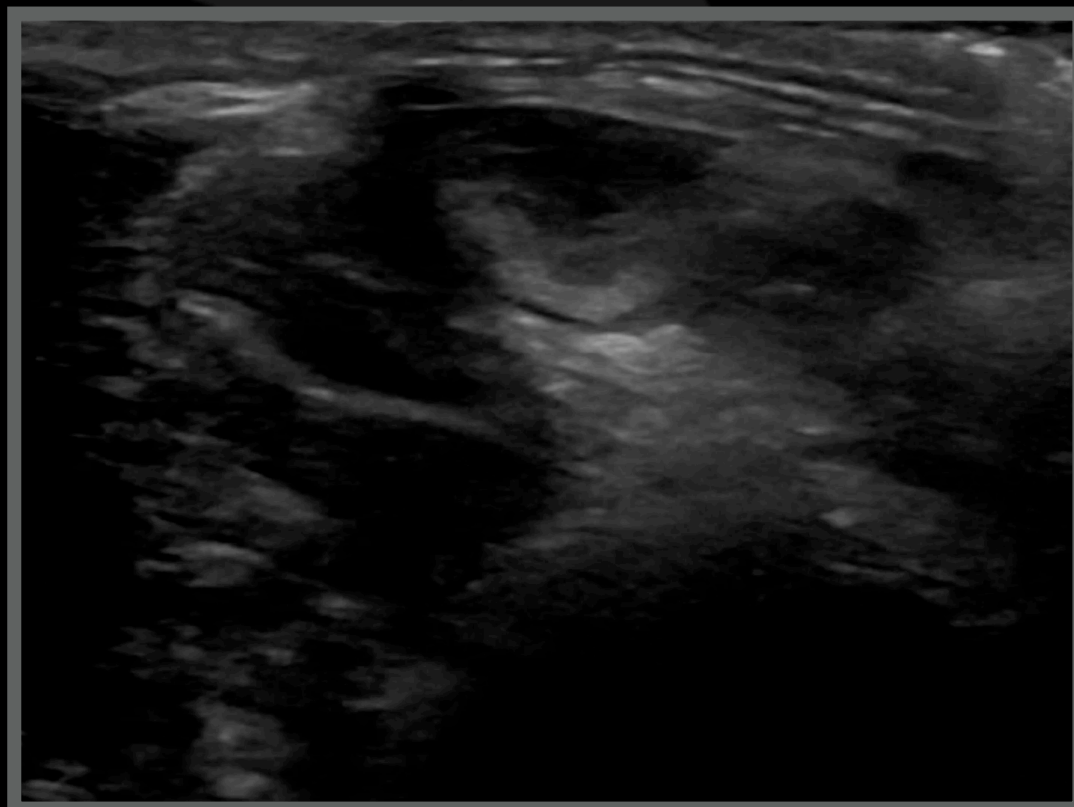
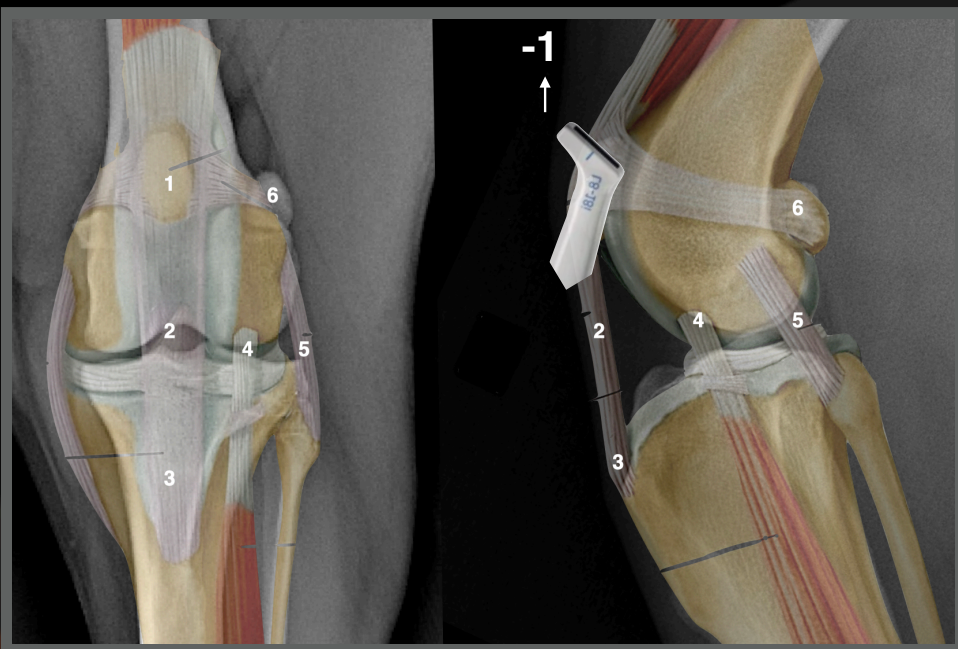
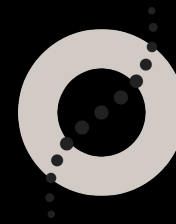
Dante, MI, 1 year

Left thigh

Affected limb

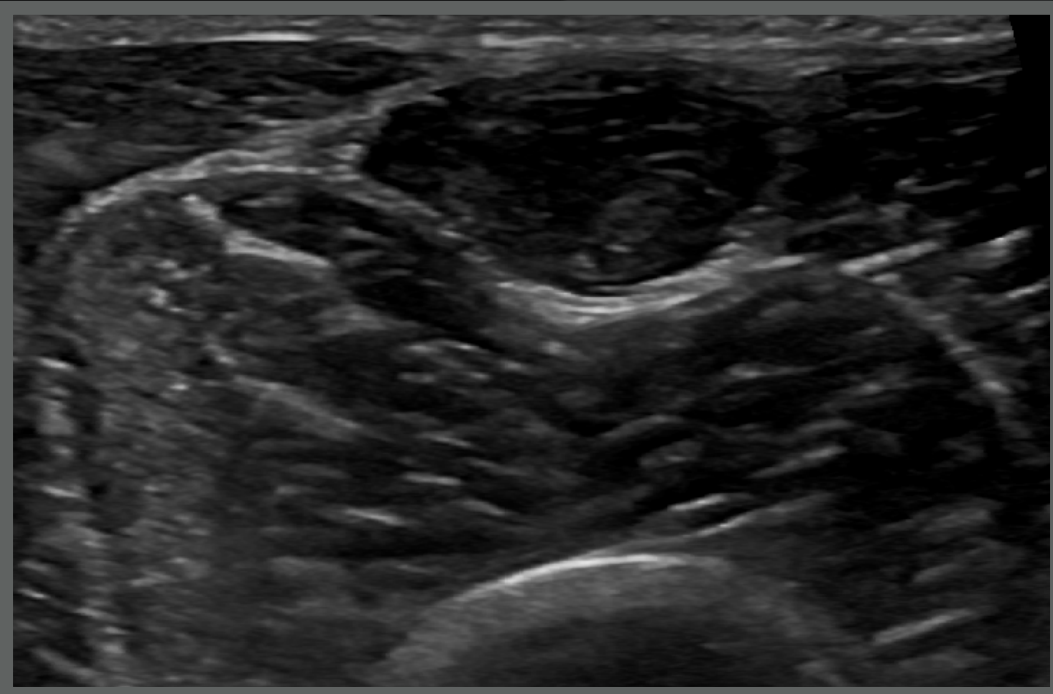
Cranial face transverse scan

1-1



Dante, MI, 1 year

Right thigh



Left thigh



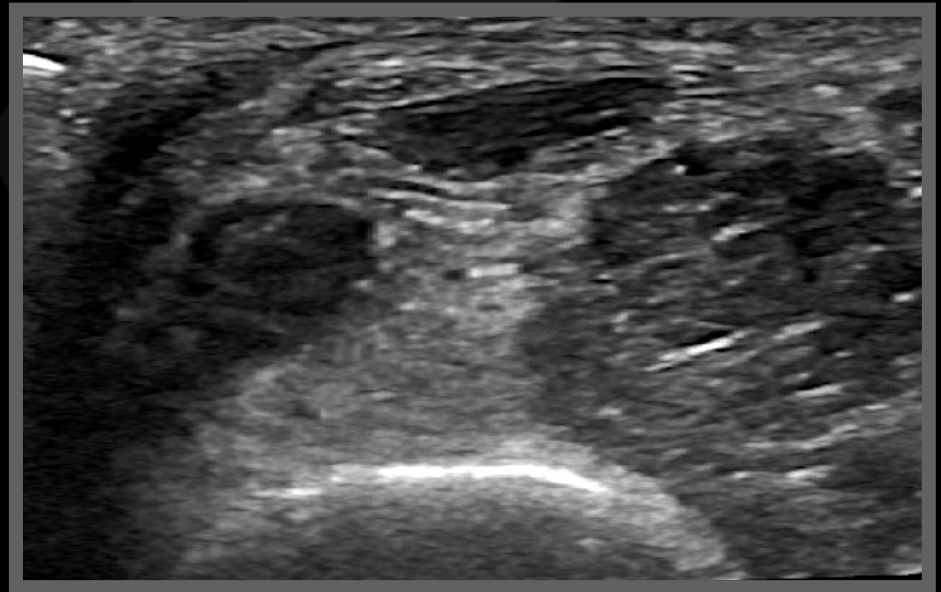
## Dante, MI, 1 year

### Ultrasonographic diagnoses:

- Left vastus intermedius (VI) myopathy

### Conclusions

Suspected partial left VI partial avulsion/tear



## How to arrive to Conclusions:

- PE examination
- X-rays, blood works...
- Ultrasonographic findings
- Literature



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612 results



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of 62



RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial

 **Rehabilitation and Return to Play Following Meniscus Repair.**

1 Wedge C, Crowell M, Mason J, Pitt W.

Cite Sports Med Arthrosc Rev. 2021 Sep 1;29(3):173-179. doi: 10.1097/JSA.0000000000000303.

PMID: 34398124 [Review](#).

Share

 **Patellar Tendon Rupture.**

2 Hsu H, Siwiec RM.

Cite 2023 Feb 13. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.

PMID: 30020647 [Free Books & Documents](#).

Share

The **quadriceps muscle** is composed of four separate muscles with different origins but a common insertion point on the patella through the **quadriceps tendon**. ...**Vastus lateralis** - greater trochanter and lateral linea aspera. **Vastus intermedius** ...

 **Utility of Neuromuscular Electrical Stimulation to Preserve Quadriceps Muscle**3 **Fiber Size and Contractility After Anterior Cruciate Ligament Injuries and****Reconstruction: A Randomized, Sham-Controlled, Blinded Trial.**

Cite Toth MJ, Tourville TW, Voigt TB, Choquette RH, Anair BM, Falcone MJ, Failla MJ, Stevens-Laplaey

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JE, Endres NK, Slauterbeck JR, Beynonn BD.

Am J Sports Med. 2020 Aug;48(10):2429-2437. doi: 10.1177/0363546520933622. Epub 2020 Jul 6.

PMID: 32631074 [Free PMC article](#). [Clinical Trial](#).

BACKGROUND: Anterior cruciate ligament (ACL) injuries and reconstruction (ACLR) promote **quadriceps muscle** atrophy and weakness that can persist for years, suggesting the need for more effective rehabilitation programs. ...**Quadriceps muscle** size and str ...

Sort by: 

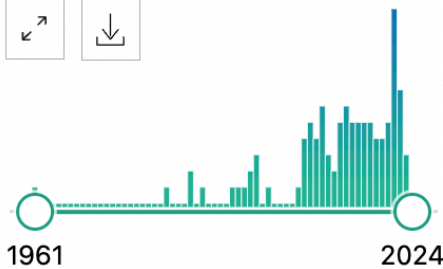


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93 results

 << < Page  of 10 > >>

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

 **Management of anterior thigh injuries in soccer players: practical guide.**

1 Lempainen L, Mechó S, Valle X, Mazzoni S, Villalon J, Freschi M, Stefanini L, García-Romero-Pérez A, Burova M, Pleshkov P, Pruna R, Pasta G, Kosola J.

Cite

BMC Sports Sci Med Rehabil. 2022 Mar 18;14(1):41. doi: 10.1186/s13102-022-00428-y.

Share

 PMID: 35303927 **Free PMC article.** [Review.](#)

Analyzing injury mechanism and adding both clinical and imaging findings, clinicians can make the right treatment decisions already often in the acute phase of the injury. Low grade contusions and **muscle** strains are treated well with planned rehabilitation, but complete te ...

 **Isolated Vastus Intermedius Avulsion Injury: A Case Report with Imaging Spectrum of this Rare Incidence.**

2 Wegner U, Singh C.

Cite

J Clin Imaging Sci. 2019 Dec 11;9:54. doi: 10.25259/JCIS\_124\_2019. eCollection 2019.

Share

 PMID: 31893162 **Free PMC article.**

Isolated mid-tendon **vastus intermedius avulsion** injuries are rare, painful, and overuse-related changes with a wide spectrum of epidemiology often demonstrating an exceptional spectrum of imaging features, especially on conventional radiographs. ...Our case r ...

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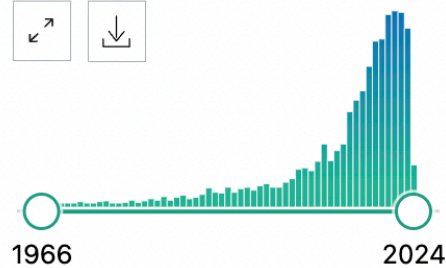
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RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

1 **Diagnostic test accuracy of ultrasound for sarcopenia diagnosis: A systematic review and meta-analysis.**

Cite Fu H, Wang L, Zhang W, Lu J, Yang M.  
Share J Cachexia Sarcopenia Muscle. 2023 Feb;14(1):57-70. doi: 10.1002/jcsm.13149. Epub 2022 Dec 13. PMID: 36513380 [Free PMC article.](#) [Review.](#)

**Muscle ultrasound** is an emerging tool for diagnosing sarcopenia. This review aims to summarize the current knowledge on the **diagnostic** test accuracy of **ultrasound** for the diagnosis of sarcopenia. ...The CSA of rectus femoris, biceps brachii muscles and ...

2 **Longer Interset Rest Periods Enhance Muscle Strength and Hypertrophy in Resistance-Trained Men.**

Cite Schoenfeld BJ, Pope ZK, Benik FM, Hester GM, Sellers J, Nooner JL, Schnaiter JA, Bond-Williams KE, Carter AS, Ross CL, Just BL, Henselmans M, Krieger JW.  
Share J Strength Cond Res. 2016 Jul;30(7):1805-12. doi: 10.1519/JSC.0000000000001272. PMID: 26605807 [Clinical Trial.](#)

The study period lasted 8 weeks with subjects performing 3 total body workouts a week comprised 3 sets of 8-12 repetition maximum (RM) of 7 different exercises per session. Testing was performed prestudy and poststudy for **muscle** strength (1RM bench press and back squat), ...

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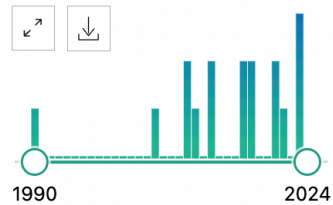
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RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
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- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial
- Review
- Systematic Review

**Ultrasound guidance to approach the femoral nerve in the iliopsoas muscle: a preliminary study in the dog.**

1  
 Cite Mahler SP.  
 Vet Anaesth Analg. 2012 Sep;39(5):550-4. doi: 10.1111/j.1467-2995.2012.00731.x. Epub 2012 May 30.  
 Share  
 PMID: 22642451 Clinical Trial.  
 Phase II. The location of the femoral nerve within the iliopsoas **muscle** was determined via **ultrasonography** in 11 healthy anaesthetized **dogs**. ...Using **ultrasonography**, it was possible to observe the femoral nerve in nine **dogs** (82%). ...

**Radiographic measurement of the quadriceps angle in dogs.**

2  
 Cite Pinna S, Romagnoli N.  
 PLoS One. 2017 Oct 12;12(10):e0185833. doi: 10.1371/journal.pone.0185833. eCollection 2017.  
 Share  
 PMID: 29023529 Free PMC article.  
 The direction of the force of the **quadriceps muscle** group is expressed by the value of the **quadriceps** angle, between the long axis of the **muscle** rectus femoris and the patellar ligament. ...The aims of the present study were to give a reference value f ...

**Long-Term Effects of Whole-Body Vibration on Hind Limb Muscles, Gait and Pain in Lame Dogs with Borderline-to-Severe Hip Dysplasia-A Pilot Study.**

3  
 Cite Gomes MVF, Rahal SC, Santos IFCD, Dadalto CR, Mamprim MJ, Negrão RR, Hormaza JM, Tsunemi MH, Gómez Álvarez CB.  
 Share  
 Animals (Basel). 2023 Nov 9;13(22):3456. doi: 10.3390/ani13223456.  
 PMID: 38003074 Free PMC article.  
 Muscles of the hind limbs were evaluated using measurements of thigh circumference, the cross-sectional thickness of selected hind limb muscles by **ultrasound** assessment, and **vastus** lateralis **muscle** activity determined by surface electromyography (EMG). ...Own ...



www.clinicalimagingscience.org



## Journal of Clinical Imaging Science



### Case Report

# Isolated Vastus Intermedius Avulsion Injury: A Case Report with Imaging Spectrum of this Rare Incidence

Urszula Wegner<sup>1</sup>, Chitrangada Singh<sup>2</sup>

<sup>1</sup>Department of Radiology, Manchester University Hospitals, Manchester, United Kingdom, <sup>2</sup>Department of Radiology, Kohinoor Hospital, Mumbai, Maharashtra, India.



**\*Corresponding author:**

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Consultant Radiologist,  
Manchester University  
Hospitals, Manchester,  
United Kingdom.

### ABSTRACT

Isolated mid-tendon vastus intermedius avulsion injuries are rare, painful, and overuse-related changes with a wide spectrum of epidemiology often demonstrating an exceptional spectrum of imaging features, especially on conventional radiographs. Although they can be easily diagnosed on magnetic resonance imaging, it is pertinent to identify the features of conventional imaging as that forms the first line of investigation. Our case report emphasizes the significance of identifying early signs of vastus intermedius avulsions on plain radiographs which can avoid neglect and functional disability. Timely identification of conventional imaging can avoid months of excruciating pain and streamline the further course of the treatment.

**Keywords:** Musculoskeletal bone, Musculoskeletal system, Magnetic resonance, Trauma, Inflammation

## Dante, Whippet, MI, 1 year

### Conclusions:

- Suspected partial rupture of the Vastus Intermedius at the bone origin



### Follow up

- Physiotherapy
- When should we recheck?

Article

# Efficacy of Serial Ultrasonographic Examinations in Predicting Return to Play in Agility Dogs with Shoulder Lameness

Maria Grazia Entani <sup>1</sup>, Alessio Franini <sup>1</sup> , Ludovica Dragone <sup>2</sup>, Gabriele Barella <sup>3</sup>, Fabio De Rensis <sup>4</sup> and Giliola Spattini <sup>5,\*</sup>

Healing phase	Tendon	Muscle
Inflammatory phase	24 h	5 days
Proliferative phase	2 days- 6 weeks	4 weeks
Remodeling phase	Consolidation 6-10 weeks Maturation 10-52 weeks	Consolidation 5-12 weeks Maturation 12-52 weeks

*Animals* **2022**, 12, 78. <https://doi.org/10.3390/ani12010078>

# Dante, MI, 1 year

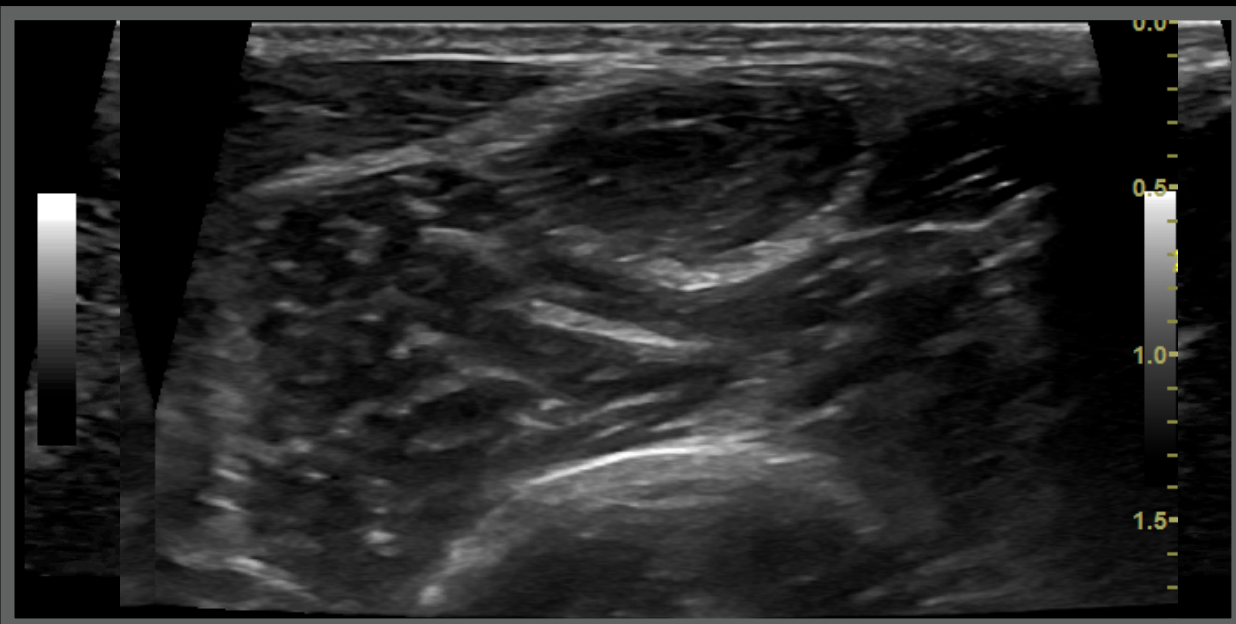
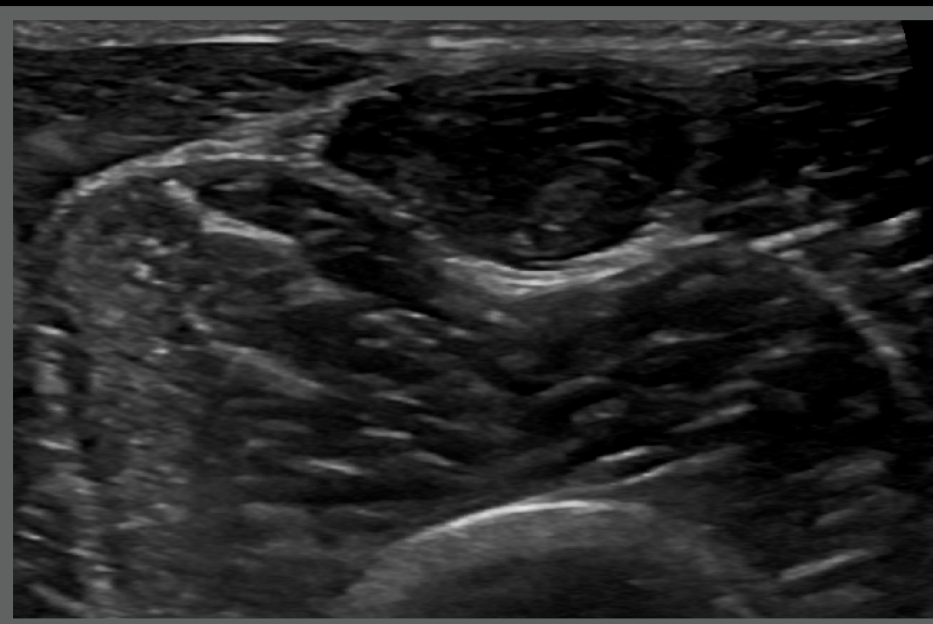
Two months recheck

Right thigh

Time 0

Left thigh

Two months later



# Dante, Whippet, MI, 1 year

Four months recheck

Right thigh

Time 0



Left thigh

Four months later



... Ultrasound healing ...

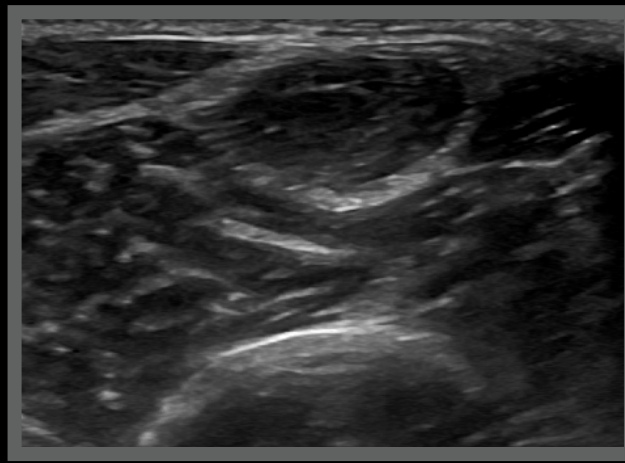
It is not functional healing

## Dante, Whippet, MI, 1 year

Time 0



Two months later



Four months later



- Recovered, sound in 2 years
- The owner is manically careful



## Arizona, Border Collie, FS, 4 years

- Trauma three weeks ago



## Arizona, Border Collie, FS, 4 years

- After that “weird gait”
- Resistant in extending caudally the left hind limb



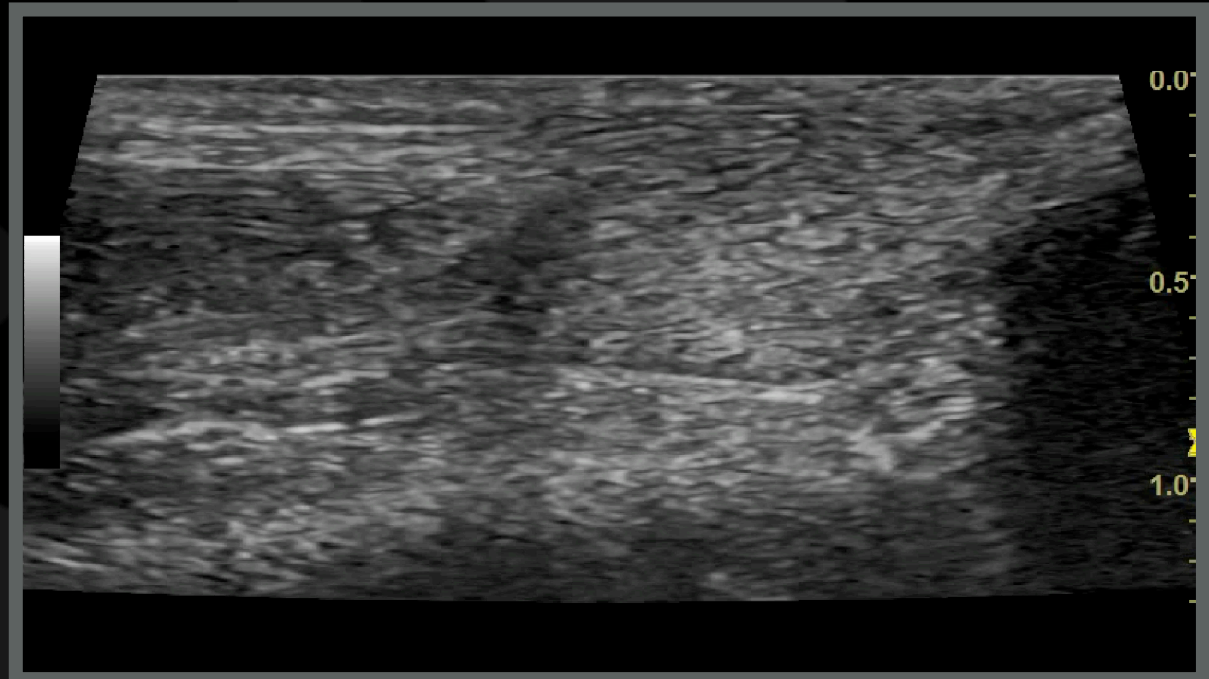
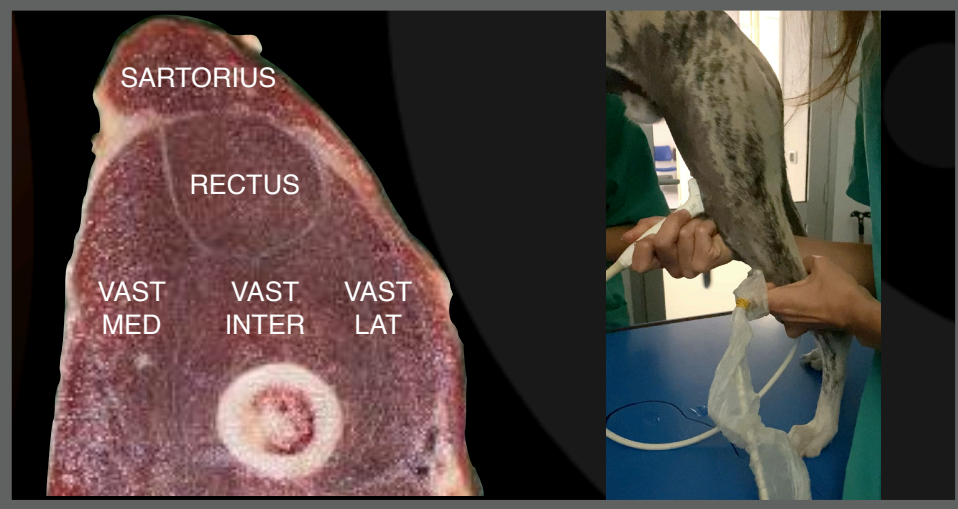
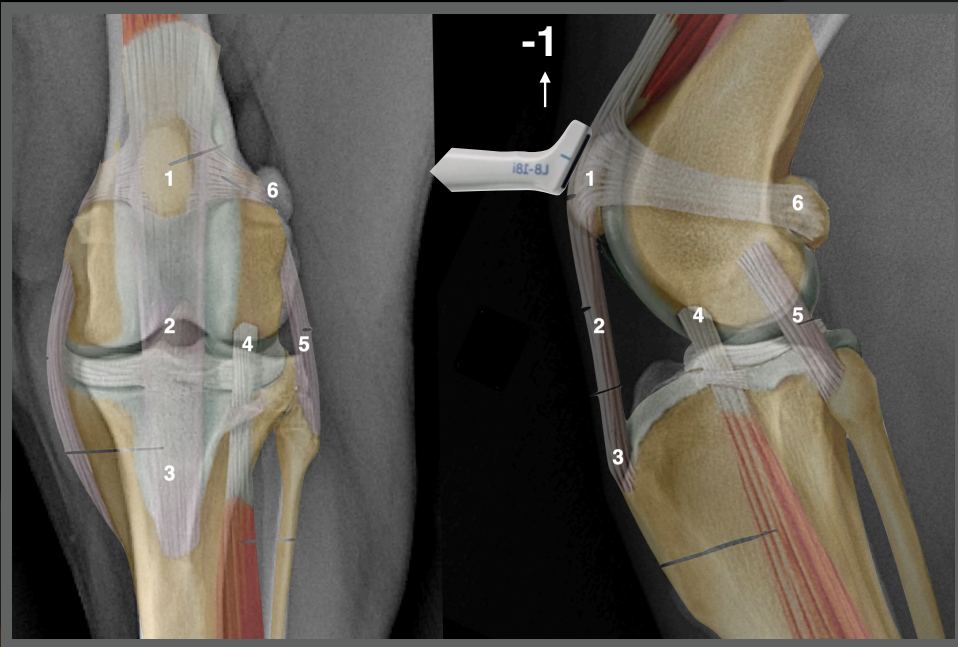
Arizona, FS, 4 years

Right thigh

Sound limb

Cranial face longitudinal scan

1-1



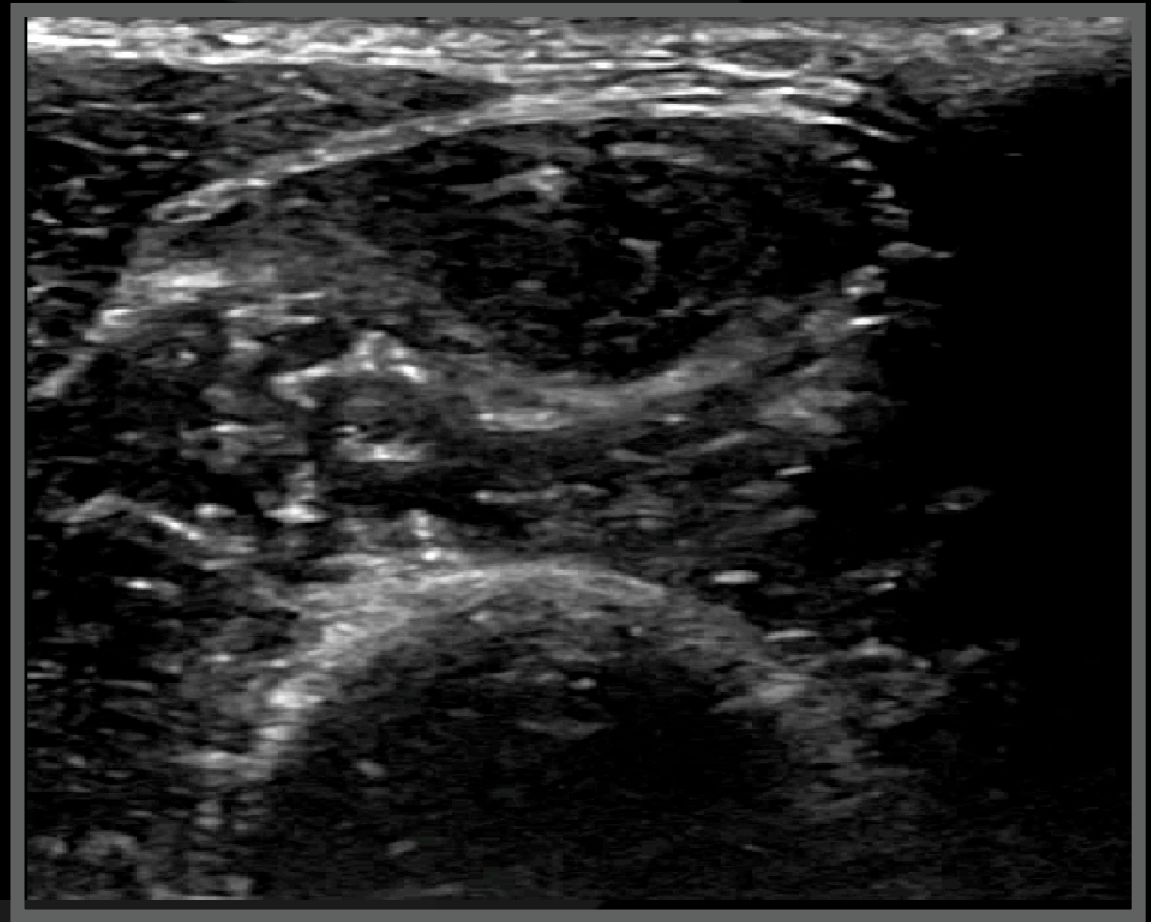
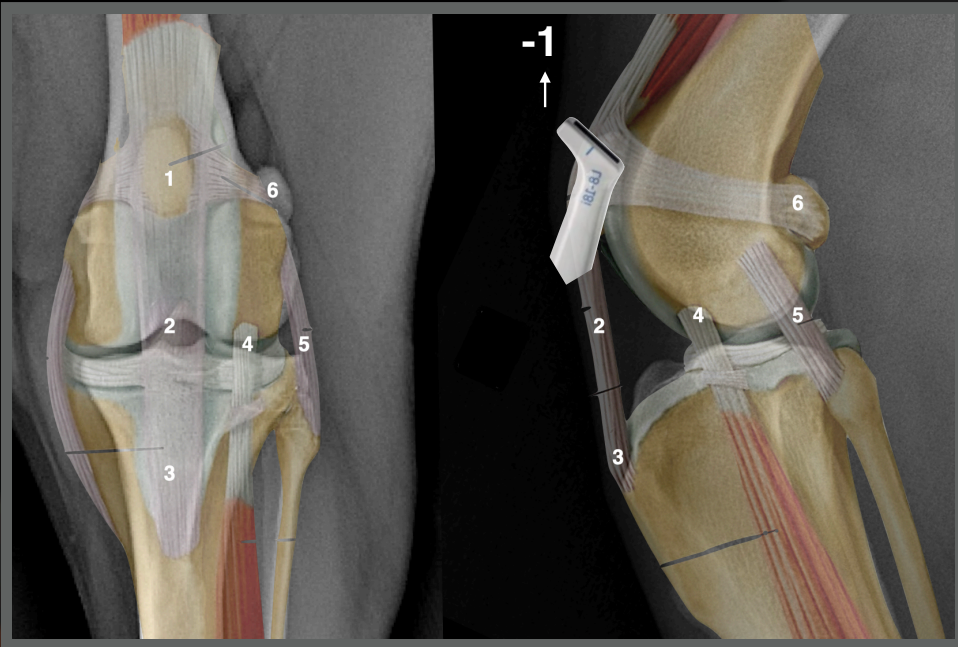
# Arizona, FS, 4 years

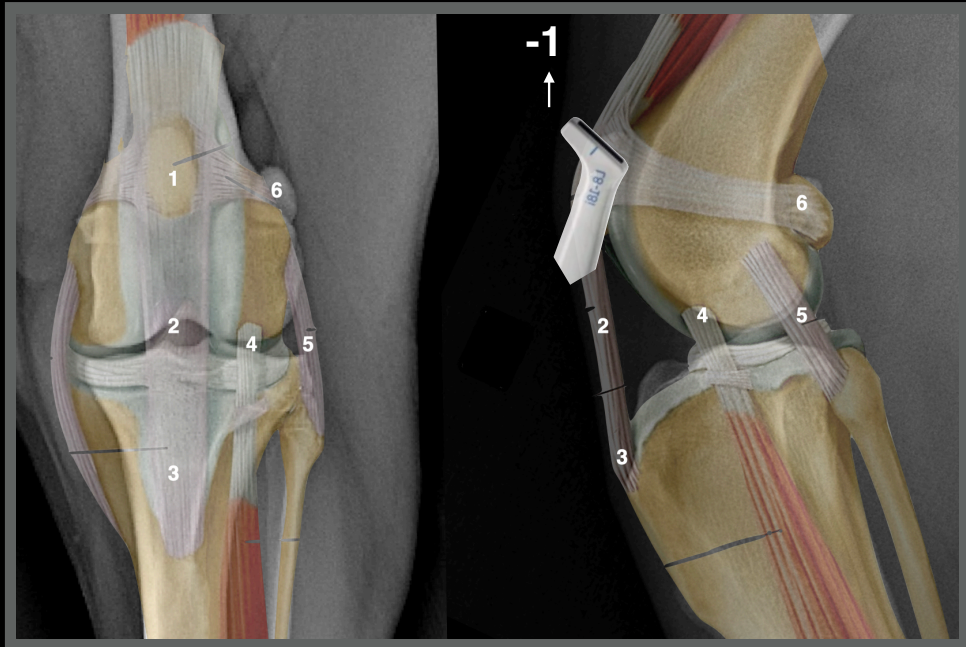
Right stifle

Sound limb

Cranial face transverse scan

1-1

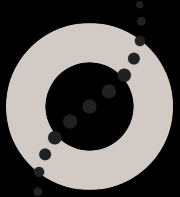




Arizona, FS, 4 years

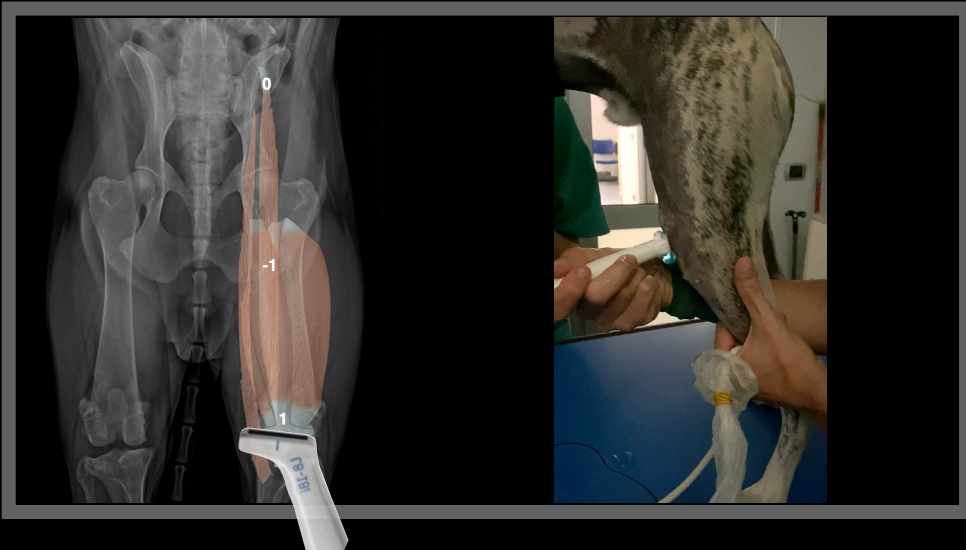
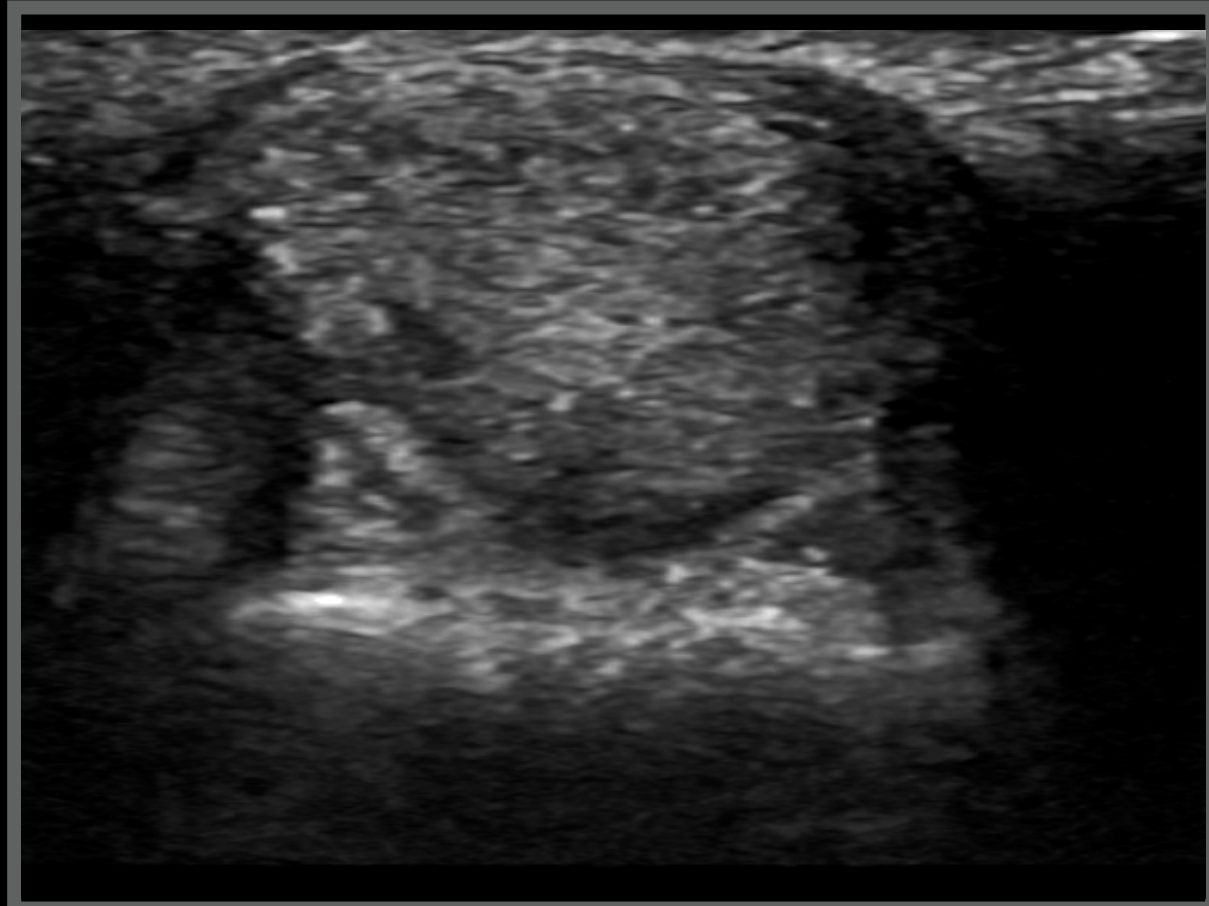
Right thigh

Sound limb

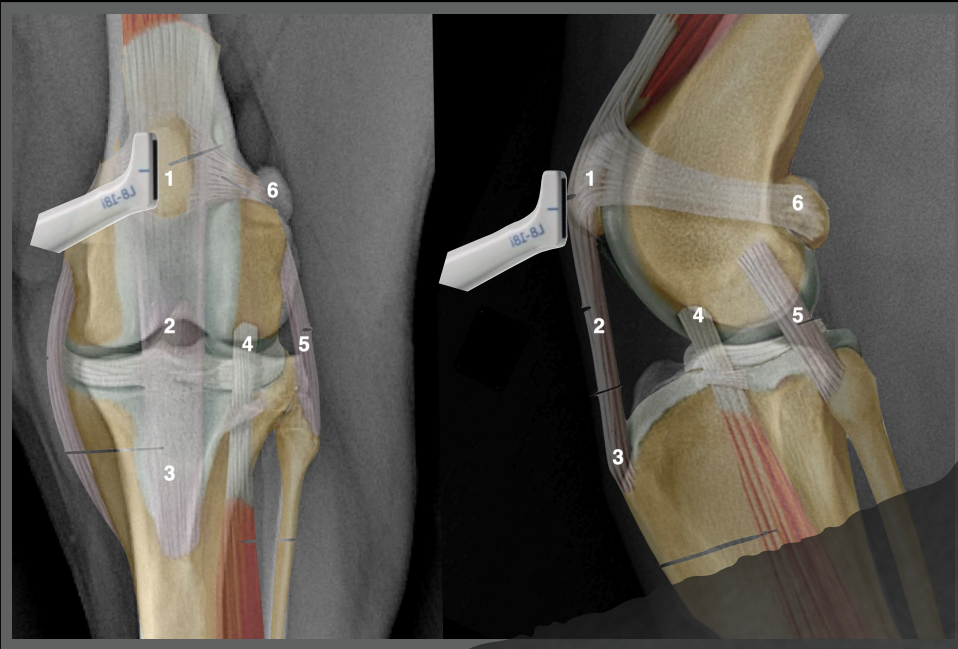
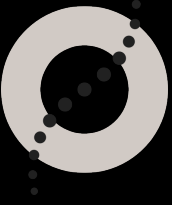


Cranial face transverse scan

1-1

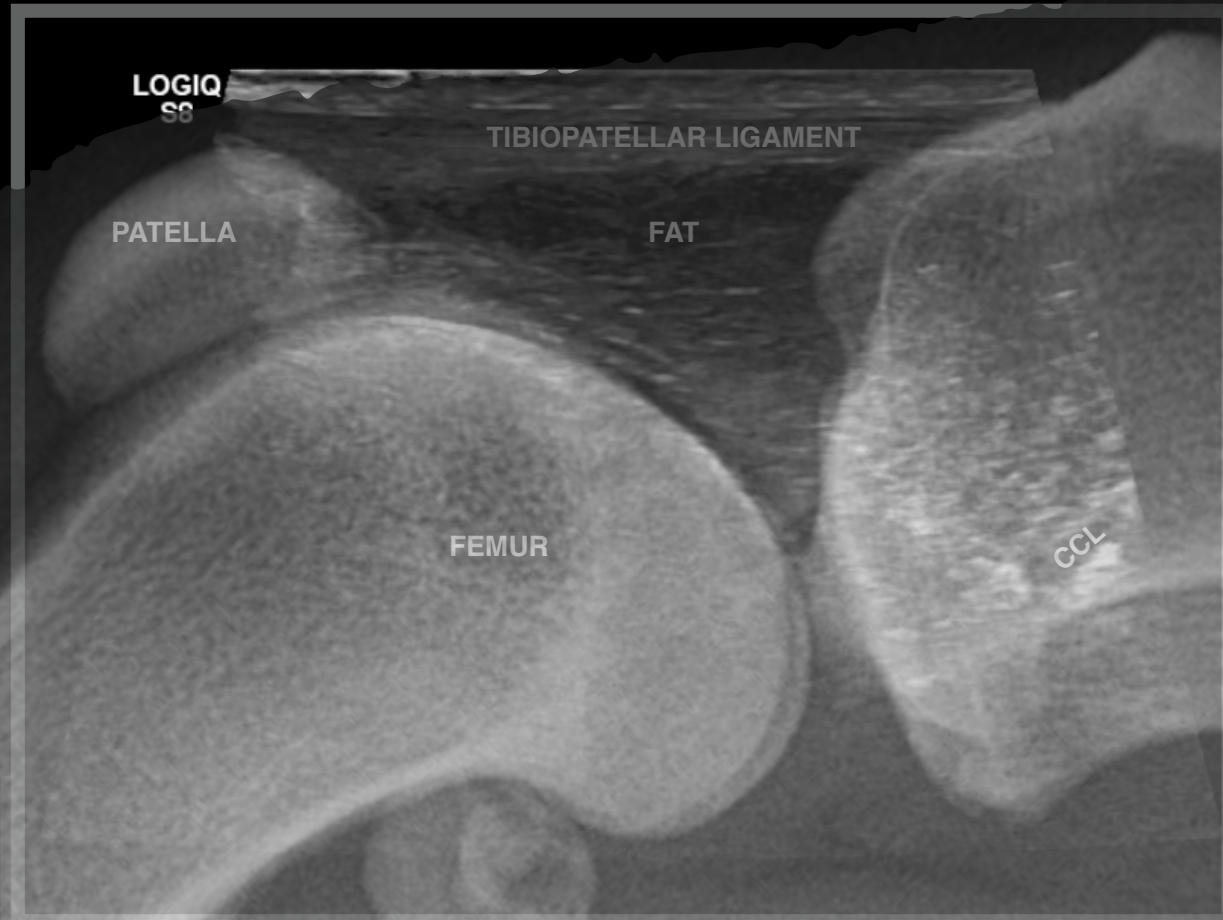
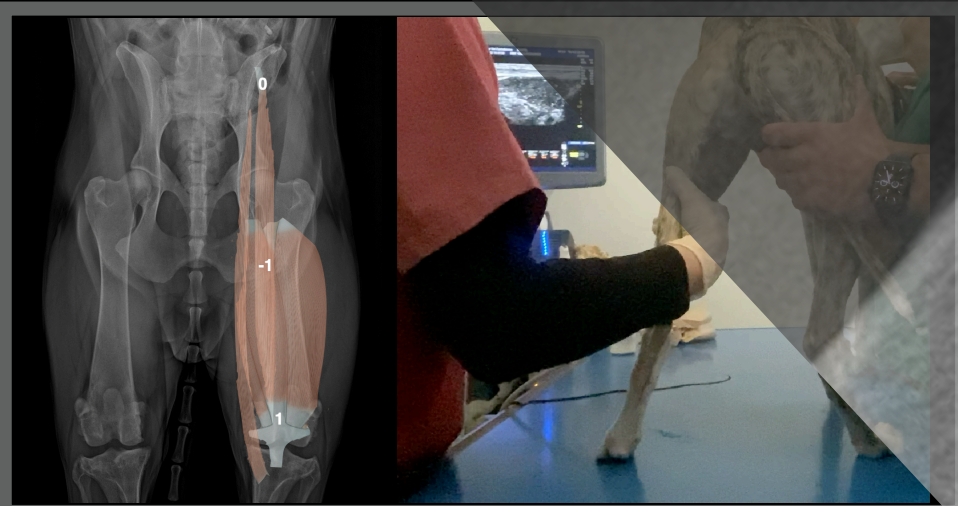


# Ultrasonographic anatomy of the cranial face of the stifle



Cranial face longitudinal scan

1-2-3



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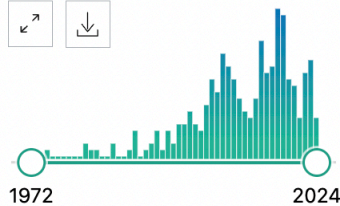
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290 results

Page 1 of 29

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

- Books and Documents
- Clinical Trial
- Meta-Analysis
- Randomized Controlled Trial
- Review

1 [High-frequency ultrasound, computed tomography and computed tomography arthrography of the cranial cruciate ligament, menisci and cranial meniscotibial ligaments in 10 radiographically normal canine cadaver stifles.](#)

Cite  
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Van der Vekens E, de Bakker E, Bogaerts E, Broeckx BJG, Ducatelle R, Kromhout K, Saunders JH. BMC Vet Res. 2019 May 14;15(1):146. doi: 10.1186/s12917-019-1892-y. PMID: 31088469 [Free PMC article.](#)

Untreated **cranial cruciate ligament** disease and concurrent meniscal lesions cause progressive osteoarthritis and pain of the stifle joint. ...Linear areas of contrast may be detected within the **cranial cruciate ligament** of radiographicall ...

2 [Cranial cruciate ligament rupture in the dog--a retrospective study comparing surgical techniques.](#)

Cite  
Share

Moore KW, Read RA. Aust Vet J. 1995 Aug;72(8):281-5. doi: 10.1111/j.1751-0813.1995.tb03555.x. PMID: 8579557

Three surgical techniques, grouped as intra-articular techniques, extracapsular techniques and fibular head transposition, were used for repair of the **cranial cruciate ligament** (CCL)-deficient stifle in 113 **dogs** over a 4 year 4 month period. The clinic ...

3 [Tibial osteotomies for cranial cruciate ligament insufficiency in dogs.](#)

Cite  
Share

Kim SE, Pozzi A, Kowaleski MP, Lewis DD. Vet Surg. 2008 Feb;37(2):111-25. doi: 10.1111/j.1532-950X.2007.00361.x. PMID: 18251804 [Review.](#)


OBJECTIVE: To review the biomechanical considerations, experimental investigations, and clinical data pertaining to tibial osteotomy procedures for treatment of **cranial cruciate ligament** (CrCL) insufficiency in **dogs**. STUDY DESIGN: Literature review. ...

RESEARCH ARTICLE

Open Access

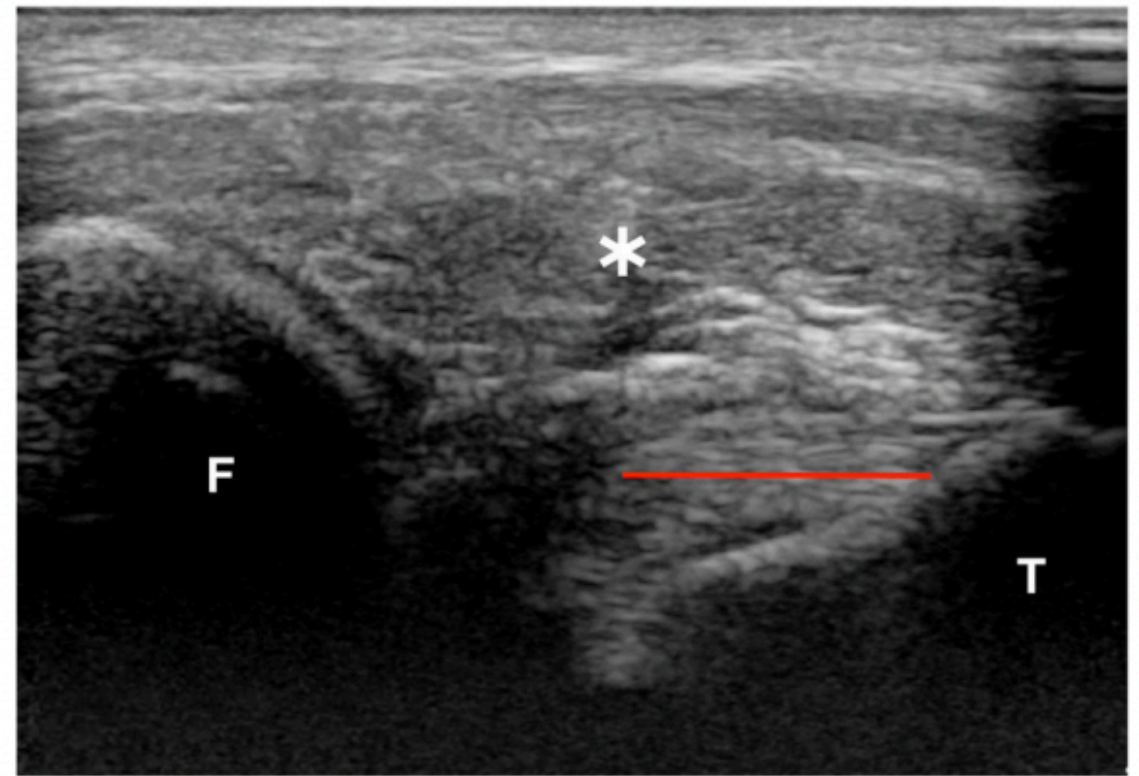
# High-frequency ultrasound, computed tomography and computed tomography arthrography of the cranial cruciate ligament, menisci and cranial meniscotibial ligaments in 10 radiographically normal canine cadaver stifles



Elke Van der Vekens<sup>1\*</sup> , Evelien de Bakker<sup>1</sup>, Evelien Bogaerts<sup>1</sup>, Bart J. G. Broeckx<sup>2</sup>, Richard Ducatelle<sup>3</sup>, Kaatje Kromhout<sup>1</sup> and Jimmy H. Saunders<sup>1</sup>

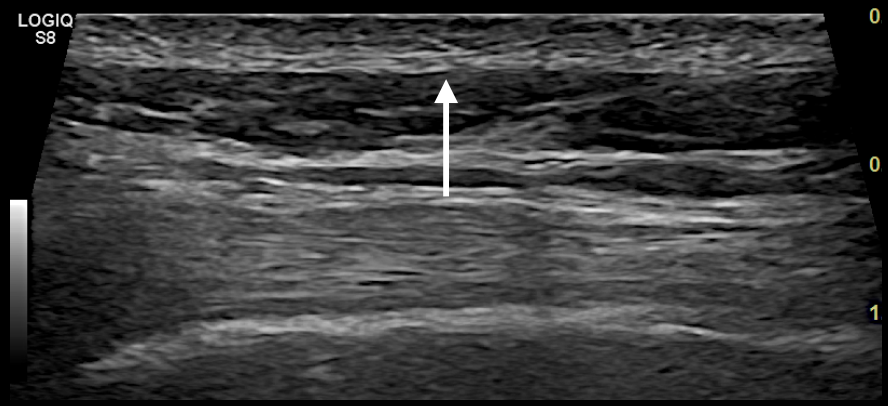
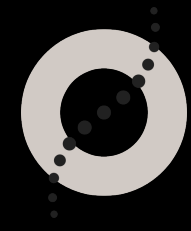
## Why we cannot assess the CCL by ultrasound?

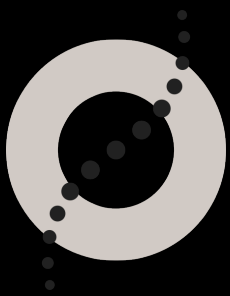
- Bone “cage”
- Anisotropy artifact
- Speed error artifact



**Fig. 1** Cranial proximolateral-distomedial oblique sagittal ultrasonographic image of the left stifle of dog 4 in flexion. A clear fibrillar pattern is visible within the distal aspect of the CrCrL. More proximal the ligament becomes hypoechoic because of anisotropy artifact. F: Femur; T: tibia; \*: infrapatellar fat pad; red line: length fibrillar pattern visible within CrCrL. Proximal is left and cranial to the top in the image

Anisotropy artefact

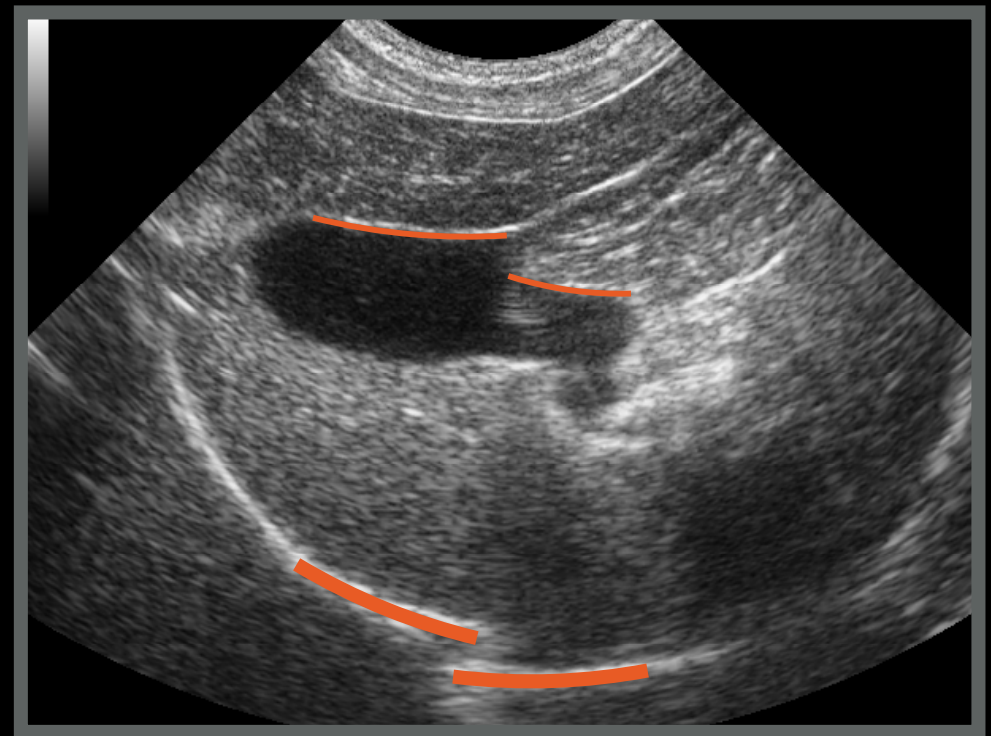




## Speed error artefact

### Velocity of Sound in Various Materials

Material	Velocity (m/s)
air	331
fat	1450
water (50°C)	1540
human soft tissue	1540



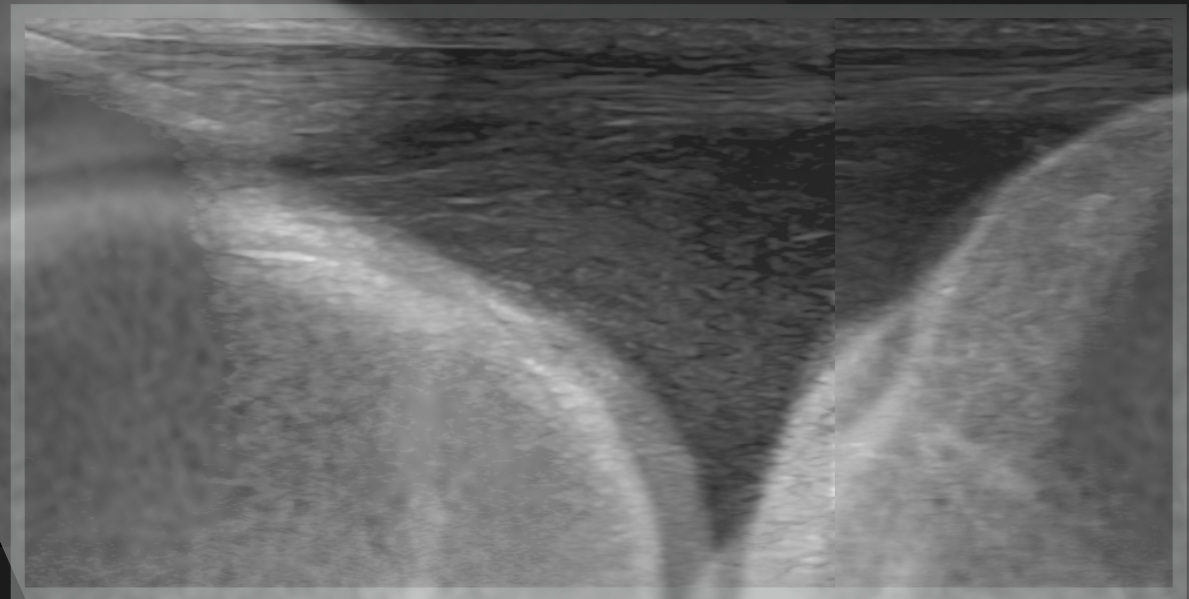
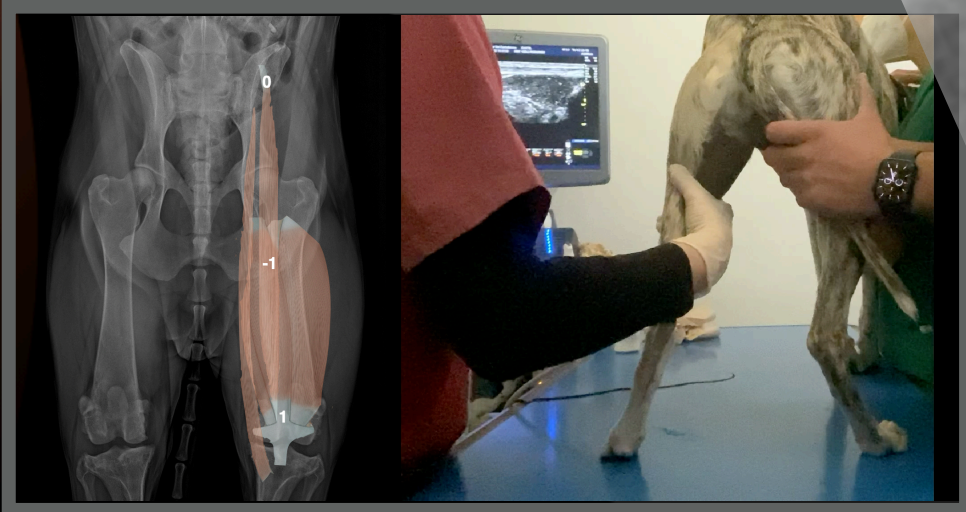
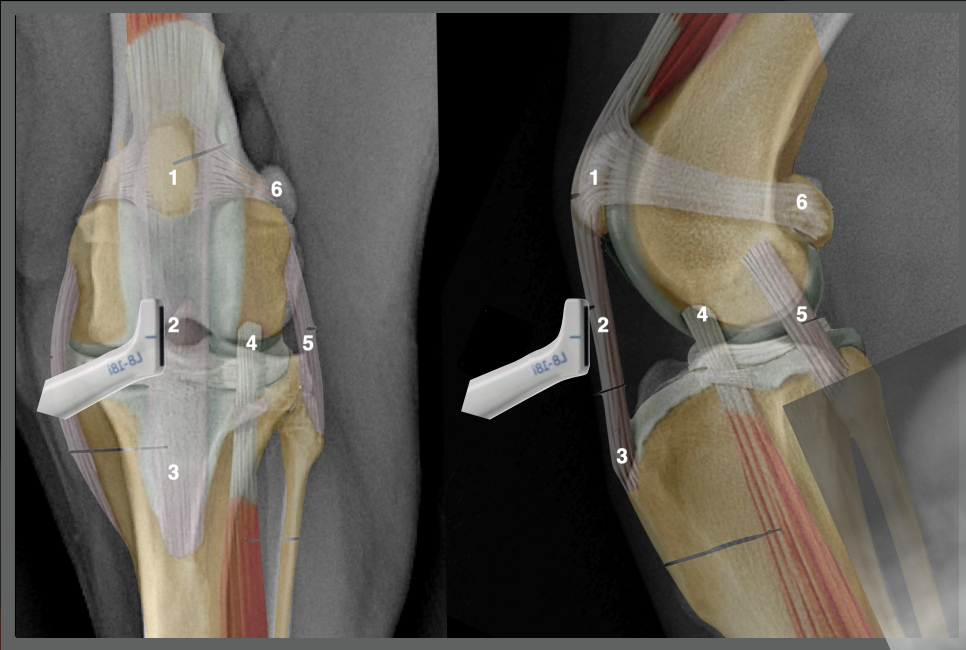
**Arizona, FS, 4 years**

Right stifle

Sound limb

1-2-3

Cranial face longitudinal scan



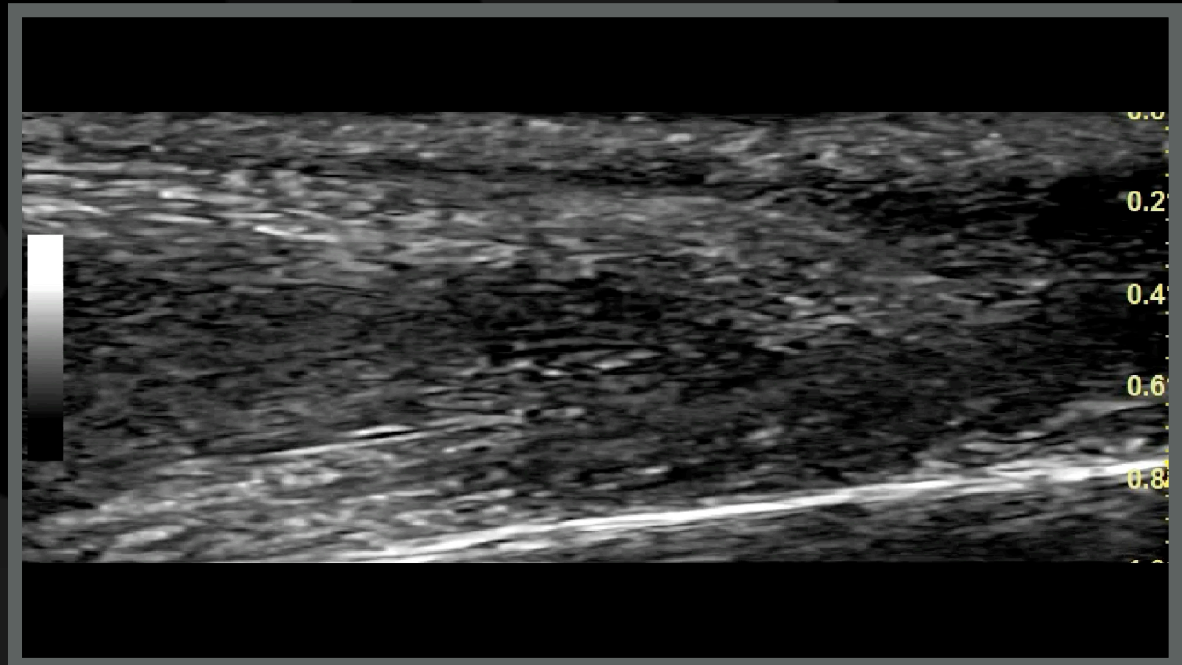
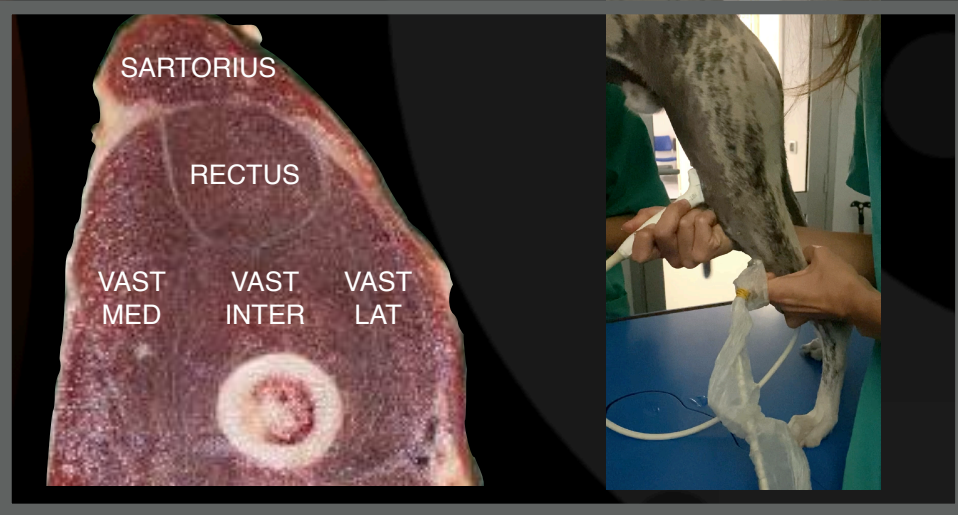
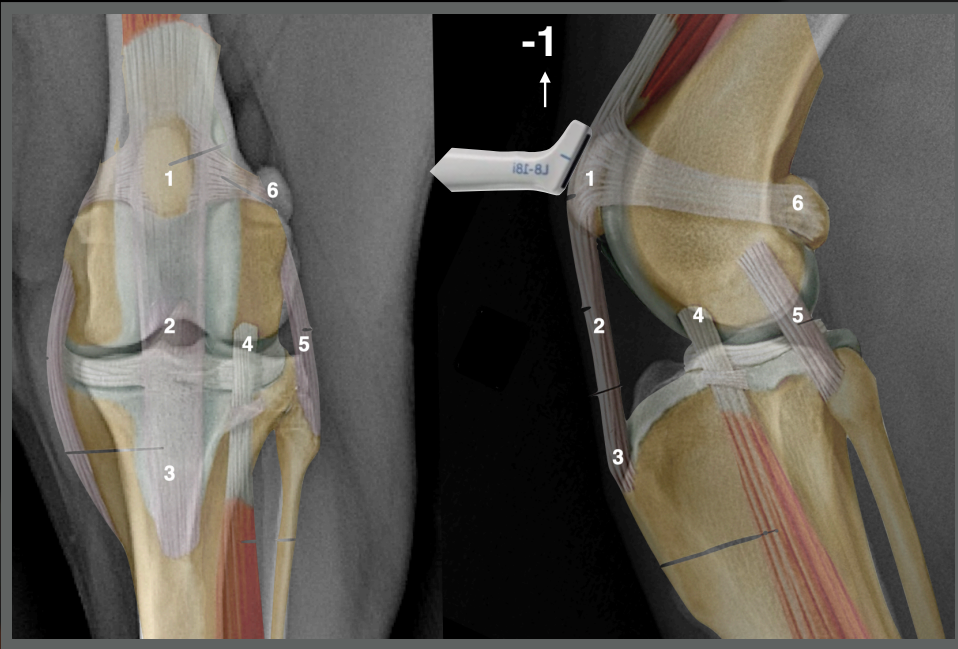
# Arizona, FS, 4 years

Left stifle

Affected limb

Cranial face longitudinal scan

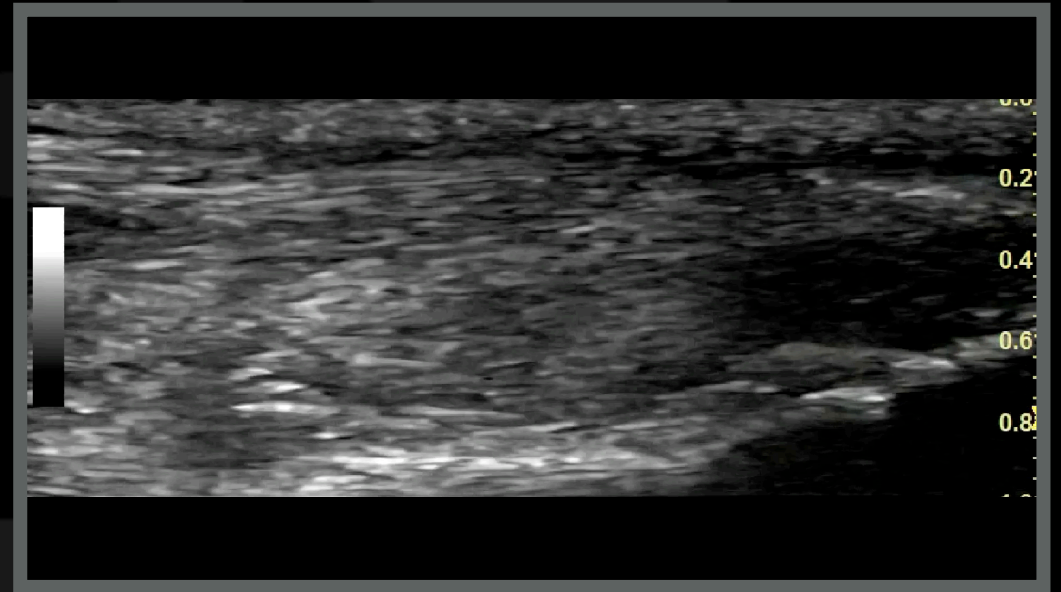
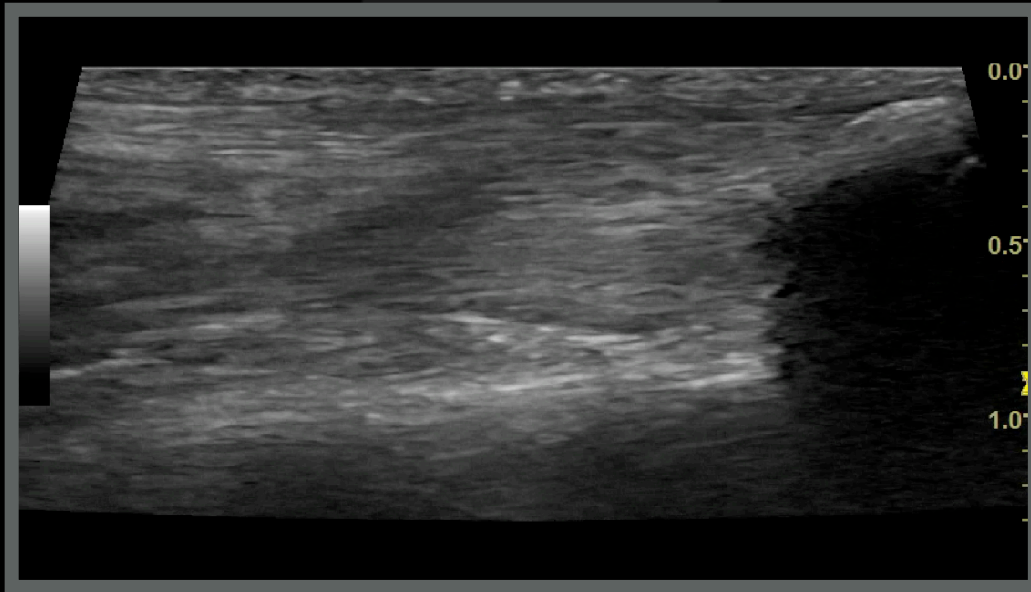
1-1



# Arizona, Border Collie, FS, 4 years

Right thigh

Left stifle

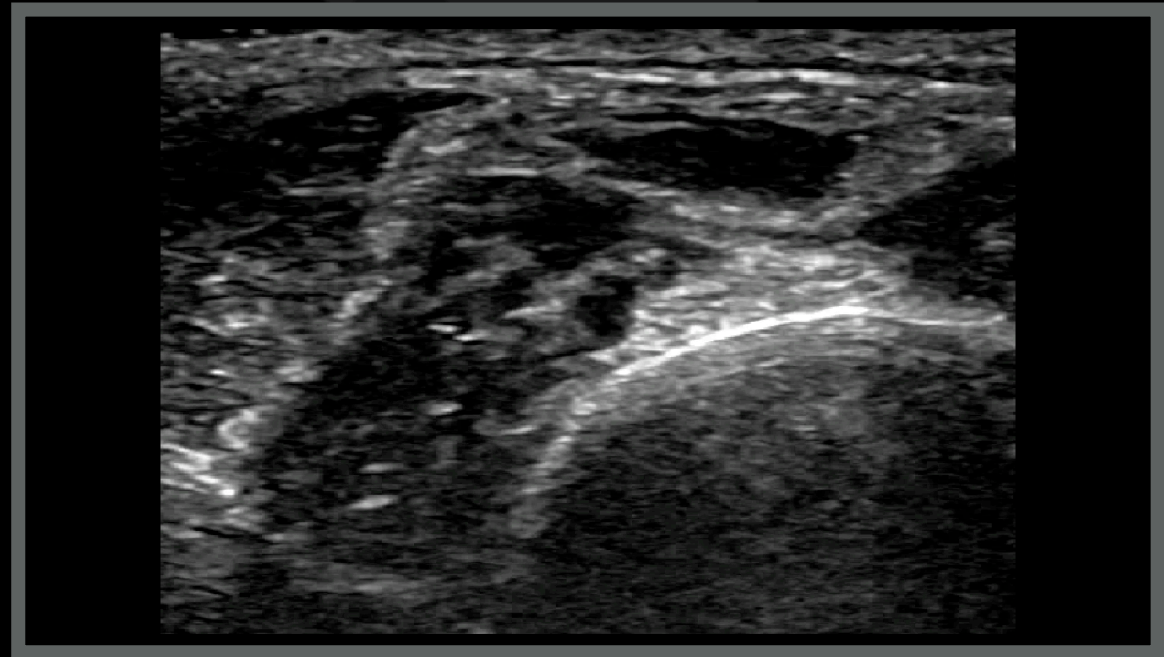
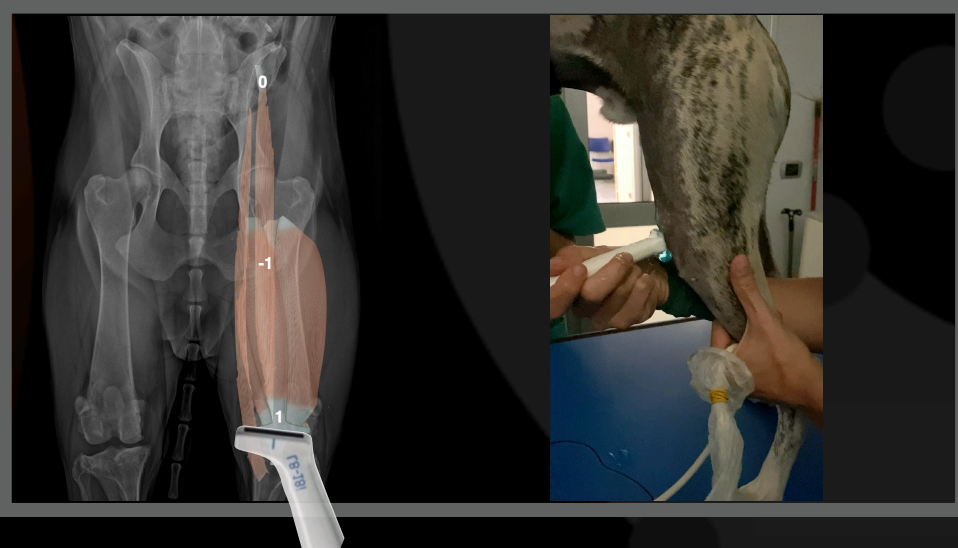
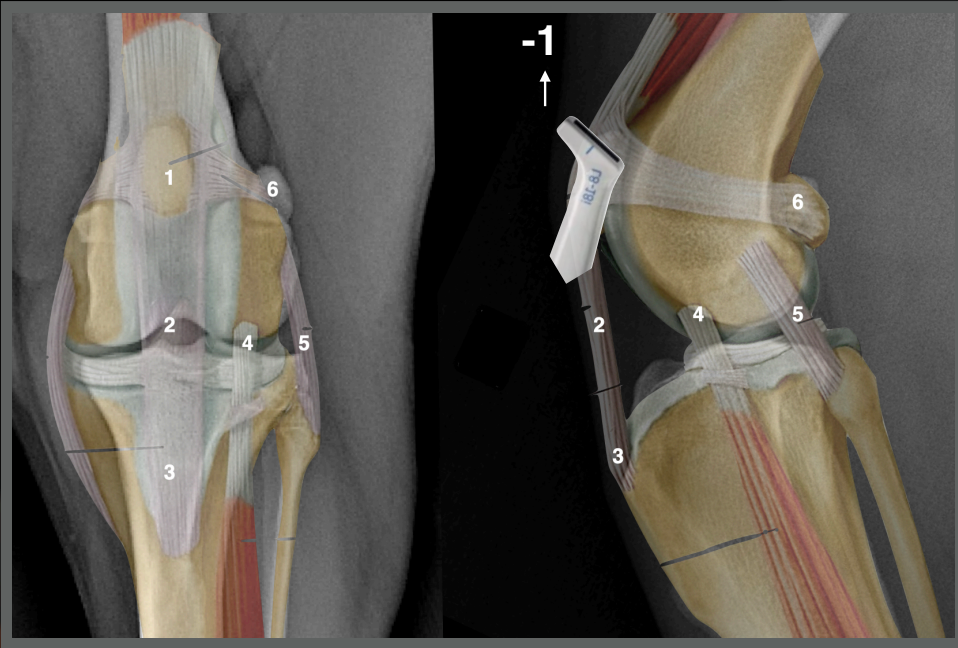


Arizona, FS, 4 years

Left stifle

Cranial face transverse scan

1-1

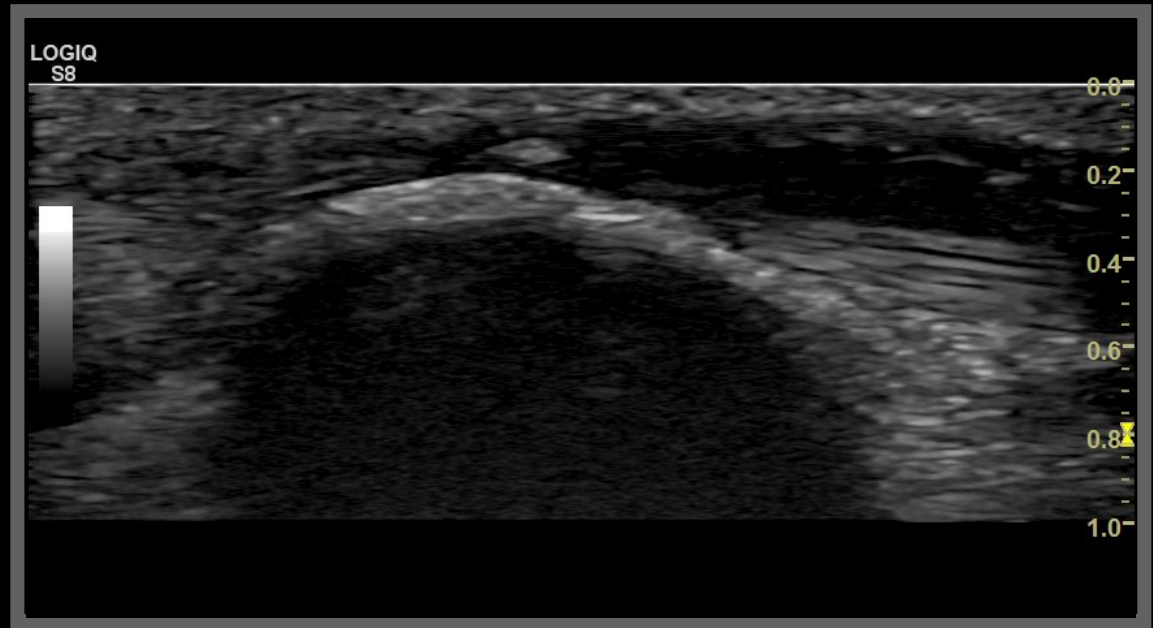
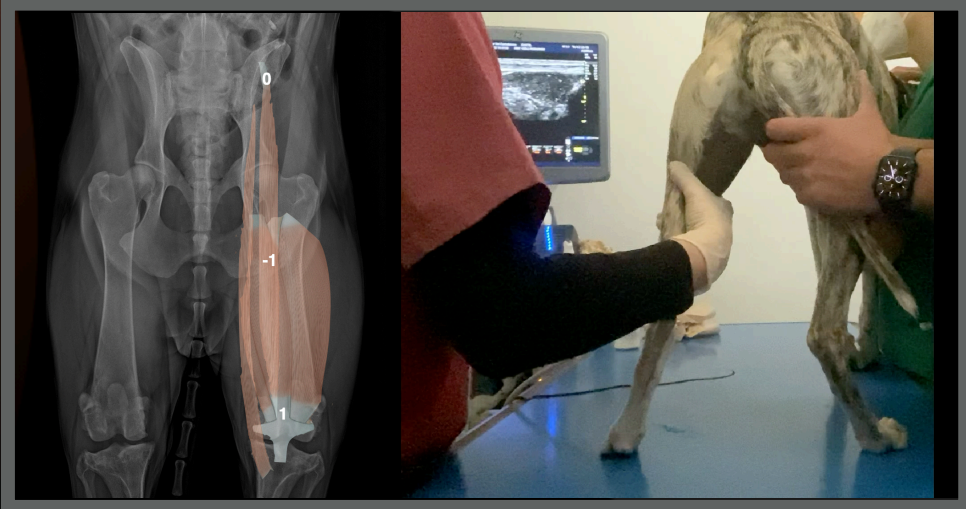
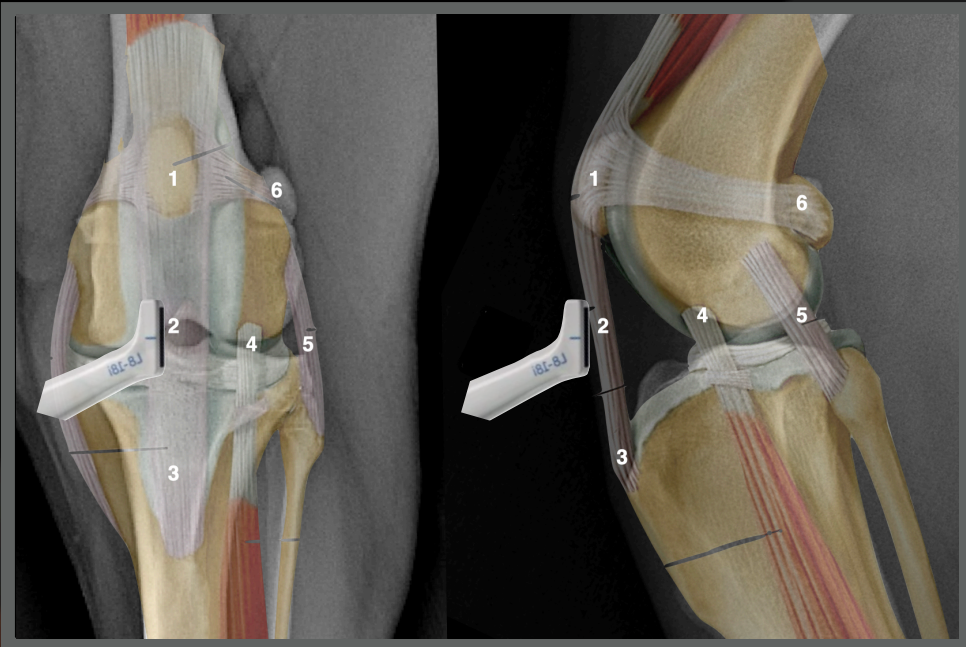


Arizona, FS, 4 years

Left stifle

Cranial face longitudinal scan

1-2-3

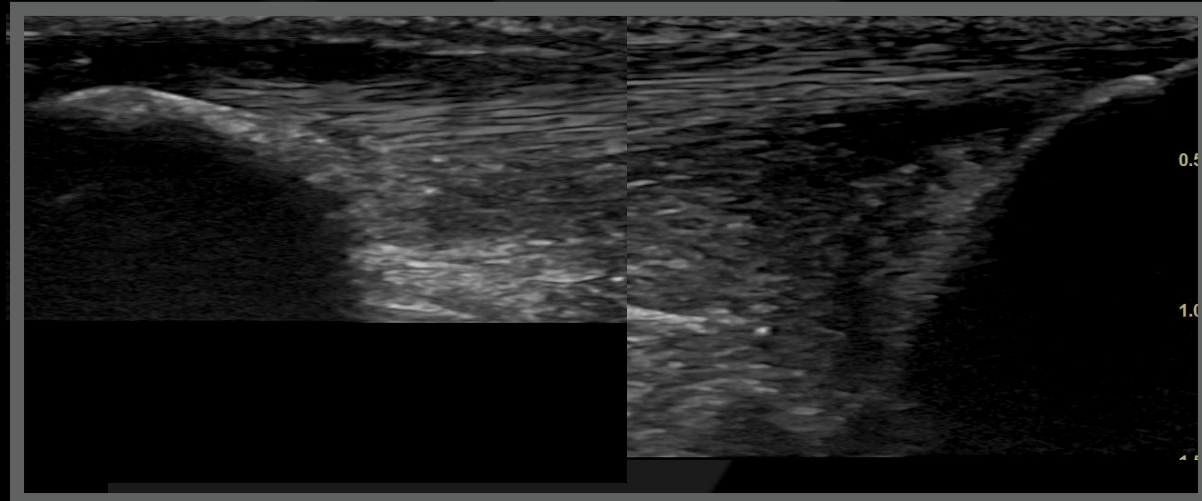
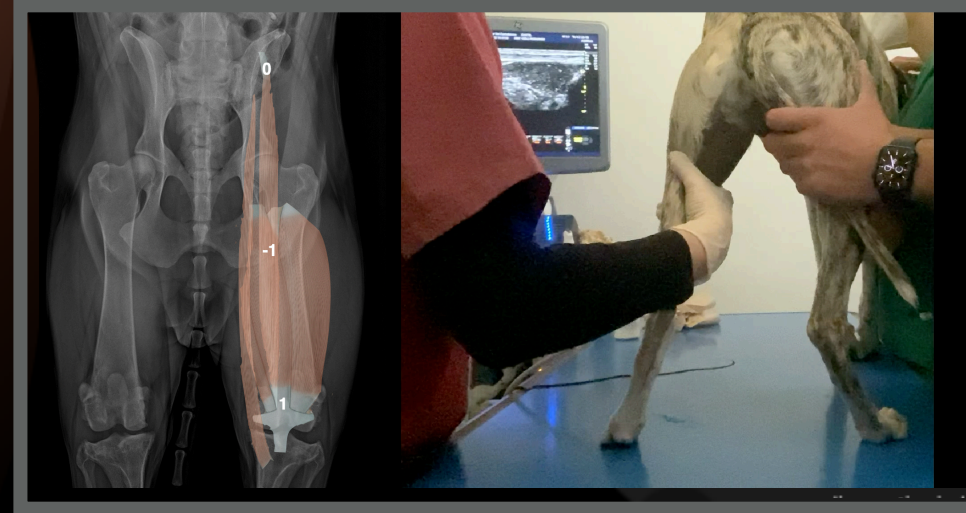
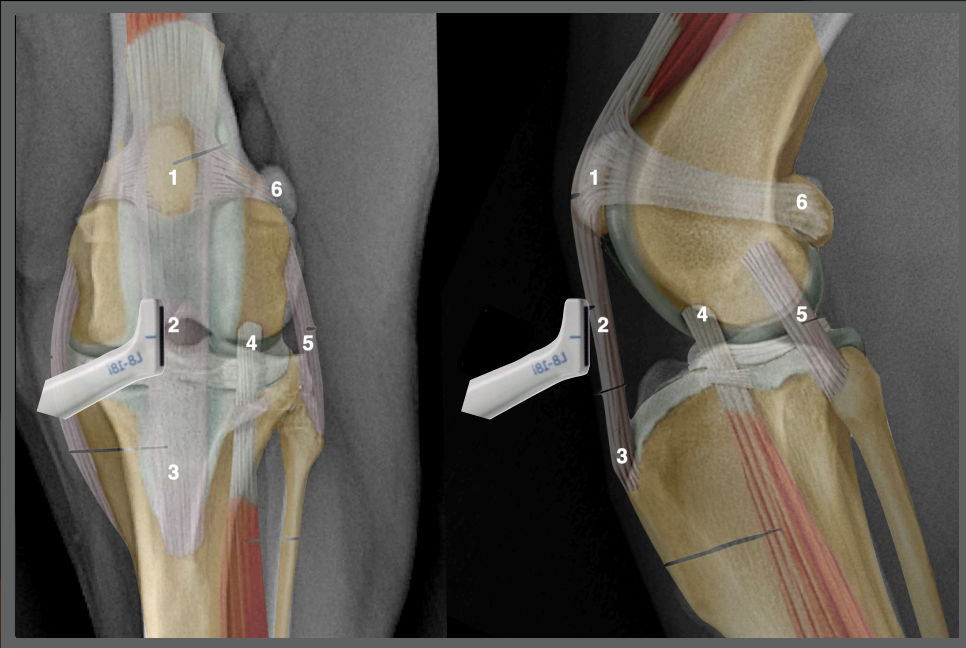


# Arizona, FS, 4 years

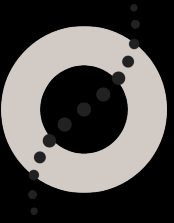
Left stifle

Cranial face longitudinal scan

1-2-3

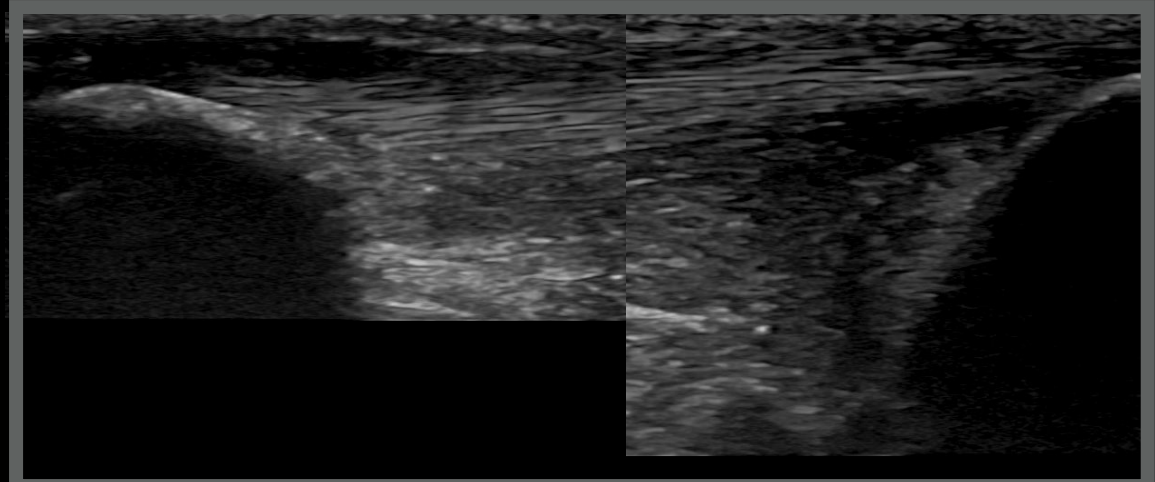
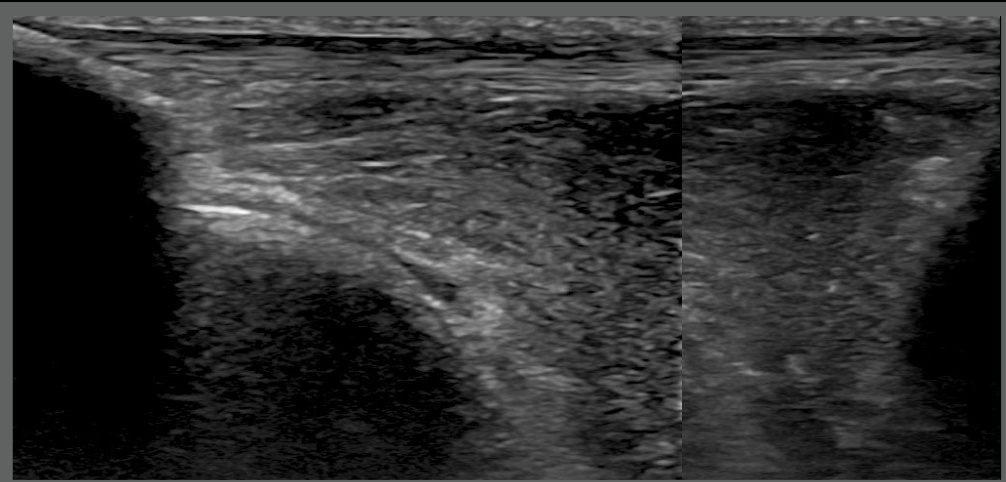


# Arizona, Border Collie, FS, 4 years



Right stifle

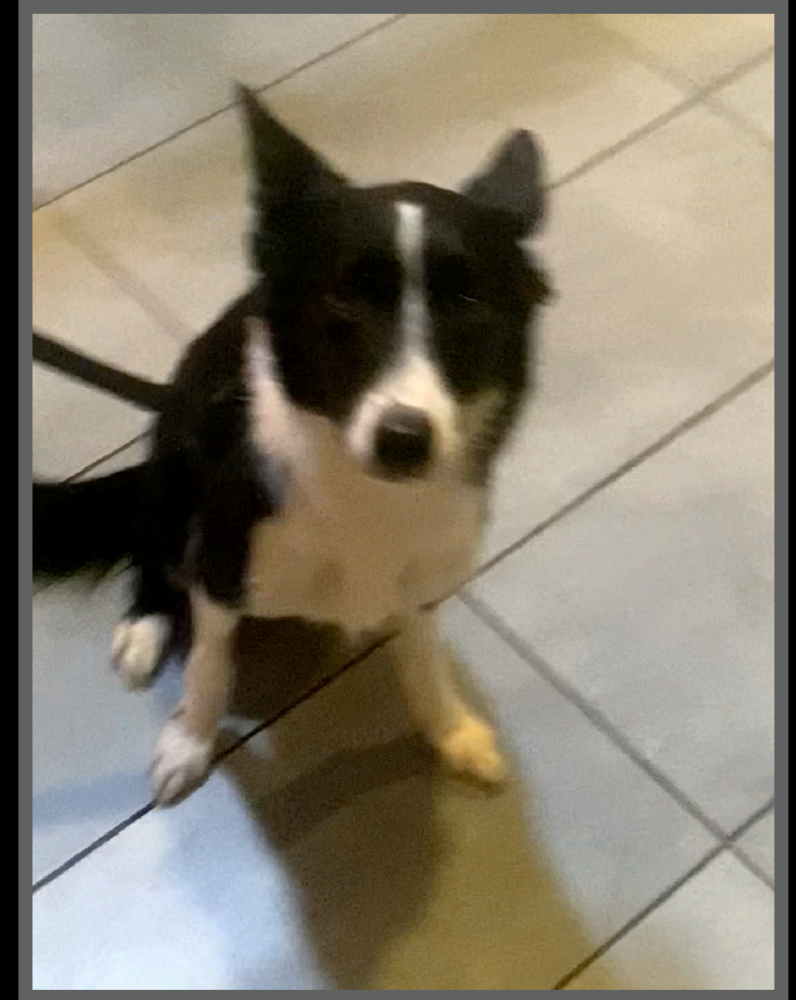
Left stifle



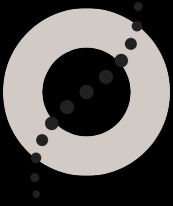
## Arizona, Border Collie, FS, 4 years

### Ultrasonographic diagnoses:

- Suspected chip fragment arising from the dorsal margin of the left patella
- Possible hematoma on the left tibia-patellar ligament



Next step?

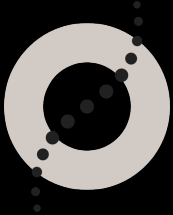
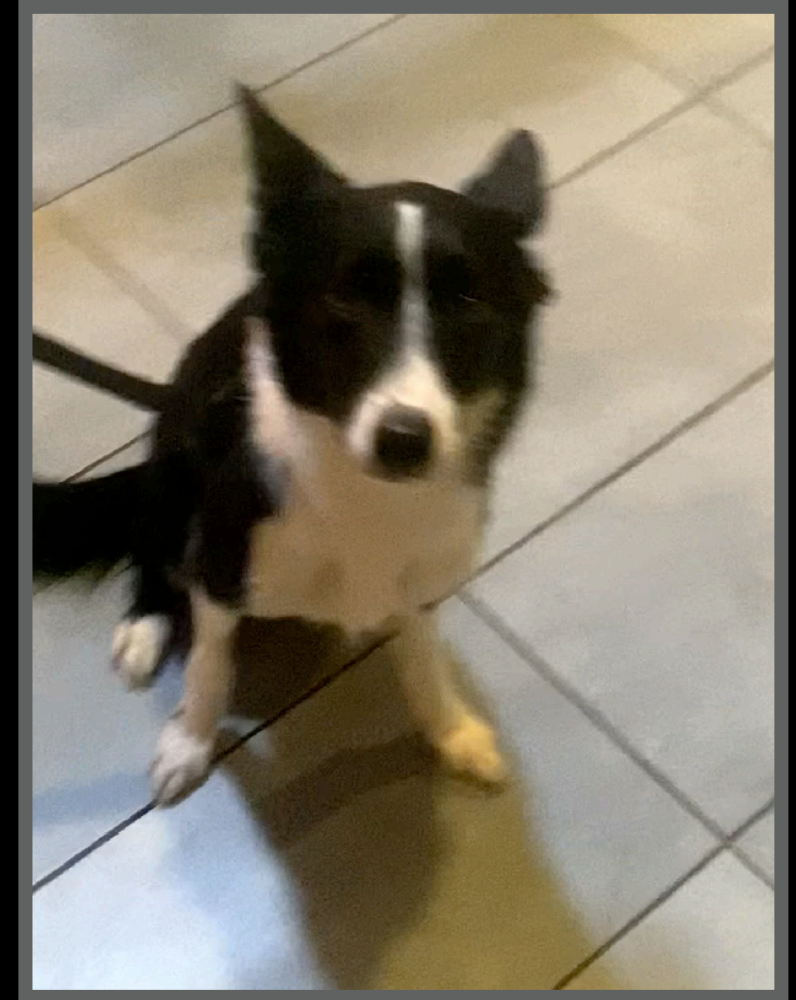




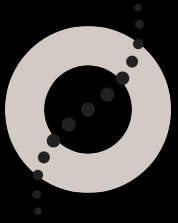
## Arizona, Border Collie, FS, 4 years

### Follow up

- Physiotherapy started
- When She can go back to work?
- When would you do the follow up?



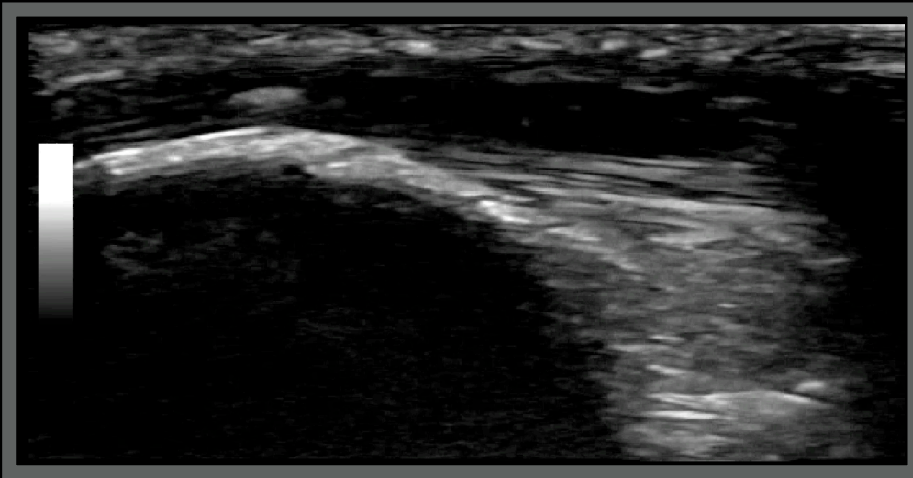
# Arizona, Border Collie, FS, 4 years



Six months recheck

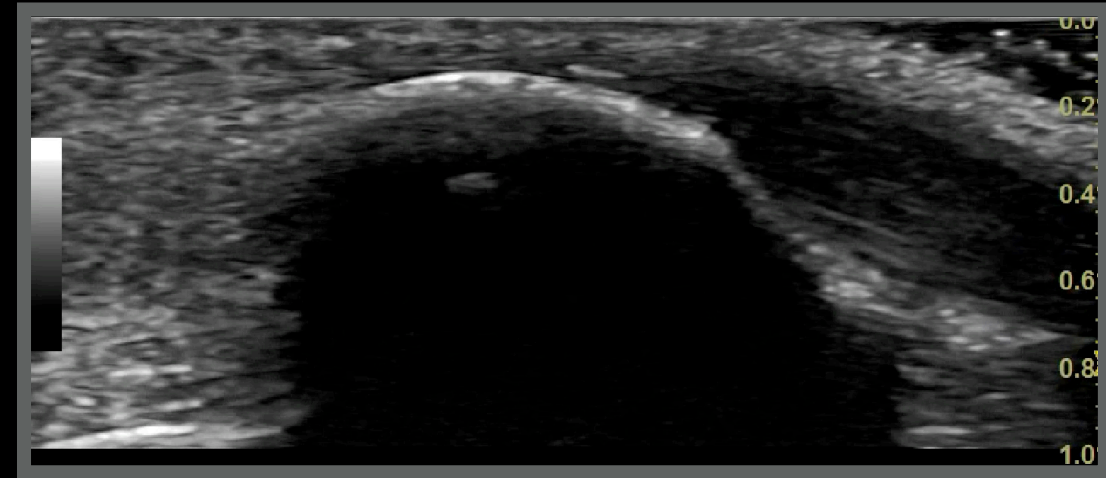
Left stifle

Time 0



Left stifle

Six months later



- Back to Agility aiming for international competitions

## Conclusions

Ultrasound has a role in hind limb lameness in sportive patients. To use this modality is needed:

- 1) Anatomy knowledge
- 2) Systematic approach
- 3) Understand the artefacts
- 4) To know the most relevant conditions



**Antique runic alphabet for death, used against nuclear army development in 1958 by Gerald Holton**

# Thank you



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