

Ultrasound of the cranial aspect of the thigh and stifle

Giliola Spattini
DVM, GP Cardio, CCRT, PhD, DECVDI



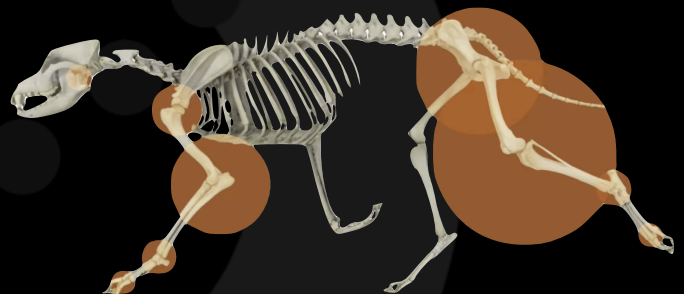
Diagnostic Mindset



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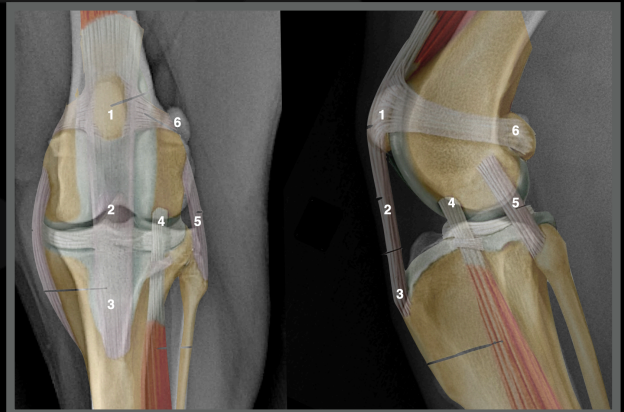
Objectives

- 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



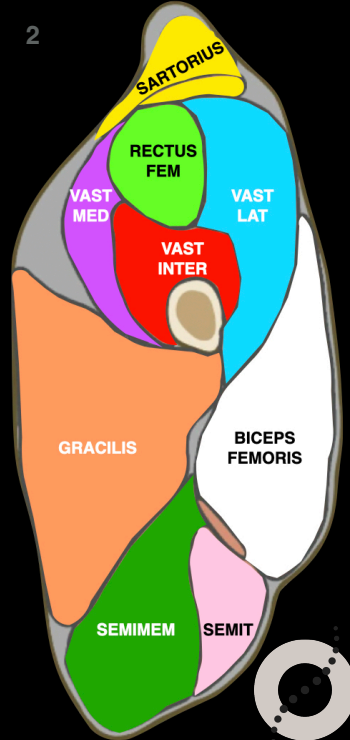
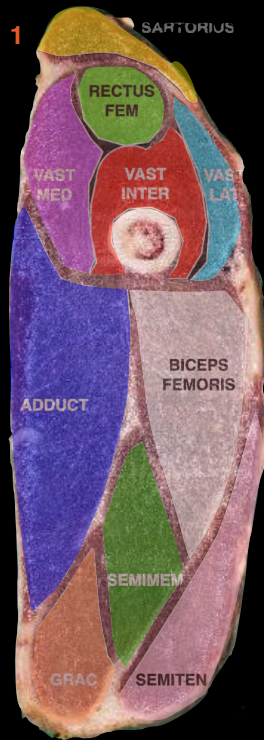
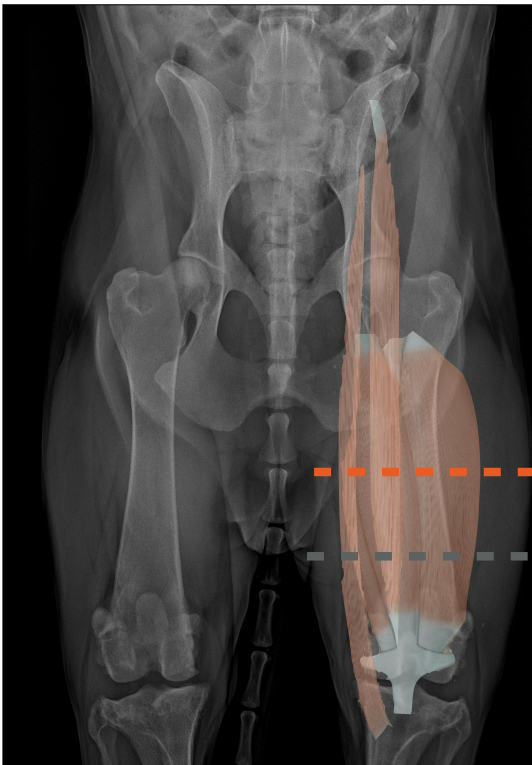
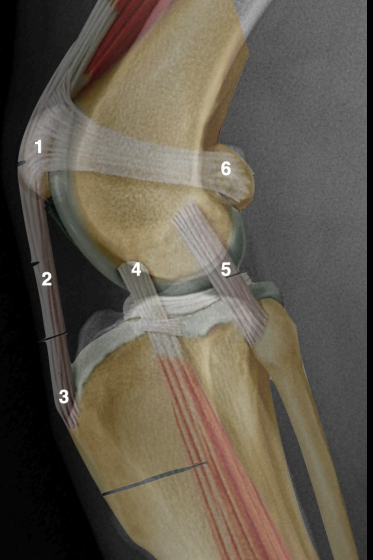
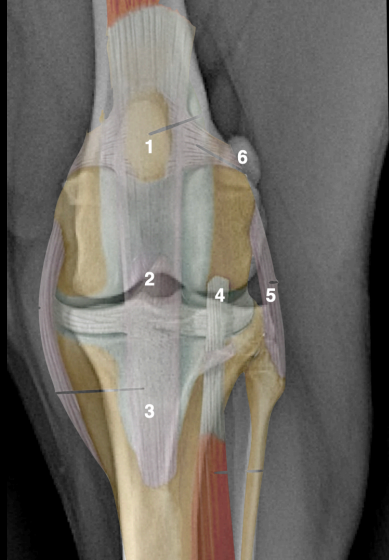
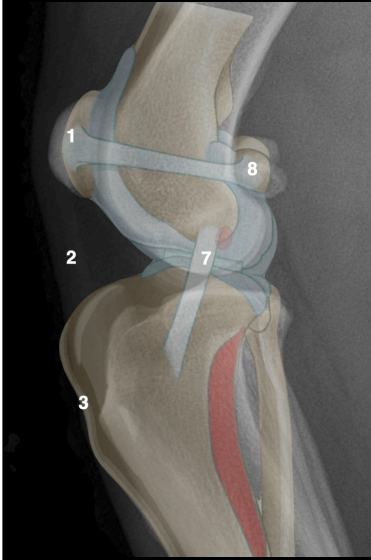
Stifle joint: 1-8

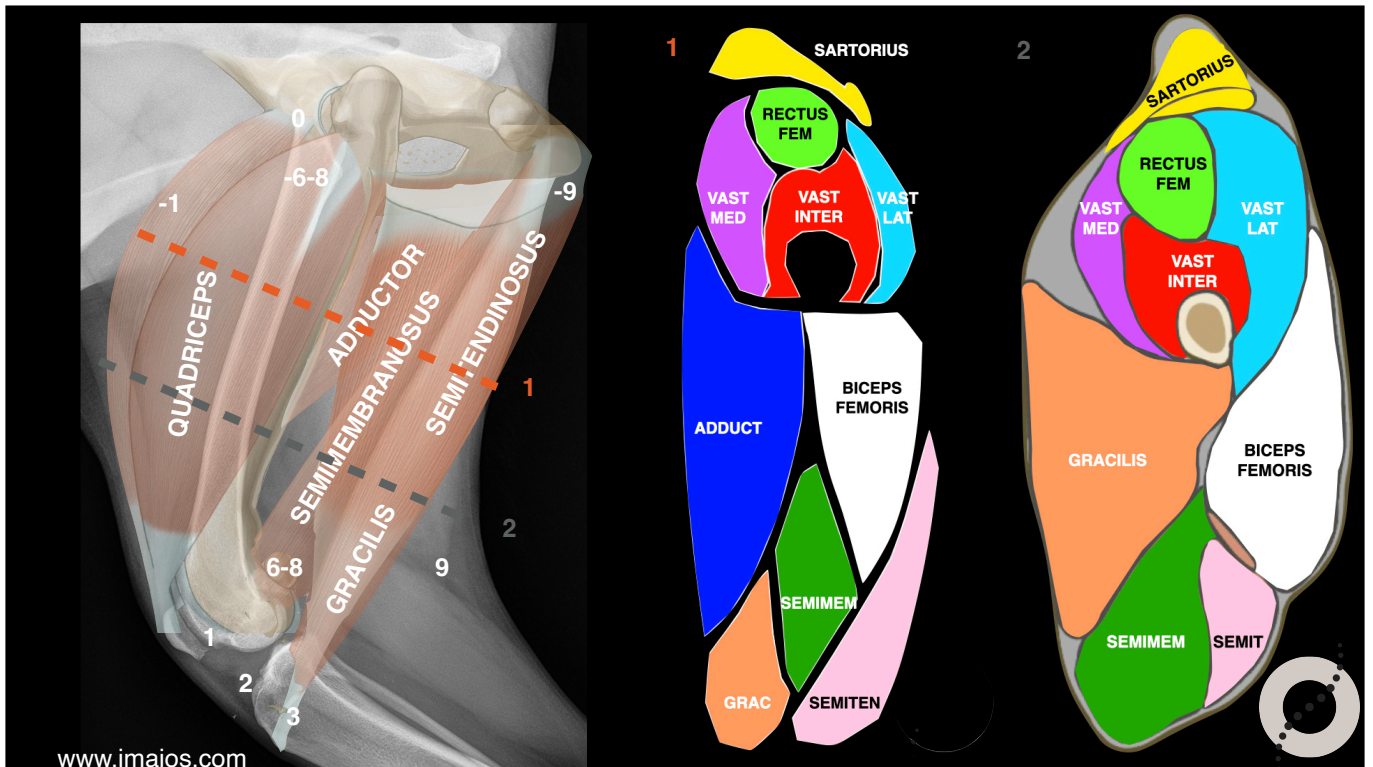


Medial face

Cranial face

Lateral face





Dante, Whippet, Ml, 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



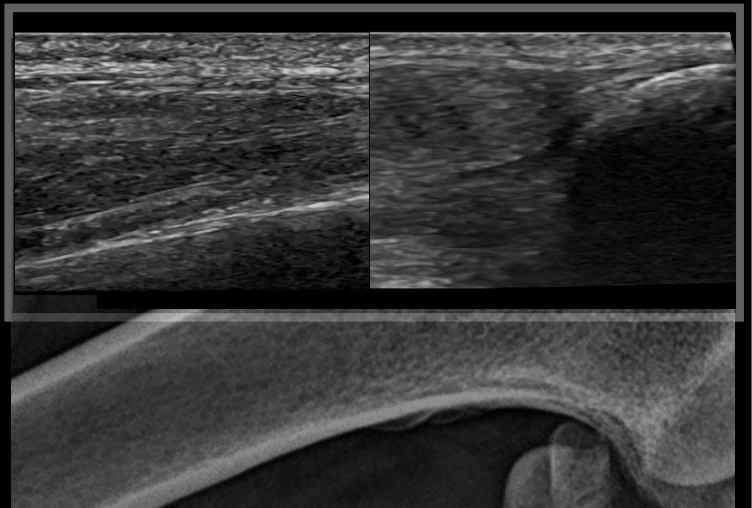
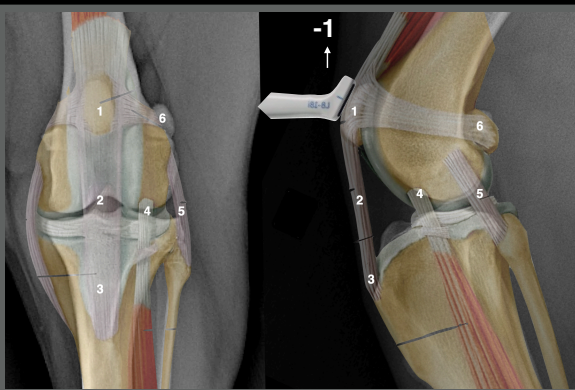
Dante, MI, 1 year

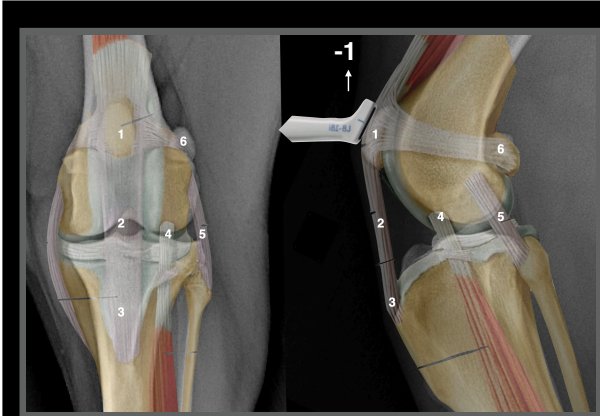
Right thigh

Sound limb

Cranial face longitudinal scan

1-1





Dante, MI, 1 year

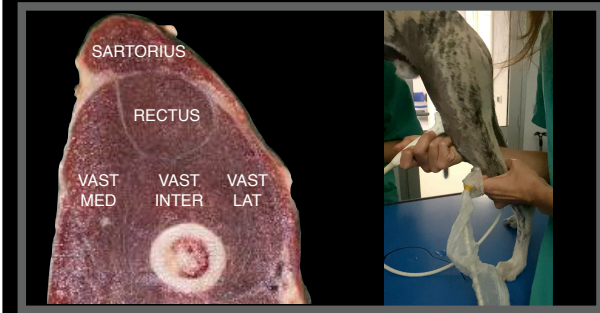
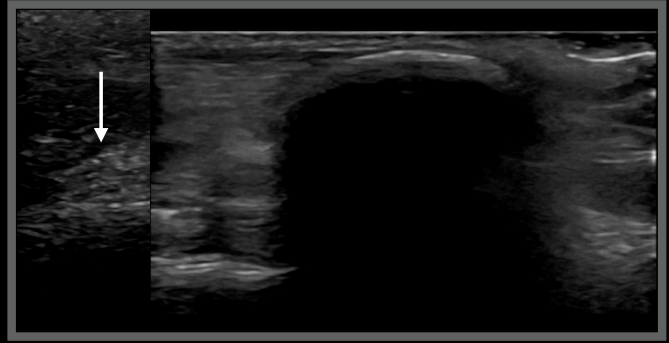
Left thigh

Affected limb



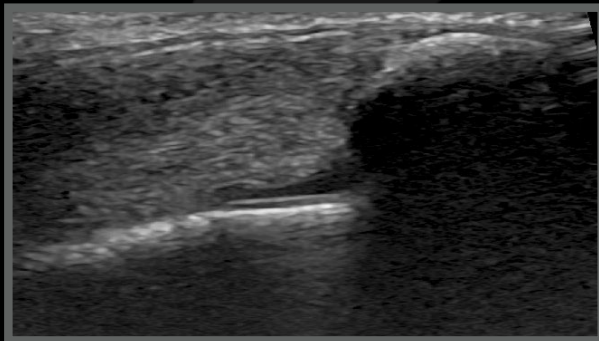
Cranial face longitudinal scan

1-1

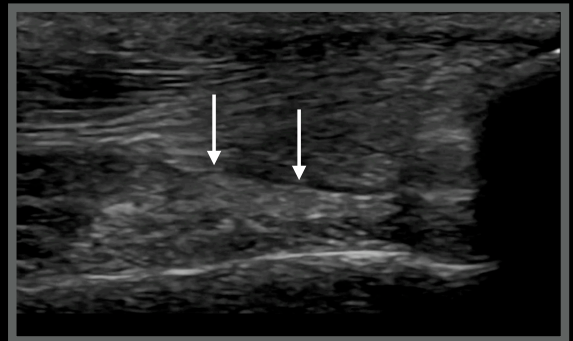


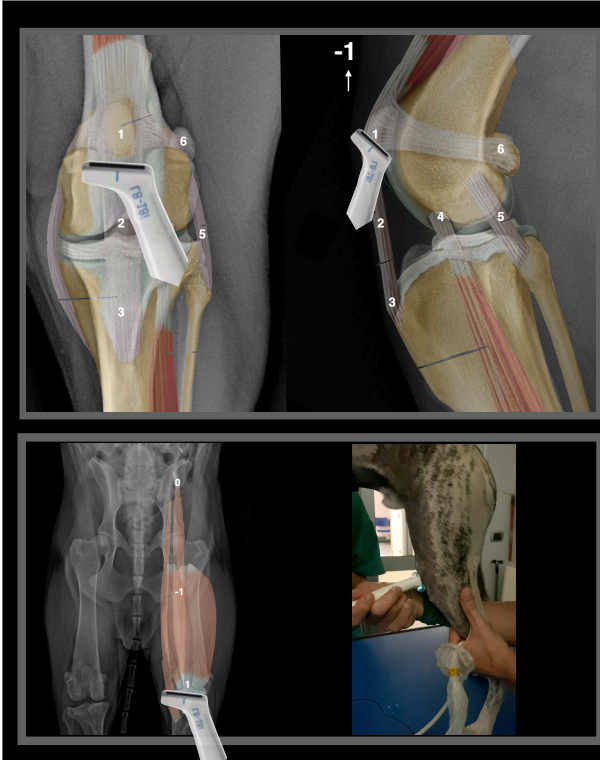
Dante, MI, 1 year

Right thigh



Left thigh





Dante, MI, 1 year

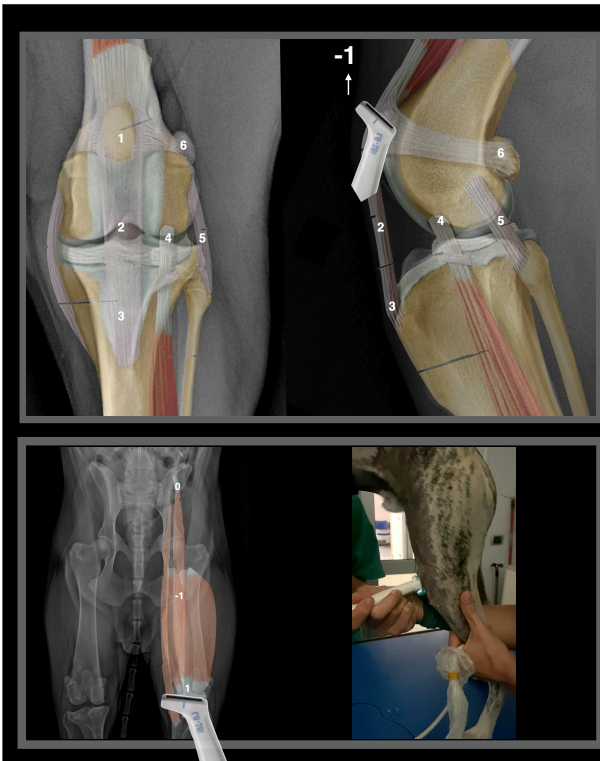
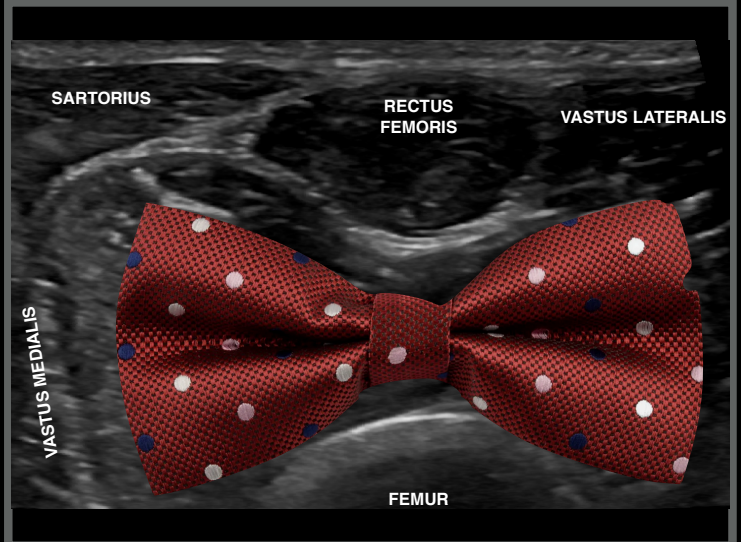
Right thigh

Sound limb



Cranial face transverse scan

1-1



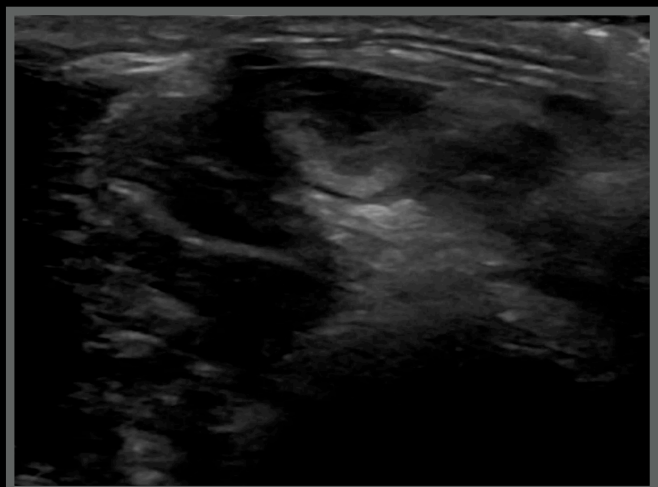
Dante, MI, 1 year

Left stifle



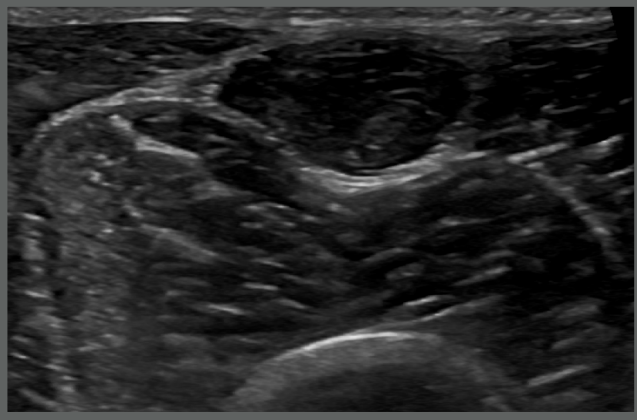
Cranial face transverse scan

1-1

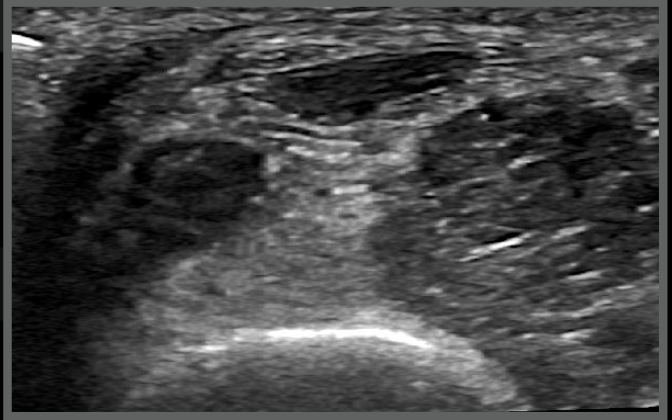


Dante, MI, 1 year

Right thigh



Left thigh



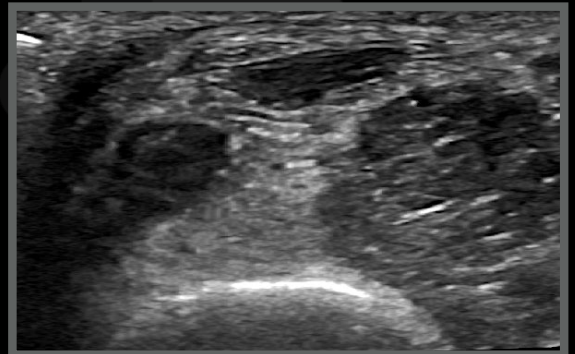
Dante, MI, 1 year

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



- Abstract
- Free full text
- Full text

- Associated data

- 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.**

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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 Fiber Size and Contractility After Anterior Cruciate Ligament Injuries and Reconstruction: A Randomized, Sham-Controlled, Blinded Trial.

3 Toth MJ, Tourville TW, Voigt TB, Choquette RH, Anair BM, Falcone MJ, Faila MJ, Stevens-Lapslay JE, Endres NK, Slaughterbeck JR, Beynnon 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.

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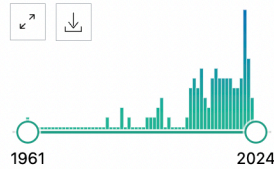
BACKGROUND: Anterior cruciate ligament (ACL) injuries and reconstruction (ACLR) promote **quadriceps muscle** atrophy and weakness that can persist for years, suggesting the need for more effective rehabilitation programs. ...**Quadriceps muscle** size and str ...

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93 results

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

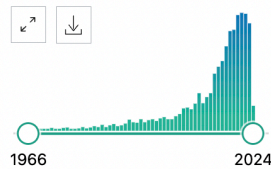
Isolated Vastus Intermedius Avulsion Injury: A Case Report with Imaging Spectrum of this Rare Incidence.
 2 Wegner U, Singh C.
 J Clin Imaging Sci. 2019 Dec 11;9:54. doi: 10.25259/JCIS_124_2019. eCollection 2019.
 PMID: 31893162 **Free PMC article.**
 Isolated mid-tendon **vastus intermedius avulsion** 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 ...

MY NCBI FILTERS

2,554 results

Page 1 of 256

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
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- Full text

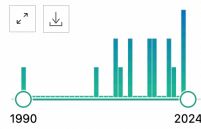
ARTICLE ATTRIBUTE

- Associated data

ARTICLE TYPE

Diagnostic test accuracy of ultrasound for sarcopenia diagnosis: A systematic review and meta-analysis.
 1 Fu H, Wang L, Zhang W, Lu J, Yang M.
 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 ...

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



- Abstract
- Free full text
- Full text

- Associated data

- 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.
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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 Lamé 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.
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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 ...



Journal of Clinical Imaging Science

Case Report

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

Urszula Wegner¹, Chitrangada Singh²

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



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Urszula Wegner,
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 ¹, Alessio Franini ¹ , Ludovica Dragone ², Gabriele Barella ³, Fabio De Rensis ⁴ and Giliola Spattini ^{5,*}

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

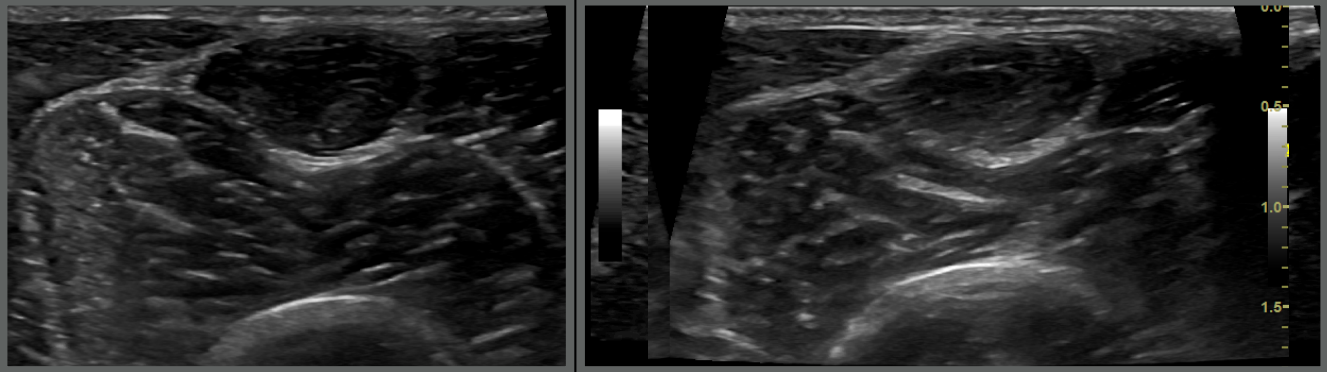
Two months recheck

Right thigh

Time 0

Left thigh

Two months later



Dante, Whippet, MI, 1 year

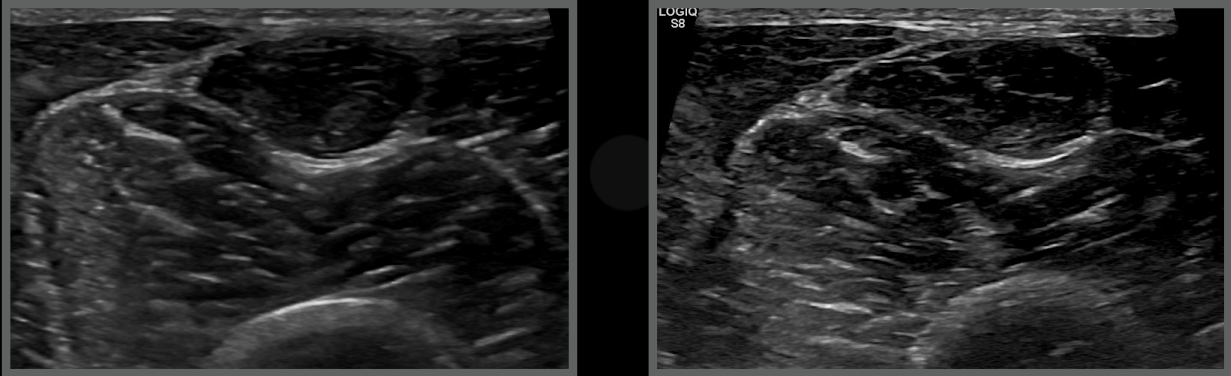
Four months recheck

Right thigh

Time 0

Left thigh

Four months later



... Ultrasound healing ...

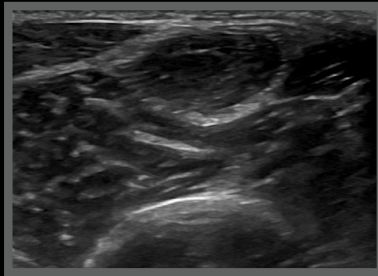
It is not functional healing

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

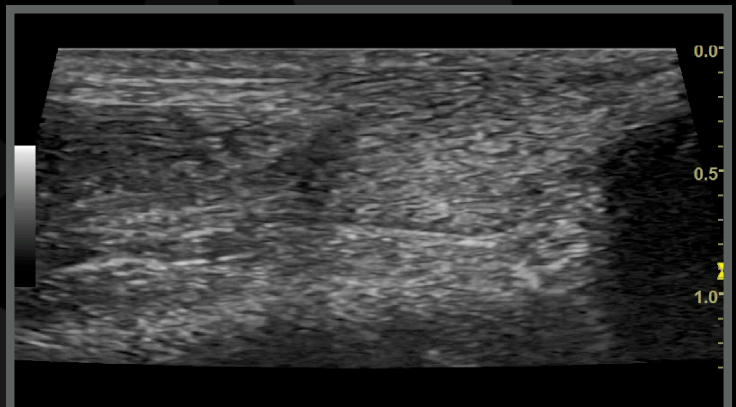
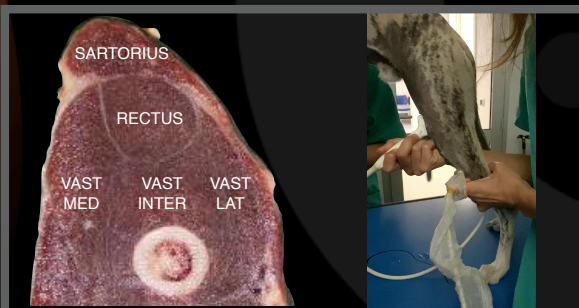
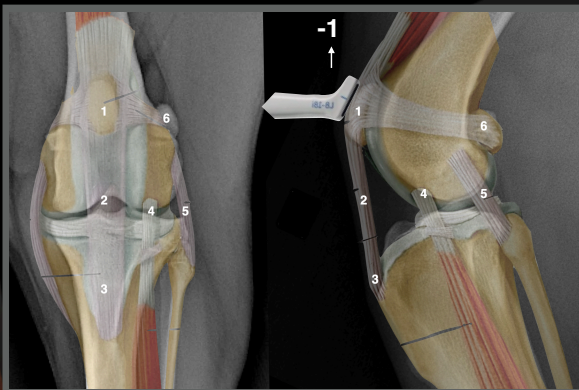


Arizona, FS, 4 years

Right thigh
Sound limb

Cranial face longitudinal scan

1-1



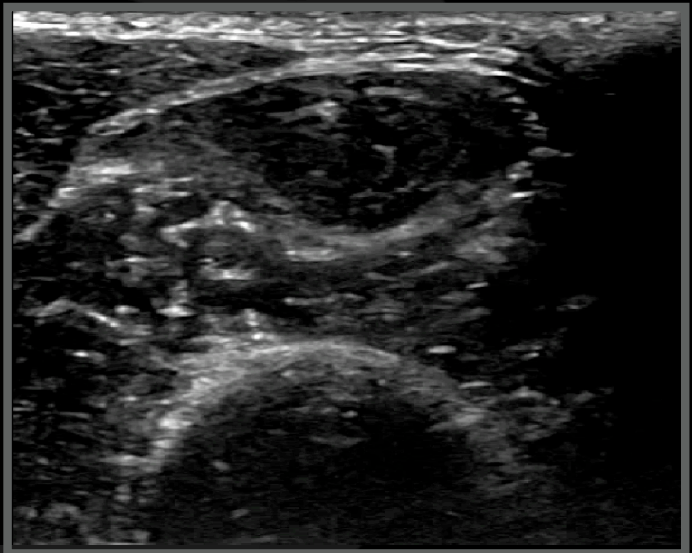
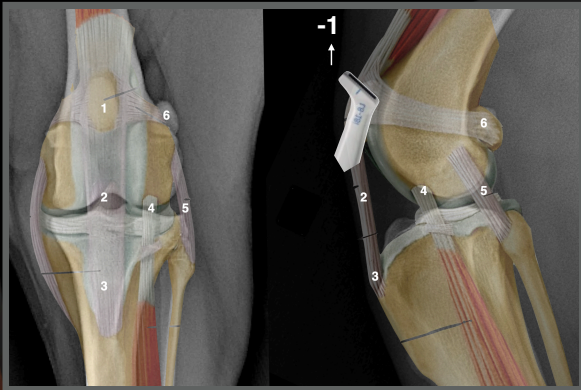
Arizona, FS, 4 years

Right stifle

Sound limb

Cranial face transverse scan

1-1



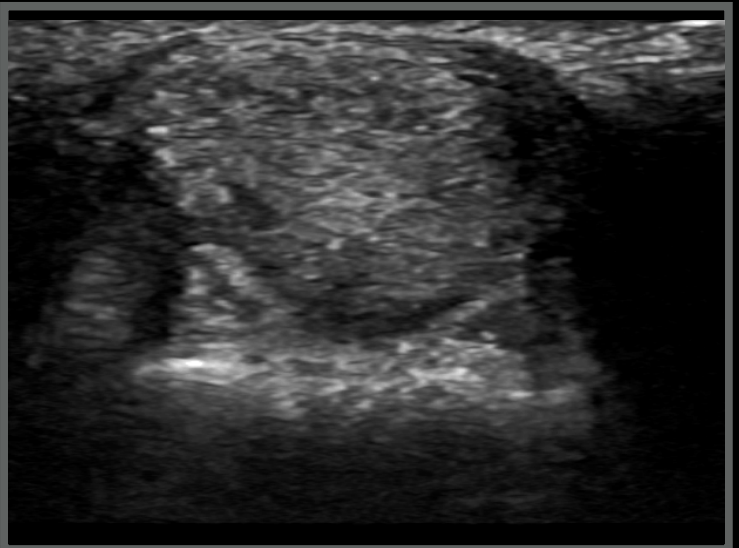
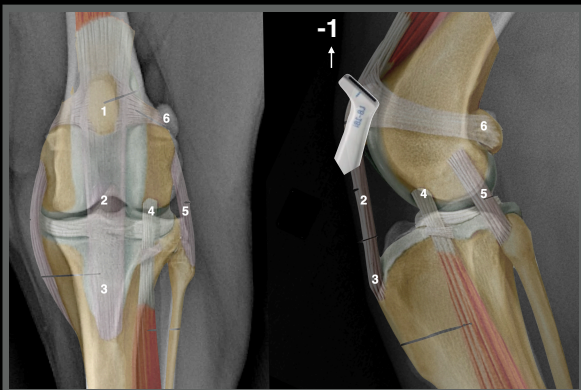
Arizona, FS, 4 years

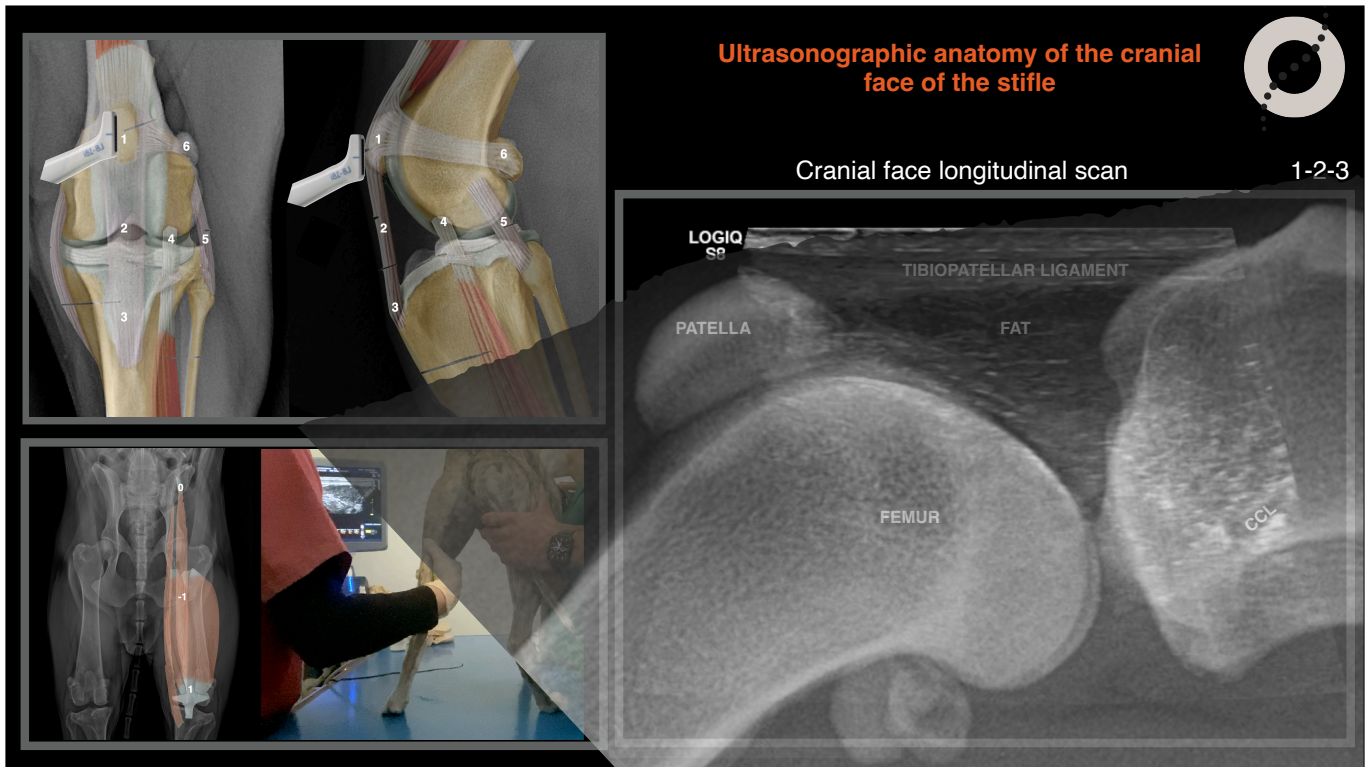
Right thigh

Sound limb

Cranial face transverse scan

1-1





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ultrasound cranial cruciate ligament dog

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MY NCBI FILTERS

RESULTS BY YEAR

1972 2024

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

290 results

Page 1 of 29

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 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.
 Share 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 radiographical ...

2 **Cranial cruciate ligament rupture in the dog--a retrospective study comparing surgical techniques.**
 Cite Moore KW, Read RA.
 Aust Vet J. 1995 Aug;72(8):281-5. doi: 10.1111/j.1751-0813.1995.tb03555.x.
 PMID: 8579557
 Share 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 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.
 Share 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^{1*} , Evelien de Bakker¹, Evelien Bogaerts¹, Bart J. G. Broeckx², Richard Ducatelle³, Kaatje Kromhout¹ and Jimmy H. Saunders¹

Why we cannot assess the CCL by ultrasound?

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

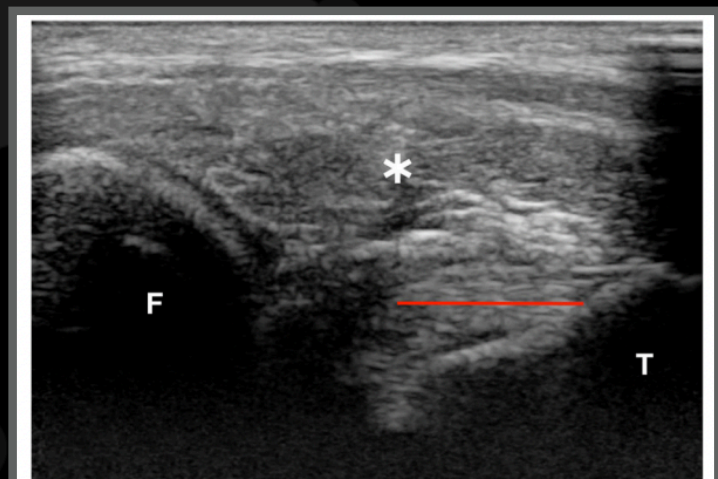
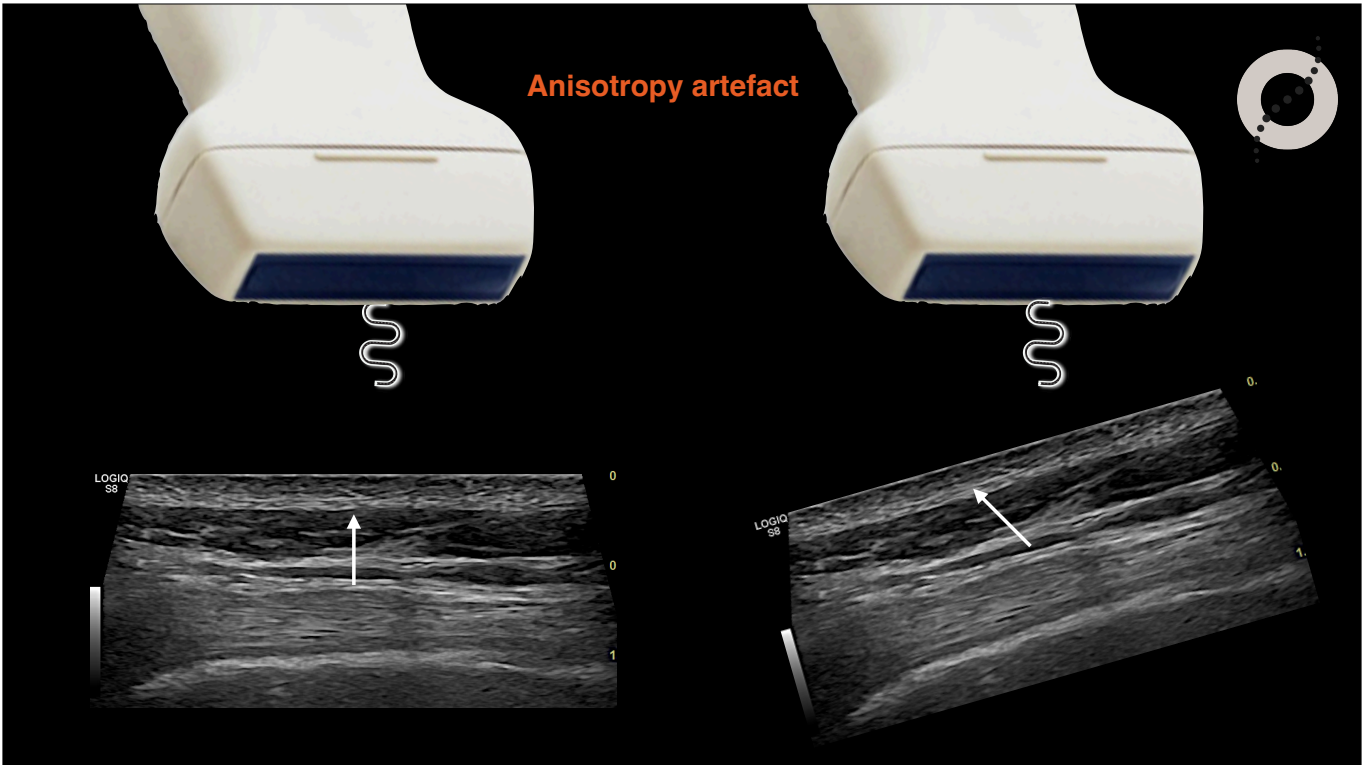


Fig. 1 Cranial proximolateral-distomedial oblique sagittal ultrasonographic image of the left stifle of dog 4 in flexion. A clear fibrillar pattern is visible within the distal aspect of the CrCrL. More proximal the ligament becomes hypochoic because of anisotropy artifact. F: Femur; T: tibia; *: infrapatellar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

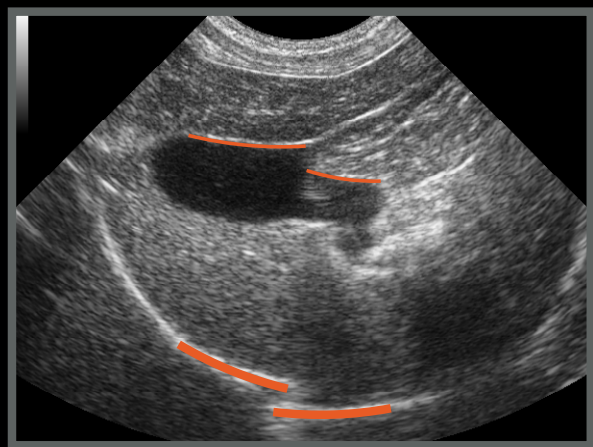
Anisotropy artefact

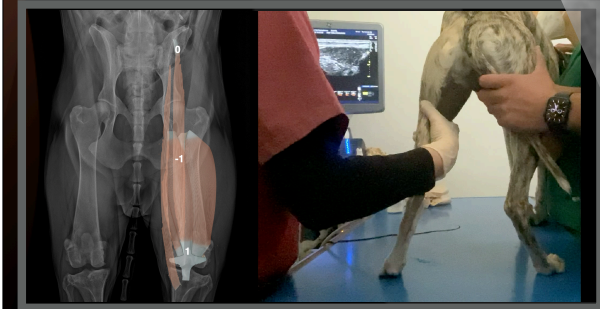
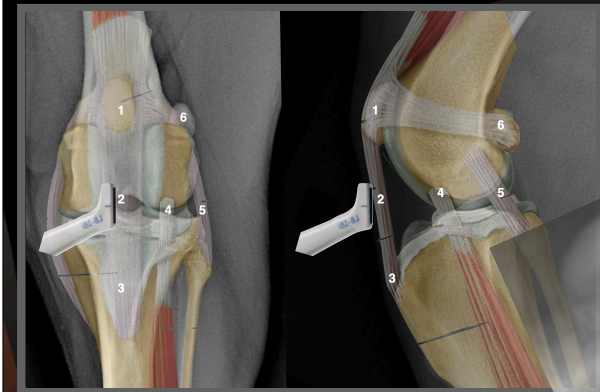


Speed error artefact

Velocity of Sound in Various Materials

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





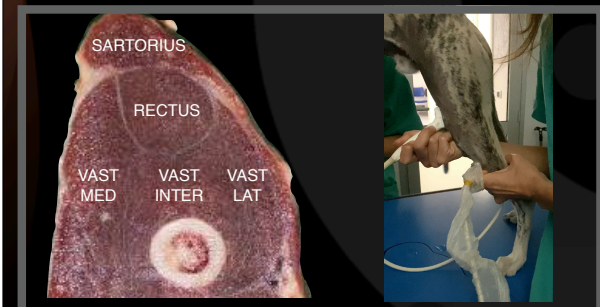
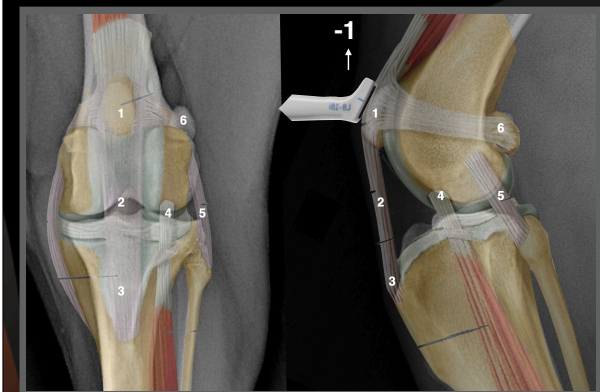
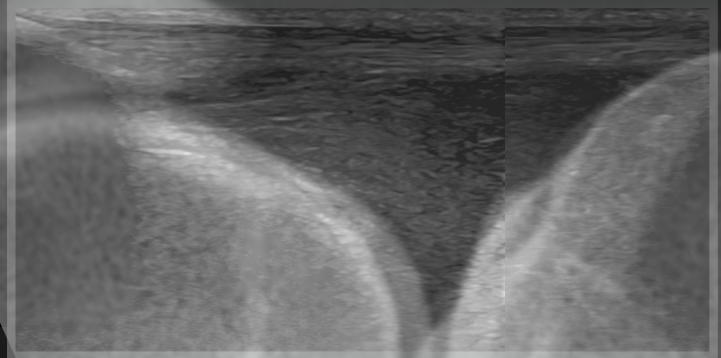
Arizona, FS, 4 years

Right stifle

Sound limb

1-2-3

Cranial face longitudinal scan



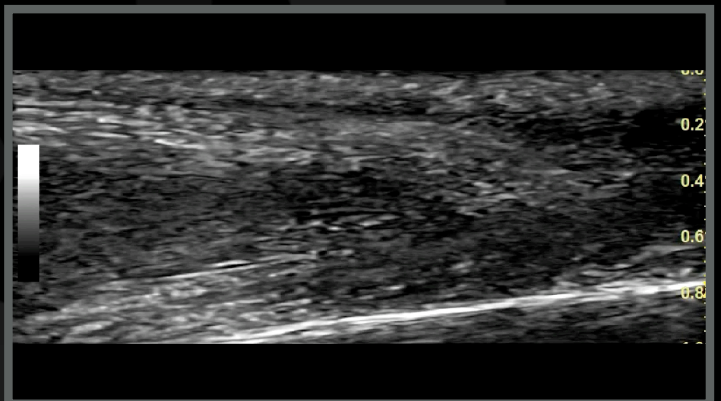
Arizona, FS, 4 years

Left stifle

Affected limb

1-1

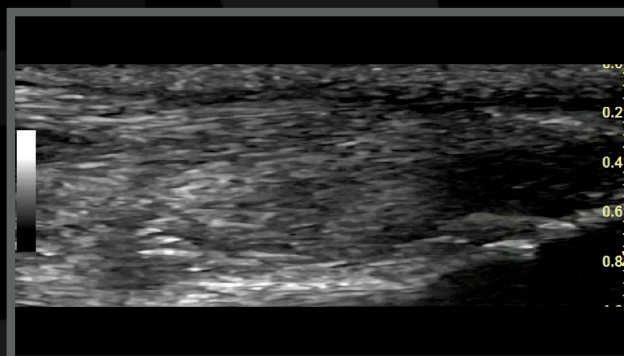
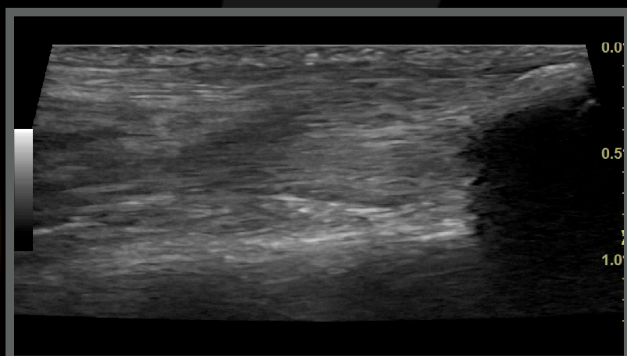
Cranial face longitudinal scan



Arizona, Border Collie, FS, 4 years

Right thigh

Left stifle

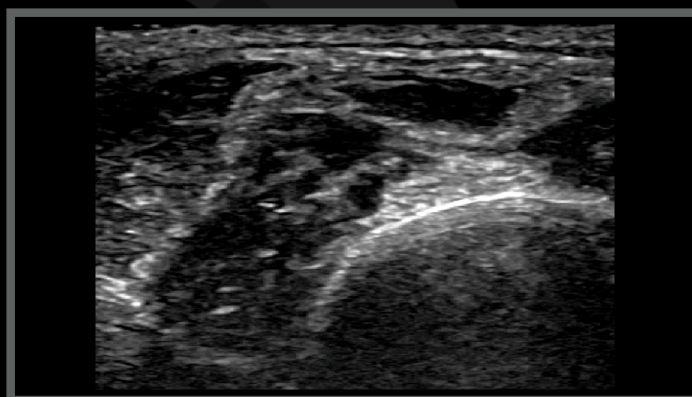
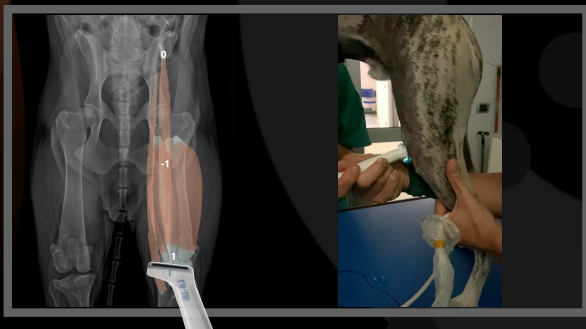
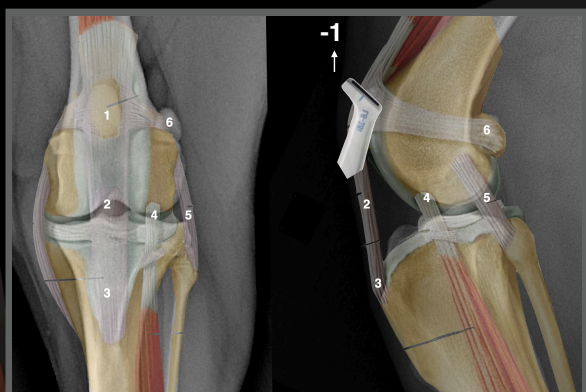


Arizona, FS, 4 years

Left stifle

Cranial face transverse scan

1-1

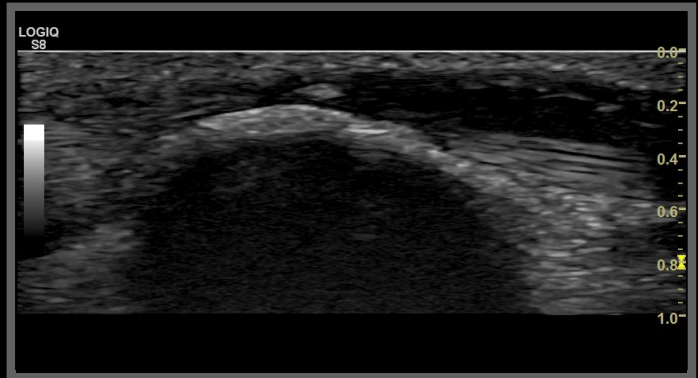
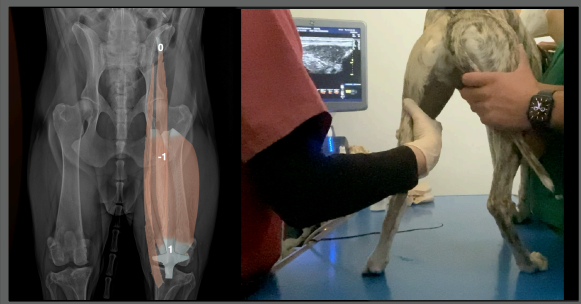
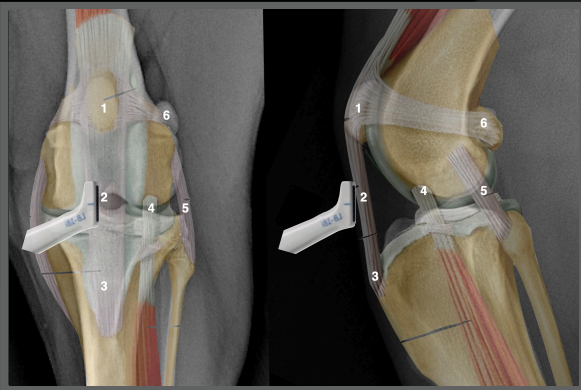


Arizona, FS, 4 years

Left stifle

Cranial face longitudinal scan

1-2-3

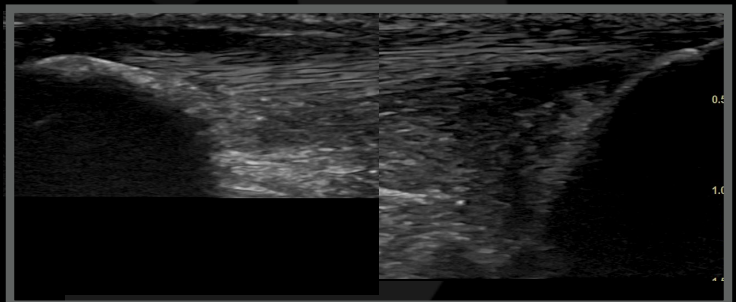
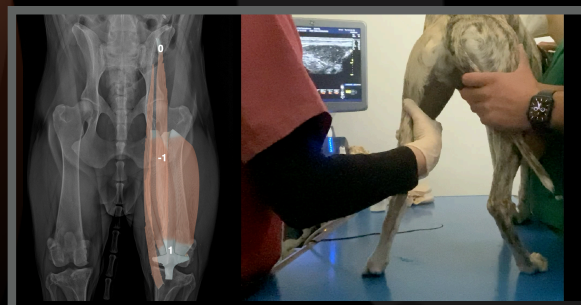
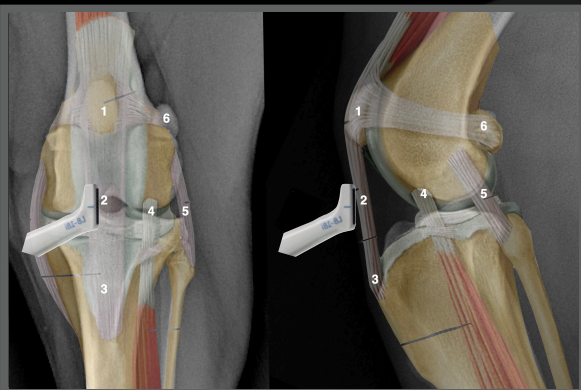


Arizona, FS, 4 years

Left stifle

Cranial face longitudinal scan

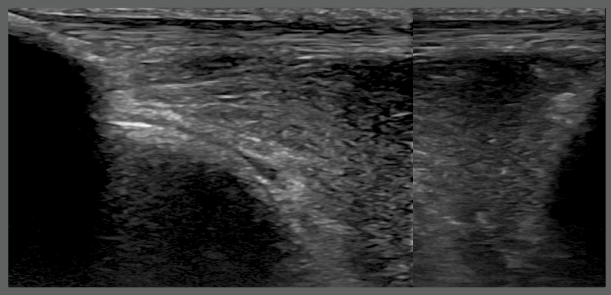
1-2-3



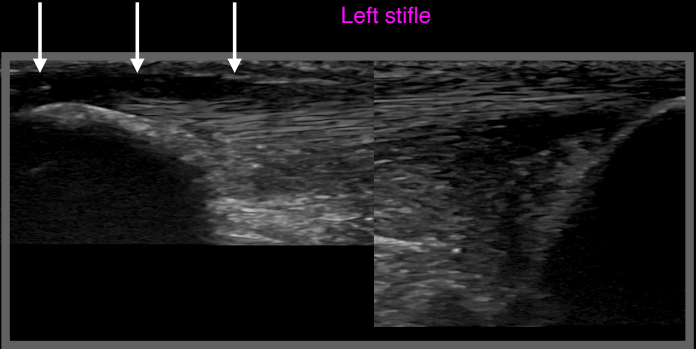
Arizona, Border Collie, FS, 4 years



Right stifle



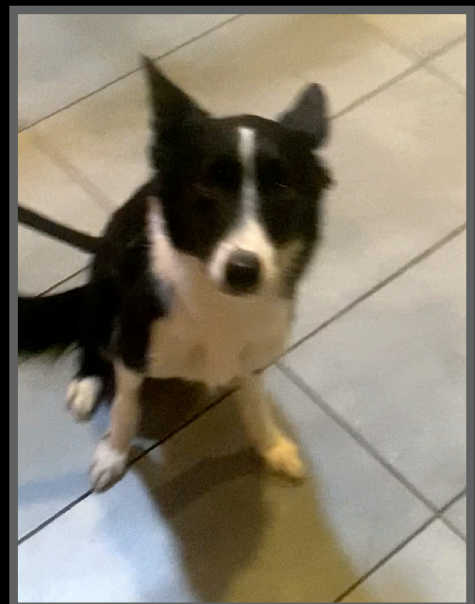
Left stifle



Arizona, Border Collie, FS, 4 years

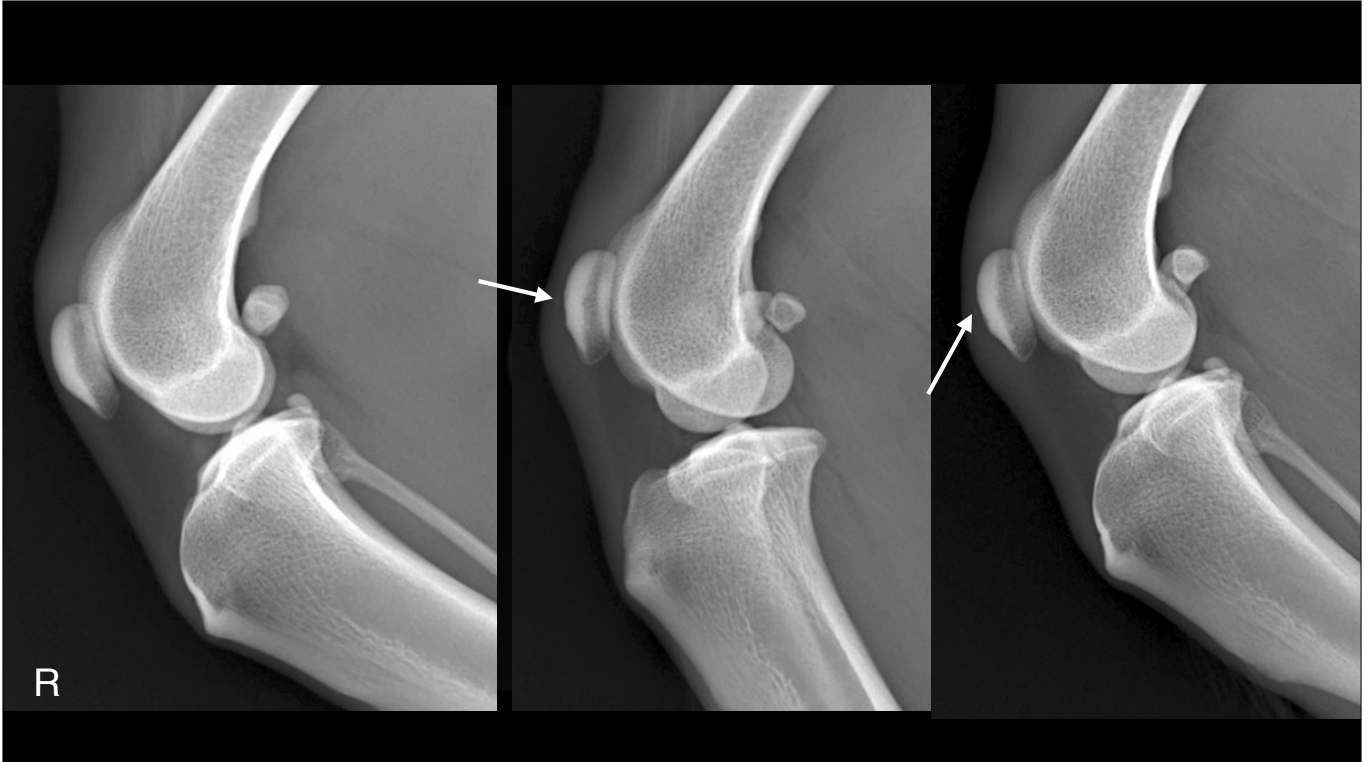
Ultrasonographic diagnoses:

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



Next step?

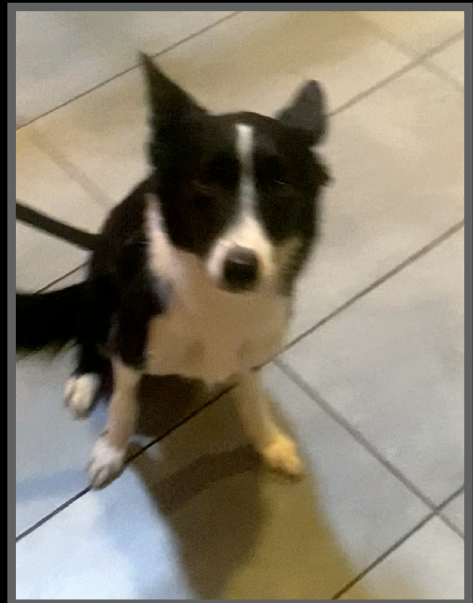




Arizona, Border Collie, FS, 4 years

Follow up

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



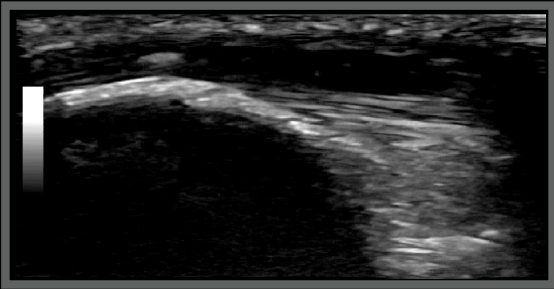
Arizona, Border Collie, FS, 4 years



Six months recheck

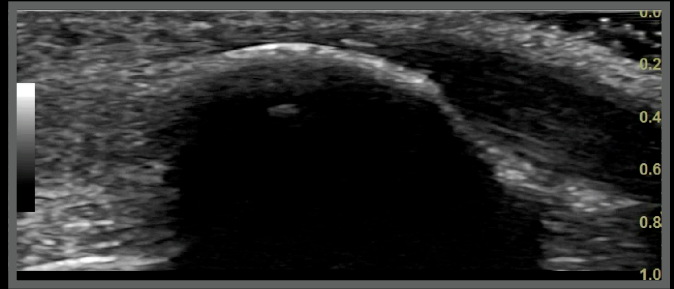
Left stifle

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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