Orthopaedic Radiography & Comparative Imaging for Advanced Practitioners

Lectures & Practical Sessions

VetPD® Veterinary Professional Development

Fri 29 - Sat 30 September 2023

Lingehoeve DIERGENEESKUNDE

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Veldstraat 3a
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VetPD Veterinary Professional Development

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Contents

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SPEAKERS/INSTRUCTORS:

Annamaria Nagy PhD, Dipl.ACVSMR, Dipl.ECVSMR,
American & European Specialist in Equine Sports Medicine & Rehabilitation
Associate Professor, University of Veterinary Medicine Budapest, Hungary

Jonathon Dixon BVetMed, MVetMed, Dipl.ECVDI, MRCVS
European Specialist in Veterinary Diagnostic Imaging
Rainbow Equine Hospital, North Yorkshire, England

Henk van der Veen DVM, Cert.ISELP
Lingehoeve Diergeneeskunde, The Netherlands

PROGRAM:

DAY 1

07:30 – 08:00	*Registration*	
08:00 – 08:10	Course Introduction	Course Administrator
08:10 – 08:50	Principles of Comparative Imaging – Radiography, Ultrasound & Whatever else is possible (MRI, CT etc.)	Jonathon Dixon
08:50 – 09:30	Foot & Pastern X-Rays – Tips, Tricks & Case-Discussions	Jonathon Dixon
09:30 – 10:10	Fetlock & Metacarpus/-tarsus – Tips, Tricks & Case-Discussions	Annamaria Nagy
10:10 – 10:20	Questions	
10:20 – 10:40	*Sound Coffee Break*	
10:40 – 11:20	Carpus & Antebrachium – Tips, Tricks & Case-Discussions	Annamaria Nagy
11:20 – 12:00	Tarsus & Tibia – Tips, Tricks & Case-Discussions	Jonathon Dixon
12:00 – 12:10	Questions	
12:10 – 13:00	*Catered Lunch*	

DAY 1 (continued)

13:00 – 15:20	**Practical Sessions on live Horses & Case-Discussions in Small Groups (45min / Station)**	
	• X-ray Tips & Tricks – Foot, Pastern & Fetlock on live horses	Annamaria Nagy
	• Ultrasound of the Heel Bulb & Pastern on live horses	Henk van der Veen
	• Foot, Pastern & Fetlock Comparative Imaging Case-Discussions	Jonathon Dixon
15:20 – 15:40	*Coffee Break*	
15:40 – 17:50	**Practical Sessions on live Horses & Case-Discussions in Small Groups (45min / Station)**	
	• Specific Views of the MC/MT, Carpus & Tarsus on live horses	Jonathon Dixon
	• Ultrasound of the Suspensory Ligament Origin – FL vs. HL	Henk van der Veen
	• MC/MT, Carpus & Tarsus Comparative Imaging Case-Discussions	Annamaria Nagy
17:50 – 18:00	Questions & Discussions	
18:00 – 19:00	*Wine & Cheese Reception*	

DAY 2

08:00 – 08:30	Elbow & Shoulder Joint – Tips, Tricks & Case-Discussions	Annamaria Nagy
08:30 – 09:10	Stifle Joint – Tips, Tricks & Case-Discussions	Jonathon Dixon
09:10 – 09:40	Pelvis & Hip Joint – Tips, Tricks & Case-Discussions	Annamaria Nagy
09:40 – 09:50	Questions	
09:50 – 10:10	*Audevard Coffee Break*	
10:10 – 10:40	The Neck – Tips, Tricks & Case-Discussions	Jonathon Dixon
10:40 – 11:10	The Back – Tips, Tricks & Case-Discussions	Annamaria Nagy
11:10 – 11:50	Prepurchase Examination – To buy or not to buy?	Henk van der Veen
11:50 – 12:00	Questions	
12:00 – 12:40	*Catered Lunch*	
12:40 – 15:00	**Practical Sessions on live Horses & Case-Discussions in Small Groups (45min / Station)**	
	• Specific Views for Elbow, Shoulder & Cran. Ribs on live horses	Annamaria Nagy
	• X-ray Tips & Tricks – Stifle on live horses	Henk van der Veen
	• Elbow, Shoulder & Stifle Comparative Imaging Case-Discussions	Jonathon Dixon
15:00 – 15:20	*Coffee Break*	
15:20 – 17:40	**Practical Sessions on live Horses & Case-Discussions in Small Groups (45min / Station)**	
	• X-ray Tips & Tricks – Neck & Back on live horses	Jonathon Dixon
	• Ultrasound of the Stifle Joint on live horses	Henk van der Veen
	• The Hip & Pelvis Comparative Imaging Case-Discussions	Annamaria Nagy
17:40 – 17:50	Questions, Discussions & Final Remarks	

Speaker/Instructor Biographies

Annamaria Nagy PhD, Dipl.ACVSMR, Dipl.ECVSMR,

Annamaria qualified in 2004 in Hungary. After two internships at Dubai Equine Hospital and the Animal Health Trust in Newmarket, UK, she completed a residency in equine diagnostic imaging at the University of Bristol. She then worked as an equine orthopaedic clinician at the Animal Health Trust for nearly a decade. Annamaria was awarded an RCVS Fellowship for her thesis on magnetic resonance imaging of the carpus and proximal metacarpal region and a PhD for her work on epidemiology of eliminations from international endurance rides. In 2016 Annamaria became a Diplomate of the American and in 2018 the European College of Veterinary Sports Medicine and Rehabilitation. She is also an RCVS Specialist status in Equine Sports Medicine. Annamaria has published over 25 scientific articles in peer-reviewed journals and has been a speaker at national and international conferences. She is currently an associate professor at Equine Clinic of the University of Veterinary Medicine Budapest and has a special interest in advanced orthopaedic imaging, including MRI and standing CT.

Jonathon Dixon BVetMed, MVetMed, Dipl.ECVDI, MRCVS

Jonathon qualified from the Royal Veterinary College and following a short period working in Egypt for a charity veterinary practice joined Rainbow Equine Hospital as an intern for 18 months, where he developed an interest in advanced imaging, in particular CT and MRI. Jonathon then completed a 3-year senior clinical training scholarship (residency) at the Royal Veterinary College in Large Animal Diagnostic Imaging before returning to Rainbow. In January 2017 he became a European Specialist in Veterinary Diagnostic Imaging. He has particular interests in CT imaging of the head and neck, and MRI of the distal limb.

Henk van der Veen DVM, Cert.ISELP

Henk graduated from Utrecht University, The Netherlands, in 1988. He spent the six years that followed working in two equine clinics in the north and southwest of The Netherlands. In 1994, Henk joined Lingehoeve Diergeneeskunde equine referral hospital in the heart of the Netherlands as equine veterinarian in the ambulatory practice. Since 2000, he has specialised in orthopaedics including lameness exams, pre-purchase exams and diagnostic imaging (radiology, ultrasound, scintygraphy and contrast CT). Henk gained his ISELP certification in 2008.

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Principles of Comparative Imaging – Radiography, Ultrasound & Whatever else is possible (MRI, CT etc.)

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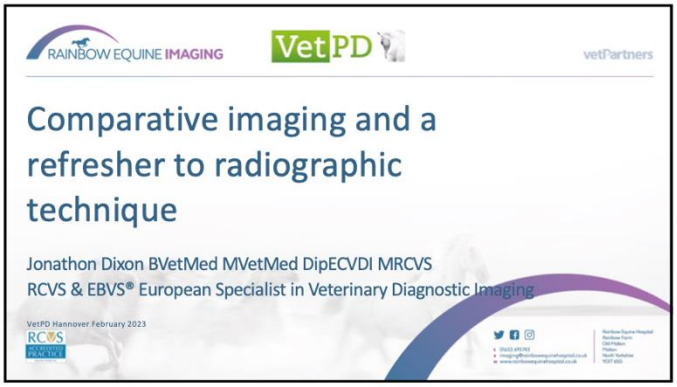

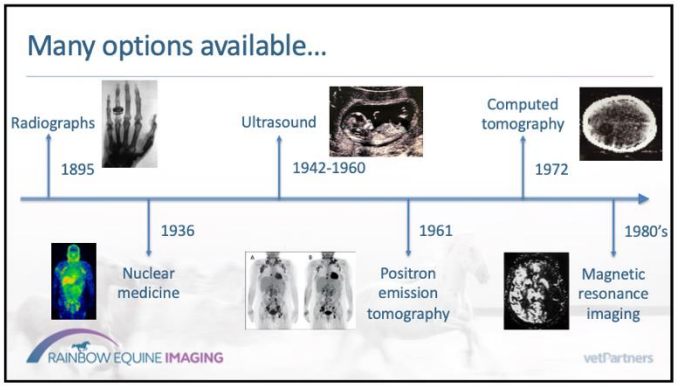

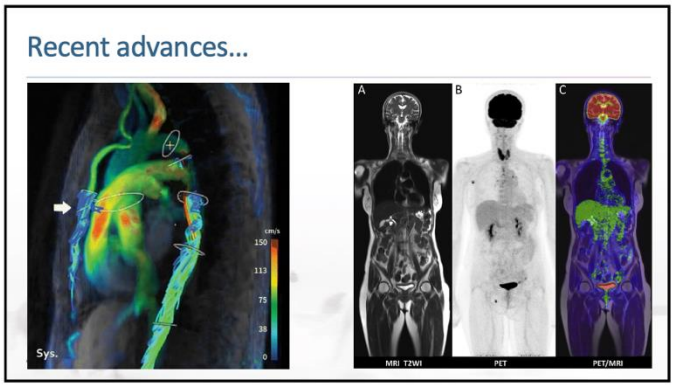

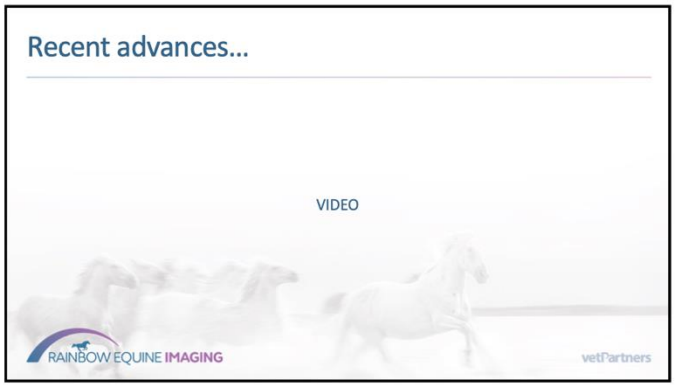

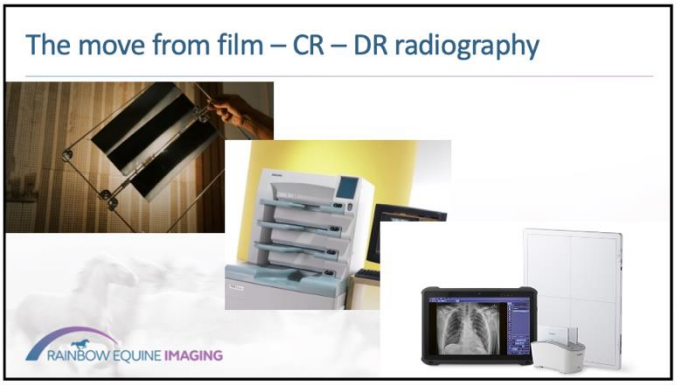

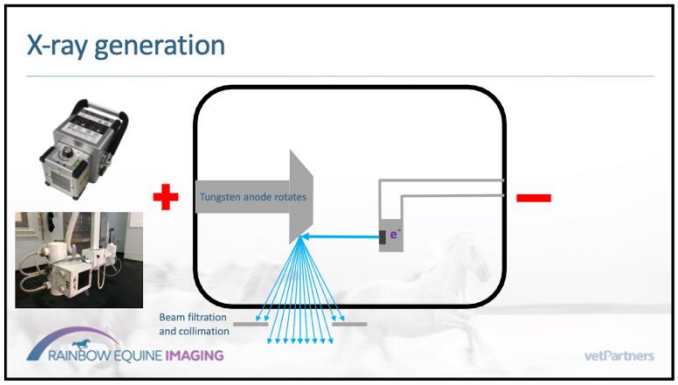

Radiography principles

Inverse square law:

- Double distance from radiation source
- Quarter radiation intensity

Typical FFD is 100cm
E.g. If you decrease this to 80cm
Increases exposure by....

- 55%
- Must decrease other parameters...

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Exposure matters

Increasing mAs

Static kVp
Same distance

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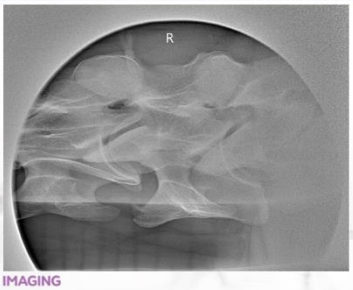
Radiography - collimation



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Radiography

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Radiography

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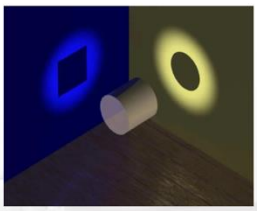
What are "conventional" radiographic views?

Localization / characterization of objects in 3D space requires **minimum of two orthogonal radiographs**.

Typical equine distal limb imaging comprises four projections at step-wise 45-degree angles

Some regions are anatomically restrictive for this process, physically preventing the possibility in horses due to the patient size

Radiation safety measures should **ALWAYS** be considered a priority



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Obtaining lesion-orientated "non conventional" views

In regions where orthogonal projections ARE possible, then ADDITIONAL projections can be useful to complement this – i.e. skyline projections

In regions where orthogonal projections are NOT possible, or do not give the answer, then LESION-ORIENTATED, or "NON-CONVENTIONAL" radiographs should be considered

We always retain the option for additional use of OTHER imaging modalities (US, CT, NM, MRI) – now often available for standing horses

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The world is your oyster, we just need to find a way

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The world is your oyster, we just need to find a way

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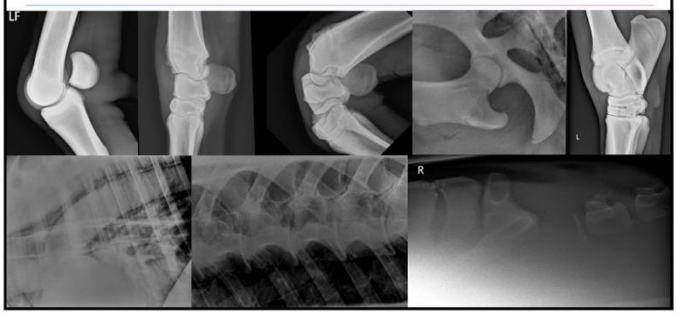
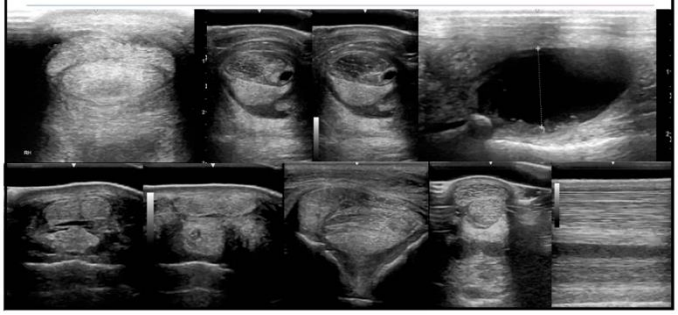
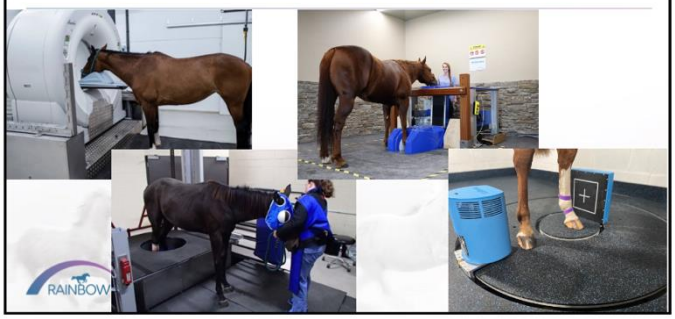
Radiography is great…



Ultrasound is super helpful, fast and available…



But… modern cross sectional imaging is brilliant!



Standing imaging options continue to advance

VIDEO

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Cross sectional imaging

VIDEO

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Recent advances…

LONG MILE
Veterinary PET Imaging

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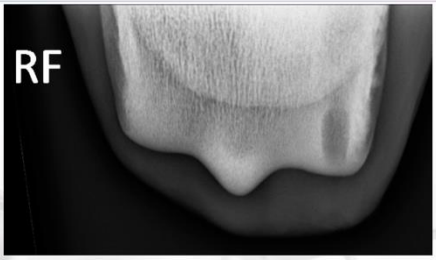
Multimodal imaging of the same regions



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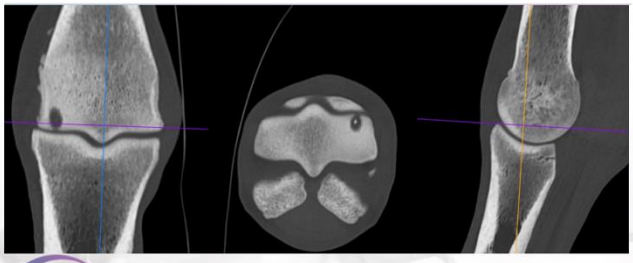
Multimodal imaging of the same regions



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How do we decide what to do?

1. What modalities are physically available in the area?
2. What is financially possible for the client?
3. What has been previously done?
4. What can "I" do and interpret
5. What is the most likely diagnosis?

What is most likely to give us the correct diagnosis and what is best for our patient?

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Respective sensitivities and specificities (IMO)

Modality	Relative spatial resolution	Relative sensitivity for lesions	Relative specificity of findings
Radiography	High	Medium	High
Ultrasound	Medium	Medium	Medium
Computed tomography	Medium	High	High
Magnetic resonance imaging	Medium - Low	High	High
Nuclear scintigraphy	Low	High	Low

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When to consider changing things up...

- When the common things have been ruled out using conventional imaging (XR and US)
- When mixed osseous and soft tissue lesions are suspected / identified
- For surgical planning
- When the identified findings do not explain the problem
- When the findings cannot be completely assessed / identified
- To give more information relating to prognosis
- To provide more information relating to "risk" of a finding

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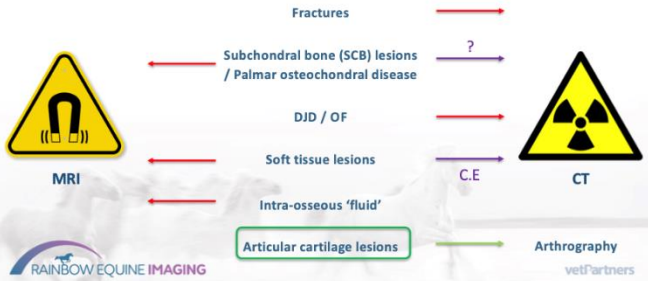
If we have a pathology suspicion... post radiographs



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1. Sykes, B. W., Hewetson, M., Hepburn, R. J., Luthersson, N., & Tamzali, Y. (2015). European College of Equine Internal Medicine Consensus Statement–equine gastric ulcer syndrome in adult horses. Journal of Veterinary Internal Medicine, 29(5), 1288.
2. https://www.diergeneesmiddeleninformatiebank.nl/ords/f?p=111:3::SEARCH:NO::P0_DOMAIN,P0_LANG,P3_RVG1:V,NL,10155
3. van den Boom, R. (2022). Equine gastric ulcer syndrome in adult horses. The Veterinary Journal, 105830.

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Foot & Pastern X-Rays – Tips, Tricks & Case-Discussions

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European Specialist in Veterinary Diagnostic Imaging

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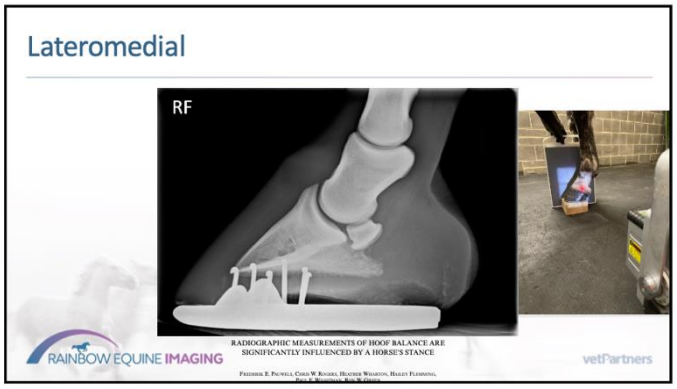

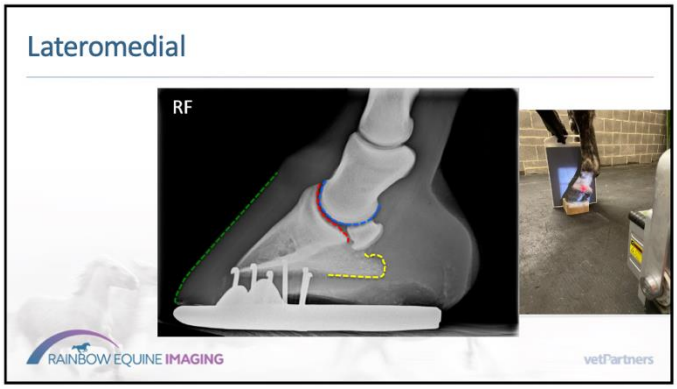

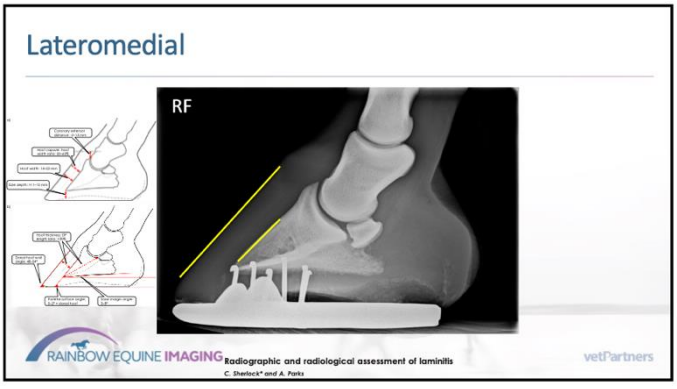

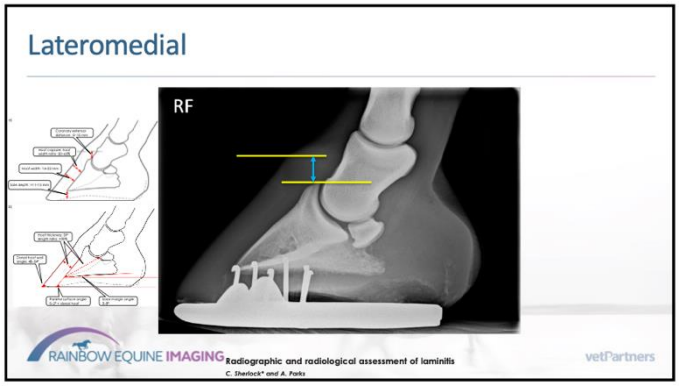

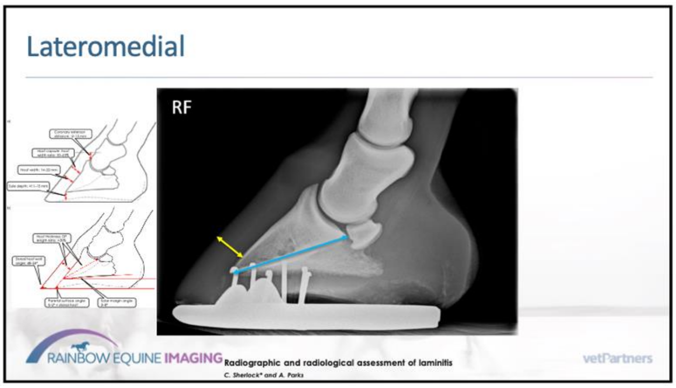
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C. Sherlock* and A. Parks
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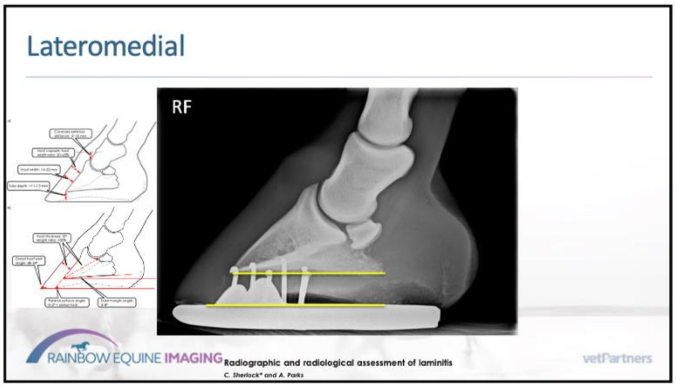
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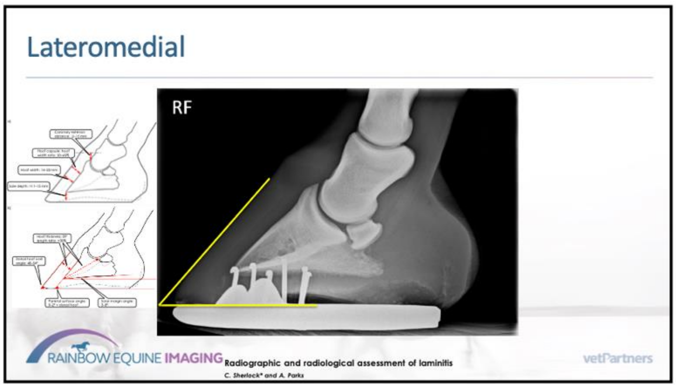
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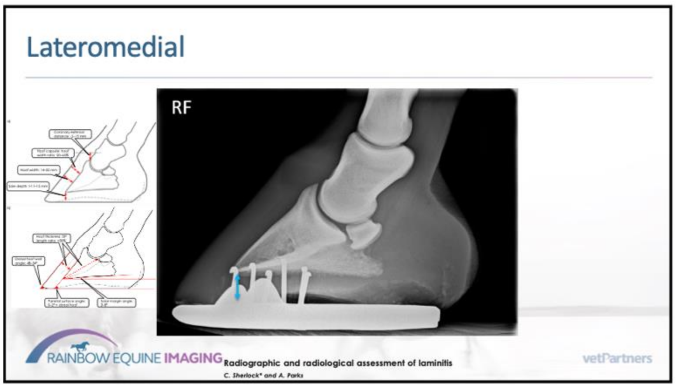
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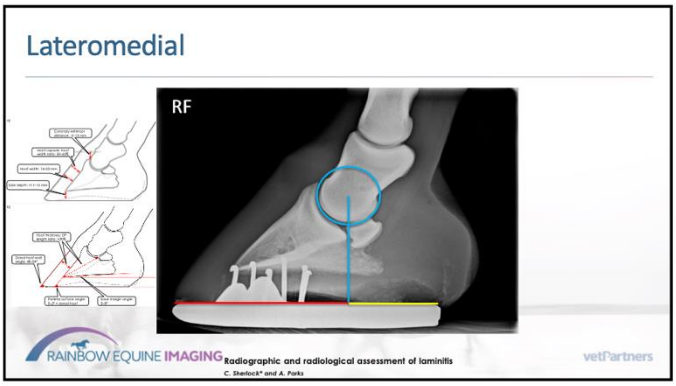
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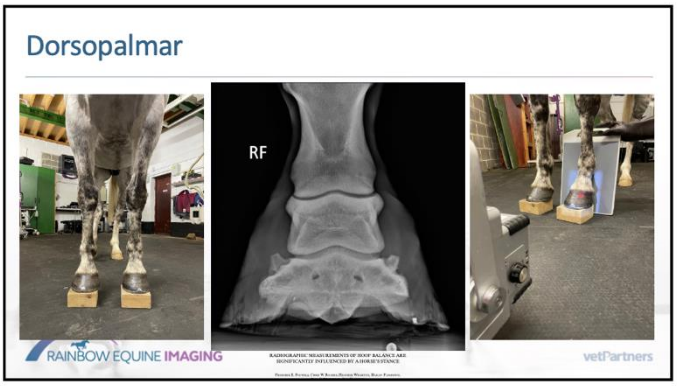
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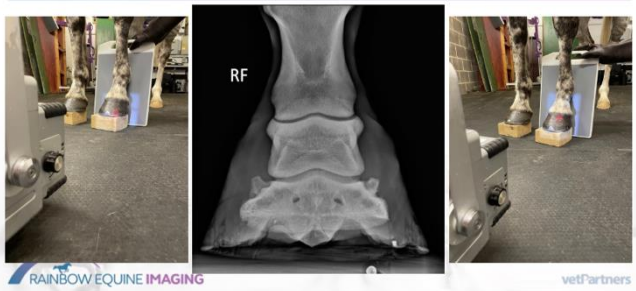

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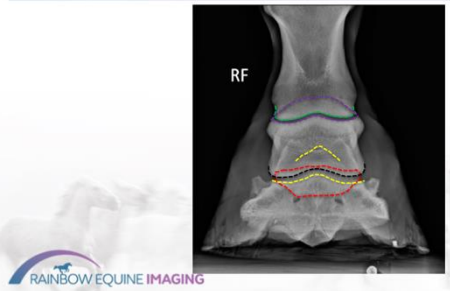

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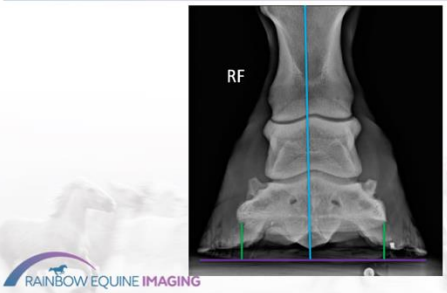
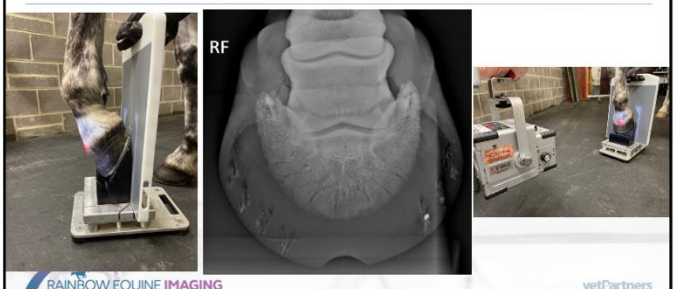
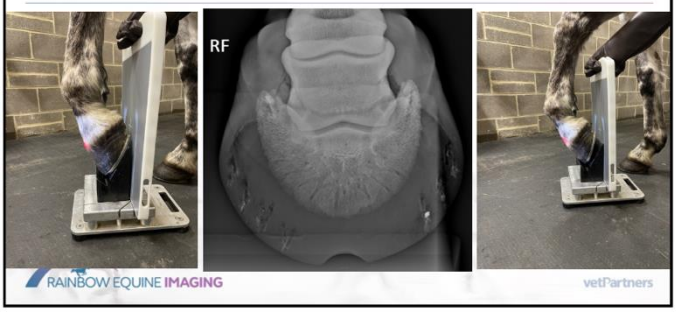


Dorsoproximal-palmarodistal oblique



Dorsoproximal-palmarodistal oblique



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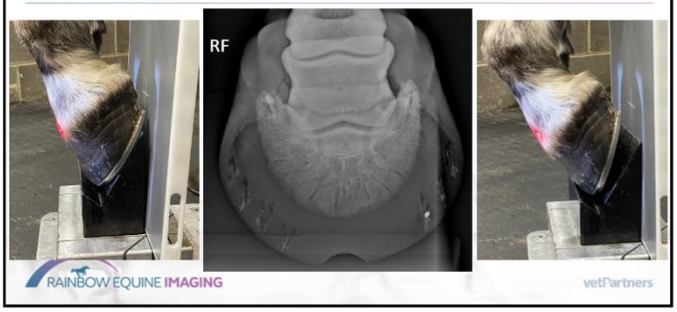

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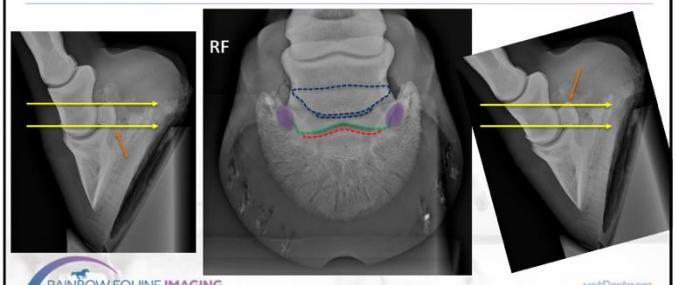

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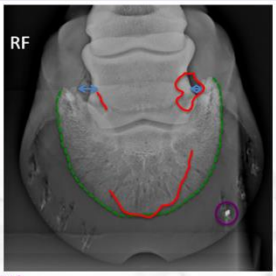
Dorsoproximal-palmarodistal oblique



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Dorsoproximal-palmarodistal oblique

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Do we need another "navicular" DPrPaDiO?

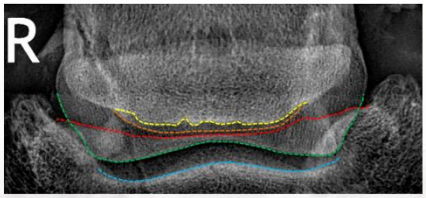
Technical innovation changes standard radiographic protocols in veterinary medicine: is it necessary to obtain two dorsoproximal–palmarodistal oblique views of the equine foot when using computerised radiography systems?

J. Whitlock, J. Dixon, C. Sherlock, R. Tucker, D. M. Bolt, R. Weller

Since the 1950s, veterinary practitioners have included two separate dorsoproximal-palmarodistal oblique (DPr-PaDiO) radiographs as part of a standard series of the equine foot. One image is obtained to visualise the distal phalanx and the other to visualise the navicular bone. However, rapid development of computed radiography and digital radiography and their post-processing capabilities could mean that this practice is no longer required. The aim of this study was to determine differences in perceived image quality between DPr-PaDiO radiographs that were acquired with a computerised radiography system with exposures, centring and collimation recommended for the navicular bone versus images acquired for the distal phalanx but were subsequently manipulated post-acquisition to highlight the navicular bone. Thirty images were presented to four clinicians for quality assessment and graded using a 1–3 scale (1=textbook quality, 2=diagnostic quality, 3=non-diagnostic image). No significant difference in diagnostic quality was found between the original navicular bone images and the manipulated distal phalanx images. This finding suggests that a single DPr-PaDiO image of the distal phalanx is sufficient for an equine foot radiographic series, with appropriate post-processing and manipulation. This change in protocol will result in reduced radiographic study time and decreased patient/personnel radiation exposure.

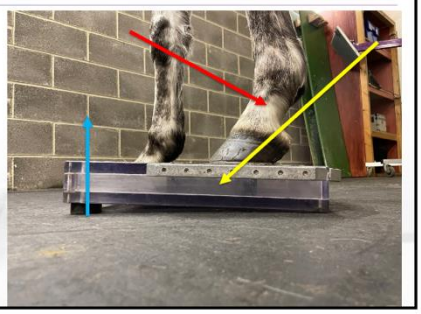
RAINBOW EQUINE IMAGING

Do we need another "navicular" DPrPaDiO?



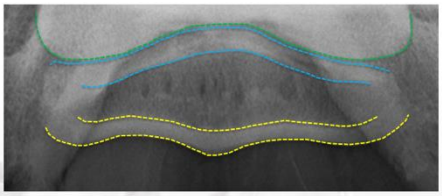
RAINBOW EQUINE IMAGING

Palmaroproximal-palmarodistal oblique



Palmaroproximal-palmarodistal oblique

Palmaroproximal-palmarodistal oblique



Palmaroproximal-palmarodistal oblique

Radiographic flexor cortical lysis indicates advanced degenerative change and its earlier recognition may improve case outcome. Aims of this prospective, diagnostic accuracy study were to determine effects of radiographic beam angle and observer on accuracy of lesion detection. The sample included 36 limbs from 31 horses. Palmaroproximal- palmarodistal oblique (skyline) radiographs were acquired at standard ($n = 38$) and more shallow (alternate) angles ($n = 58$). Images were independently reviewed by four experience levels of five observers each ($n = 20$) for the presence and severity of flexor cortical lysis. Observers also reported their confidence in these answers. Responses were compared based on seeing a standard skyline or multiple projections. The definitive presence (or absence) and severity of lysis was based upon radiologist consensus agreement. When assessed by observer, the identification of lysis and the assessment of its severity was most similar to that of radiologists when observers of all levels of experience were able to view multiple skyline projections ($P = 0.399$, $P = 0.174$). Using multiple views to detect lysis resulted in improved sensitivity (85.3% vs. 97.2%, $P < 0.001$), decreased specificity (82.8% vs. 74.5%, $P = 0.03$), and improved interobserver agreement (86.0% vs. 90.2%, $P = 0.21$). On average, observers of all levels of experience became more confident viewing multiple projections ($P < 0.001$). Skyline radiographs using a flatter angle of incidence improve radiographic detection and characterization of flexor cortical lysis severity, may allow the beam to be tangential to the more distal portion of the navicular bone, and are recommended when flexor cortical lysis is suspected.

RAINBOW EQUINE IMAGING

Additional palmaroproximal–palmarodistal oblique radiographic projections improve accuracy of detection and characterization of equine flexor cortical lysis

Sherry A. Johnson[1] | Myra F. Barrett[2] | David D. Frisbie[1]

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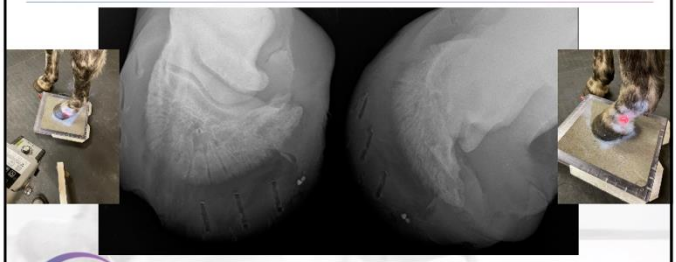
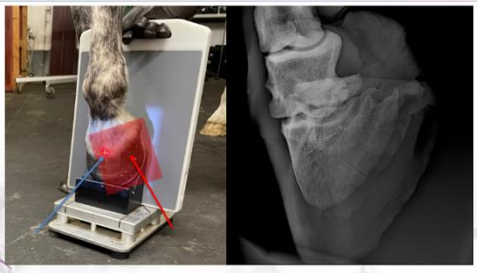
Oblique radiographs – “wing shots”

Oblique radiographs – “wing shots”



Oblique radiographs – “wing shots”



Oblique radiographs – "wing shots"

RAINBOW EQUINE IMAGING

Pedal bone fractures

J. Kidd

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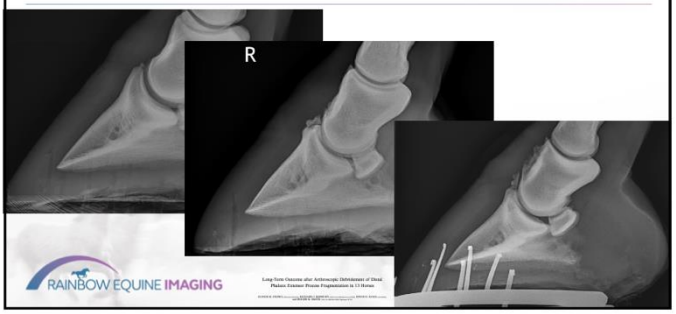
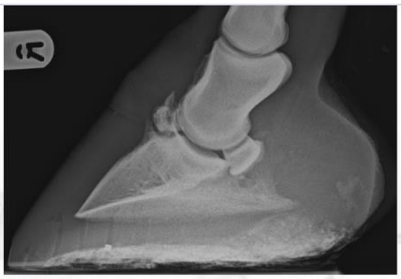
P3 extensor process



RAINBOW EQUINE IMAGING

P3 extensor process



RAINBOW EQUINE IMAGING

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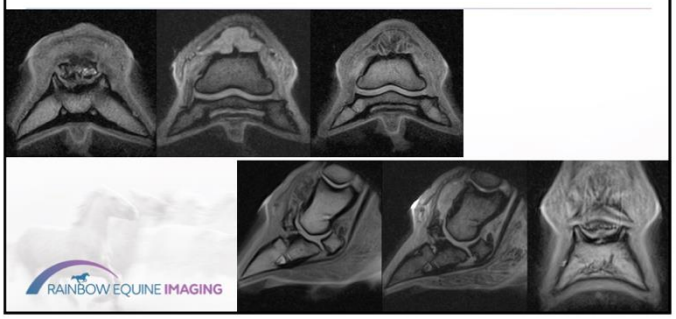
P3 extensor process



RAINBOW EQUINE IMAGING

P3 extensor process

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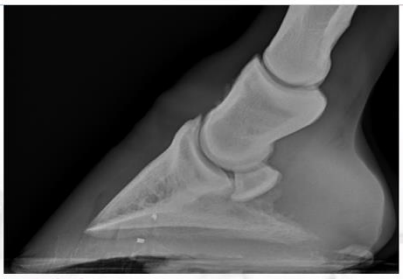
Osteoarthritis - DIP capsular entheses



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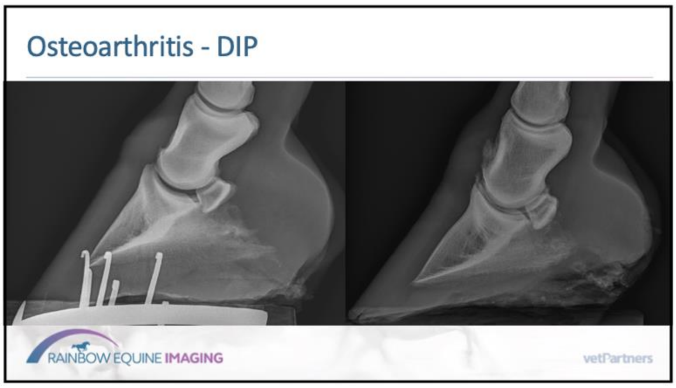

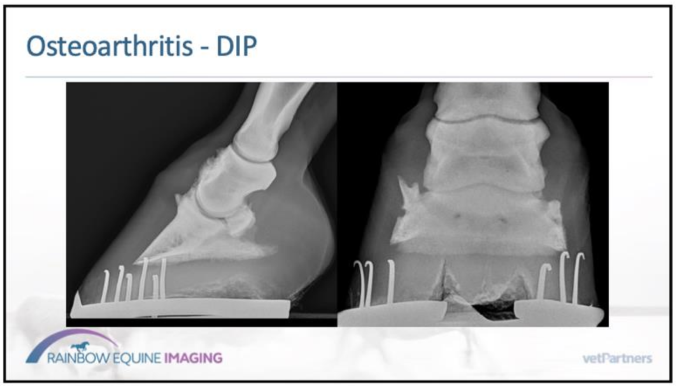

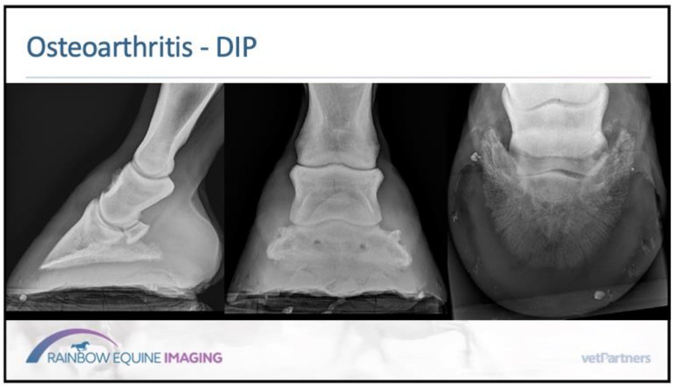

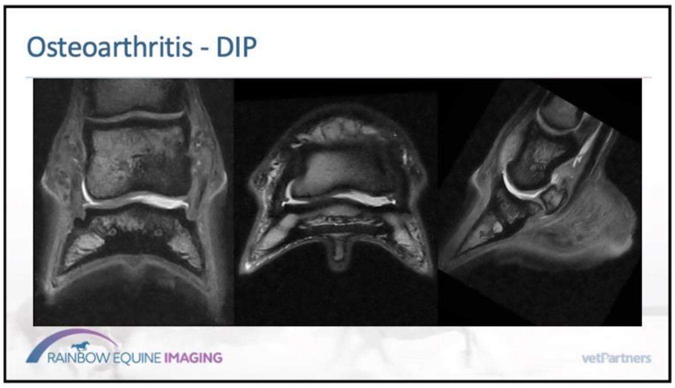

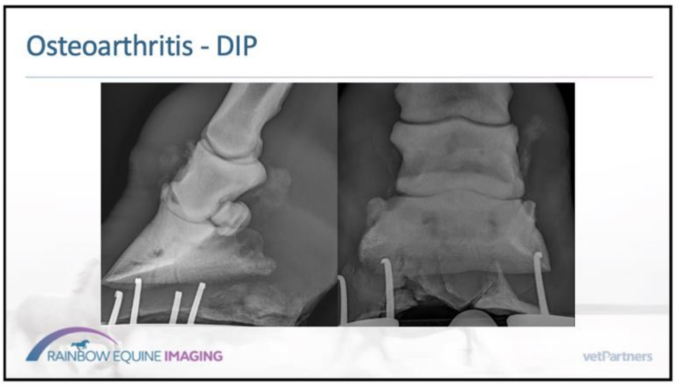

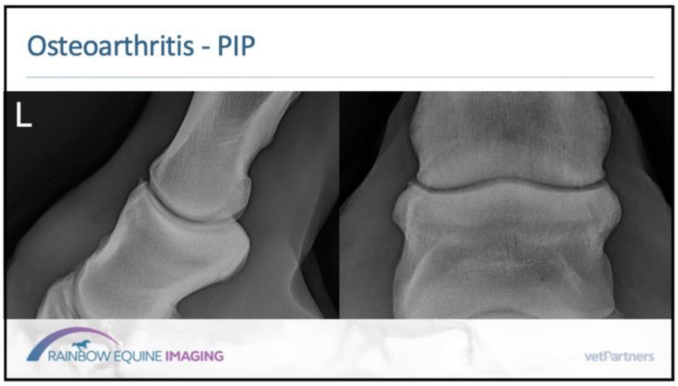

Osteoarthritis - PIP

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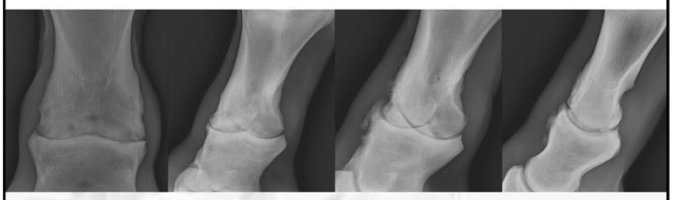
Osteoarthritis - PIP



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Osteoarthritis - PIP sepsis

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Pastern osteochondral fragment

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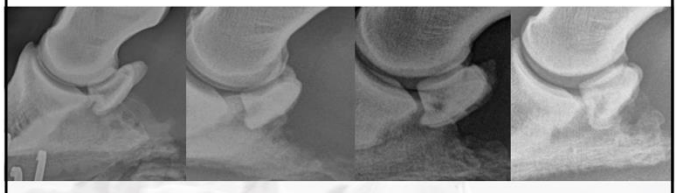
Navicular bone changes



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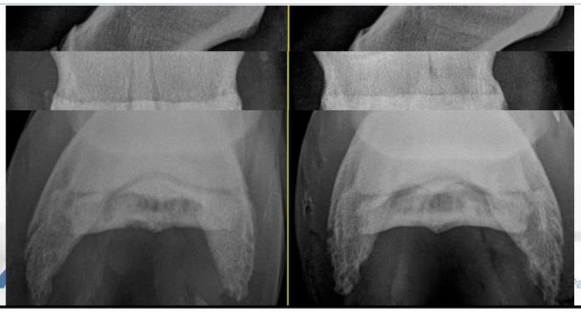
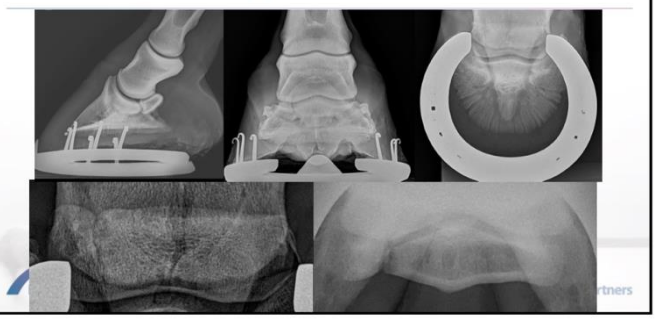
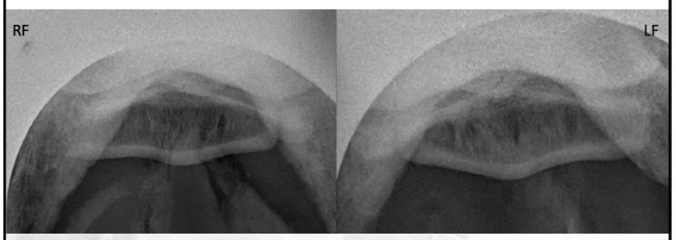
Navicular bone changes



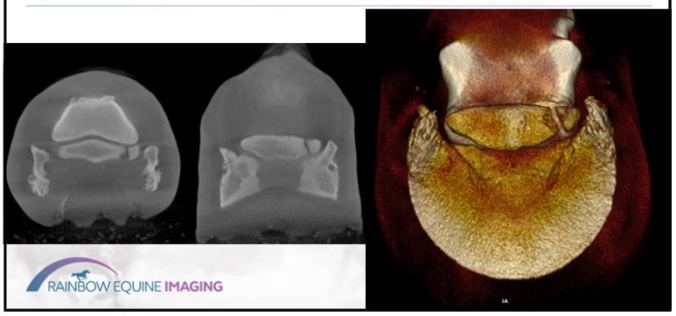
Navicular bone changes



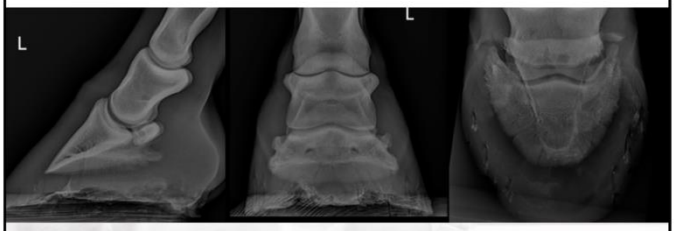
Navicular bone changes



Navicular bone changes



Navicular bone changes



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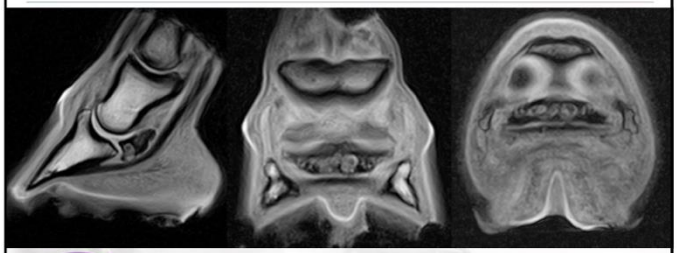

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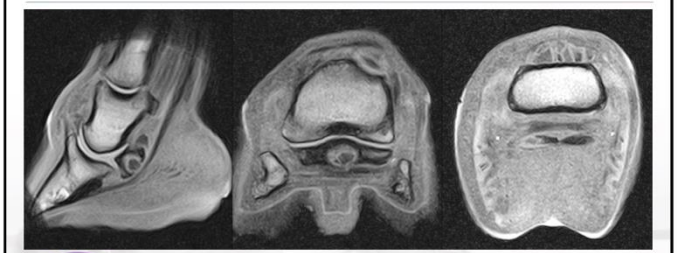

Osseous cyst-like lesions

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Osseous cyst-like lesions

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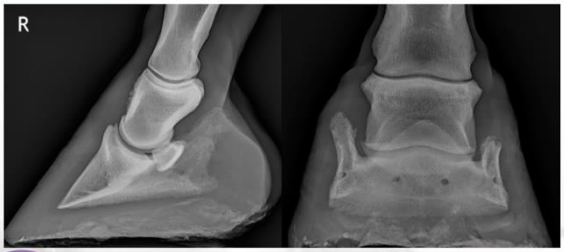
Osseous cyst-like lesions



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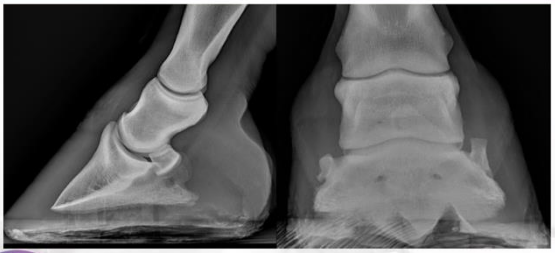
Osseous cyst-like lesions



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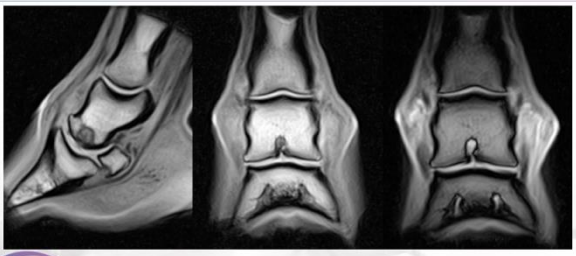
Osseous cyst-like lesions



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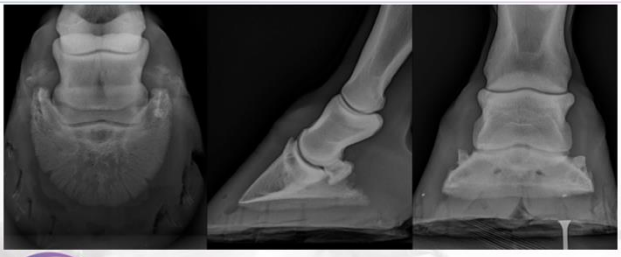
Osseous cyst-like lesions



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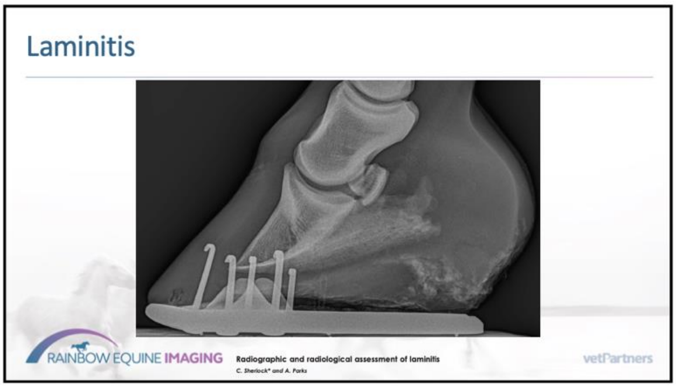
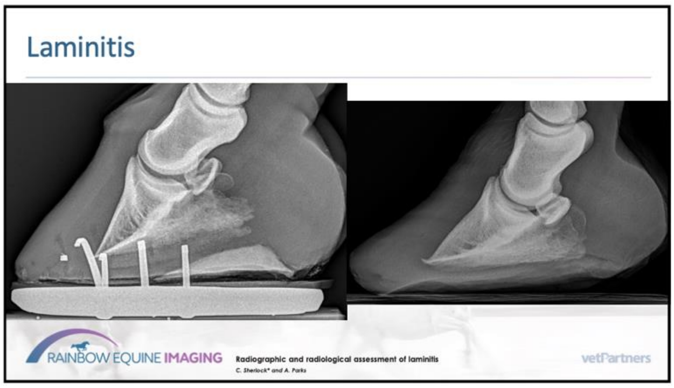
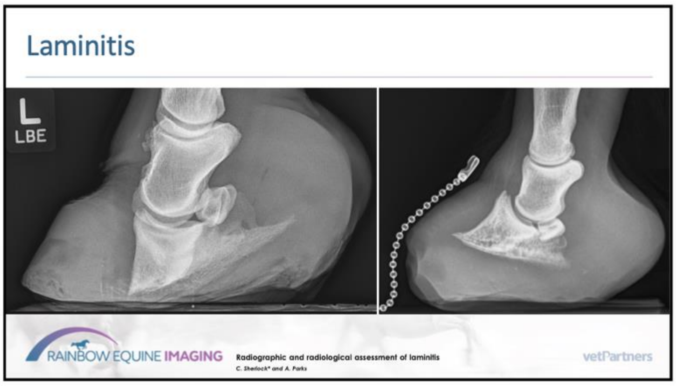
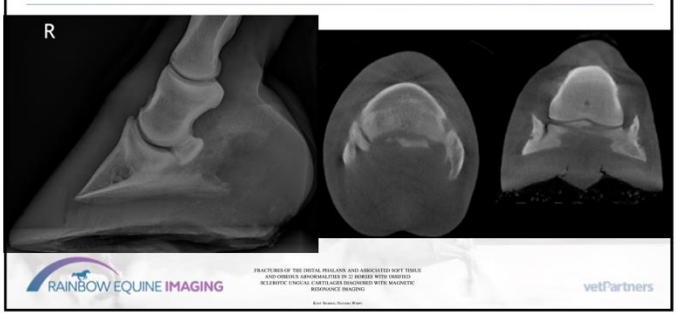






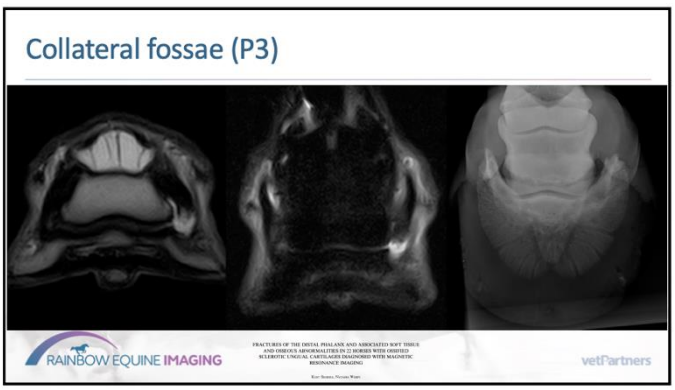
Ossified collateral cartilages

Ossified collateral cartilages

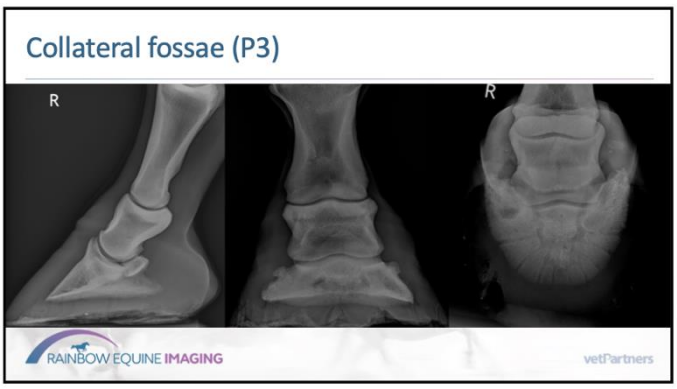


Ossified collateral cartilages

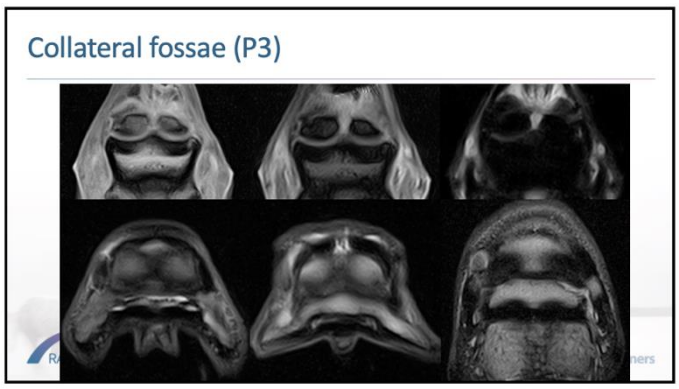
Collateral fossae (P3)



Collateral fossae (P3)



Collateral fossae (P3)



Entheseous resorption – impar?

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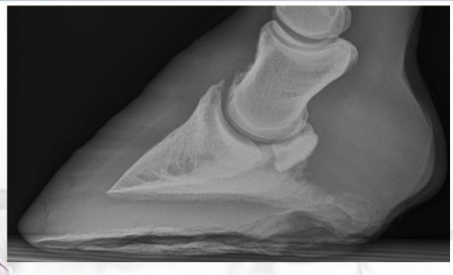
Distal sesamoidean impar ligament



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Distal sesamoidean impar ligament

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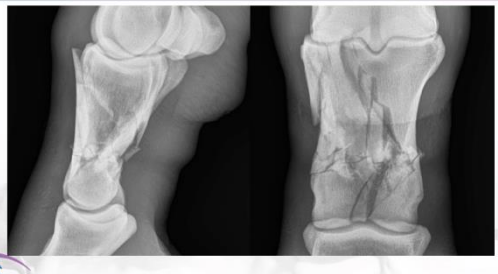
Trauma



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Trauma

RAINBOW EQUINE IMAGING vetPartners

Trauma

RAINBOW EQUINE IMAGING Pedal bone fractures J. Kidd vetPartners

Trauma

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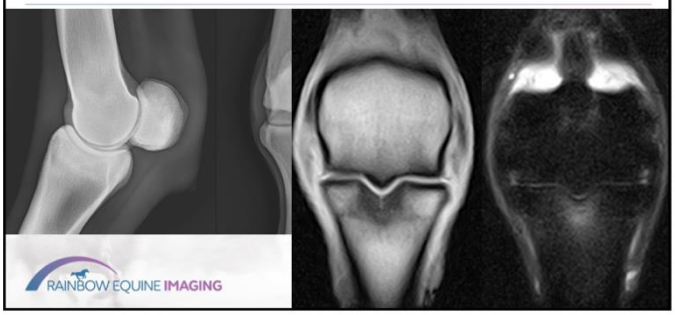
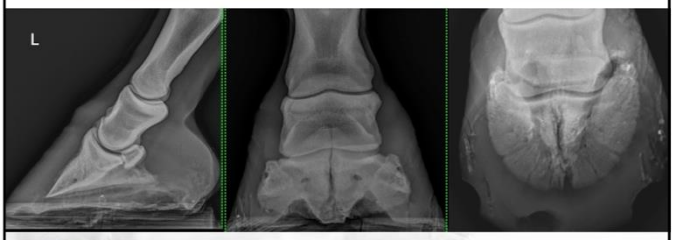
Trauma?



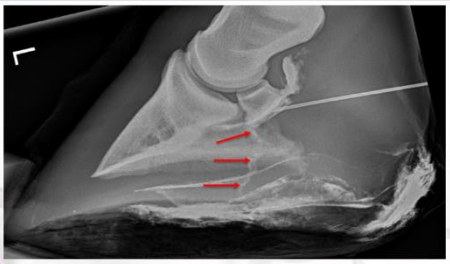
RAINBOW EQUINE IMAGING

Trauma - chronic



RAINBOW EQUINE IMAGING Pedal bone fractures J. Kidd vetPartners

Solar penetrations



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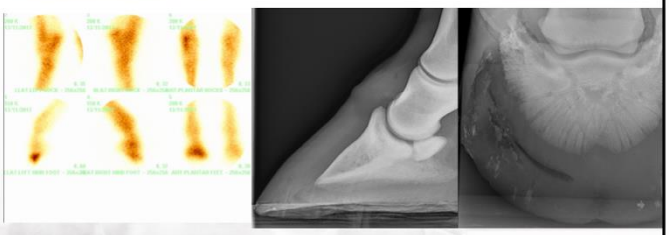
Solar penetrations

RAINBOW EQUINE IMAGING vetPartners

Solar abscessation



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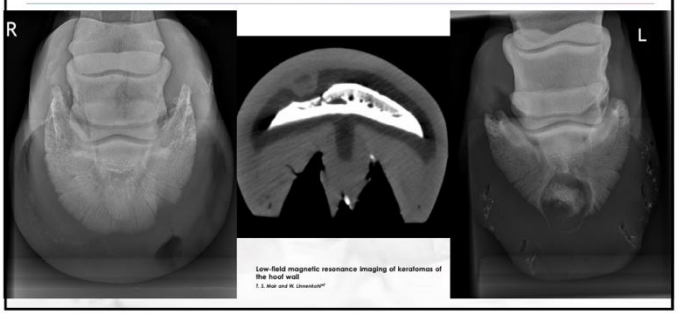
Keratoma / mass lesions



Any questions?

Pain relief becomes **painless**

60 tablet bottle

10 tablet blister pack

Equioxx
57mg Firocoxib

The only equine Non Steroidal Anti Inflammatory Drug in tablet form.

Easy to use
1 tablet per day to be fed with a small amount of feed or with a treat in the palm of the hand

Proven clinical efficacy on pain associated with osteoarthritis
Equal efficacy to phenylbutazone[1]

Once daily dosing
1 tablet is effective for 24 hours

Unique equine COX-2 selective NSAID
Retains the physiological action of COX-1[2]

Equioxx contains firocoxib. Legal category: POM-V. Further information is available from SPC or from Audevard 37-39 Rue de Neuilly, 92110 Clichy – France - en.audevard.com, info@audevard.com. Use Medecines Responsibly.

1. DOUCET M.Y., et al., Comparison of efficacy and safety of firocoxib and phenylbutazone in horses with naturally occuring osteoarthritis. JAVMA, Vol 232, 1, January 2008. 2. KNYCH H.K., Nonsteroidal anti-inflammatory drug use in horses. Vet Clin Equine 33 (2017).

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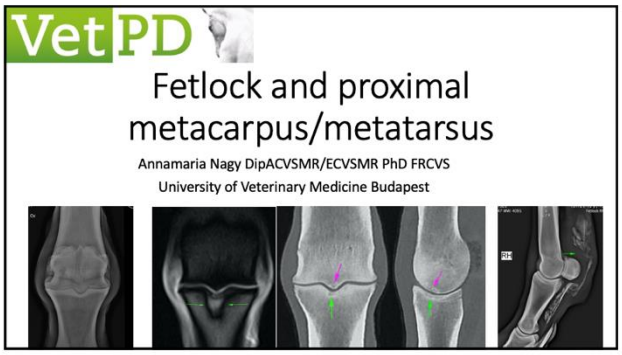
Fetlock & Metacarpus/-tarsus – Tips, Tricks & Case-Discussions

Annamaria Nagy PhD, Dipl.ACVSMR, Dipl.ECVSMR,
American & European Specialist in Equine Sports Medicine & Rehabilitation

E-mail: nagy.annamaria@univet.hu



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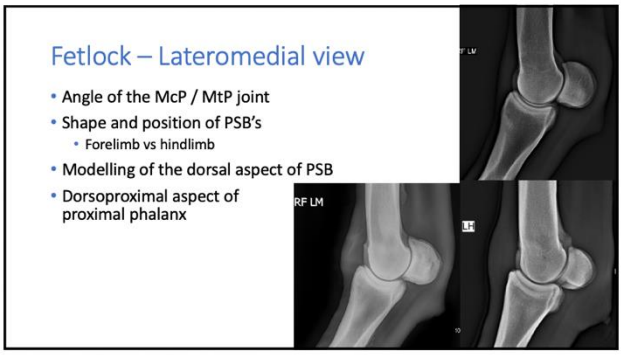

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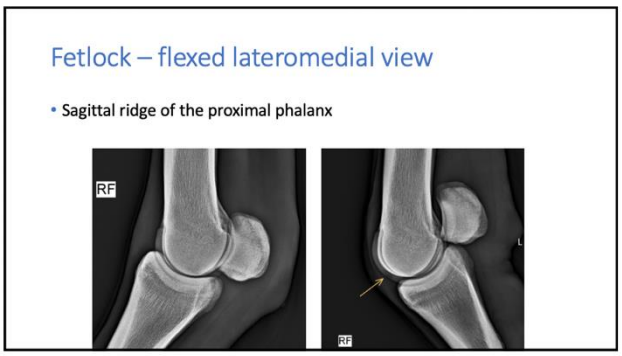

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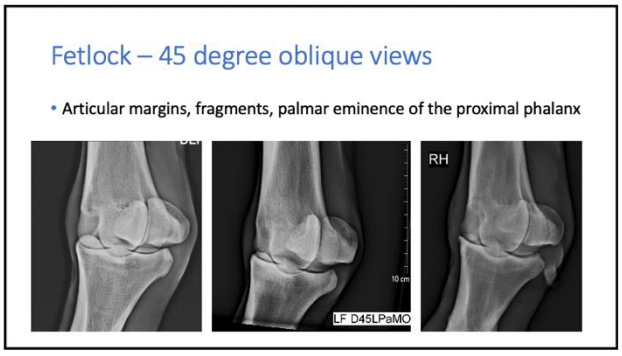

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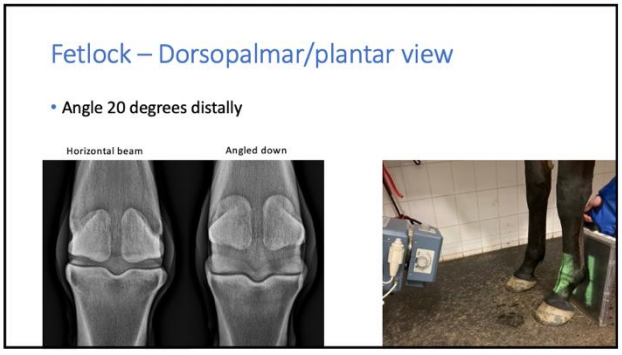


6

Fetlock – Dorsopalmar/plantar view

7

Fetlock – flexed dorsopalmar view

- Highlights the palmar aspect of the condyles

8

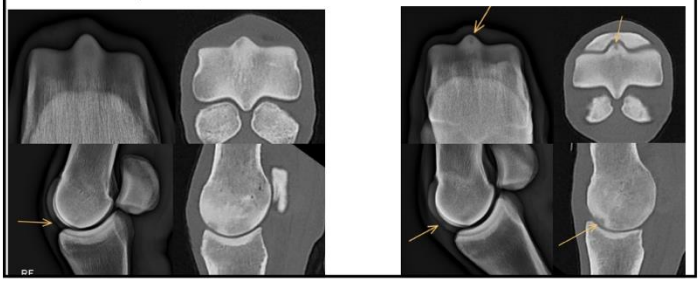
Fetlock – 'tilted oblique' views

- D30Pr45L-PaDiO
- Palmar/plantar fragments
- Condylar lesions

9

Fetlock – skyline view of McIII sagittal ridge

- Sclerosis, OCD lesions



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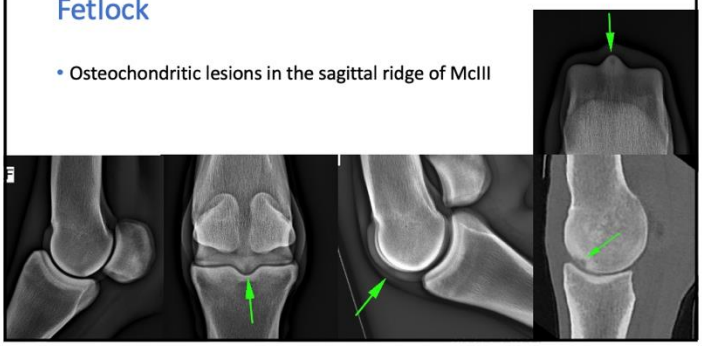
Fetlock

- Osteochondritic lesions in the sagittal ridge of McIII



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Fetlock

- Dorsal condylar lesions

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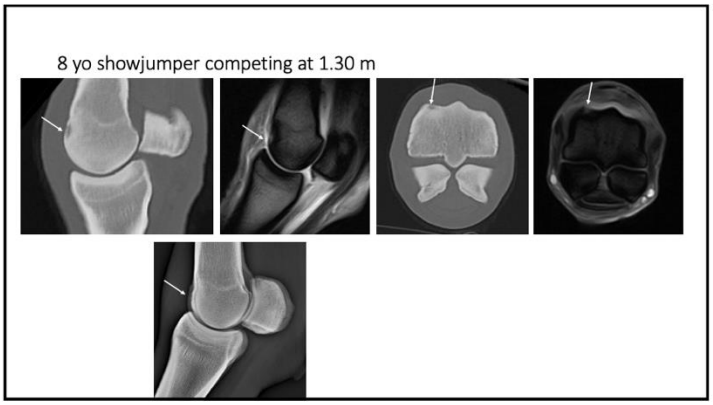

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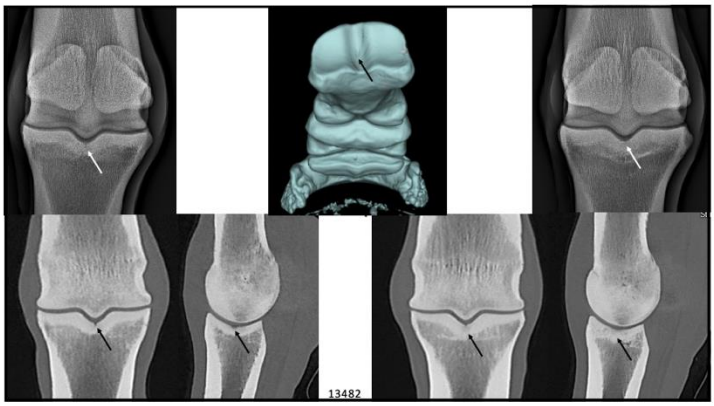

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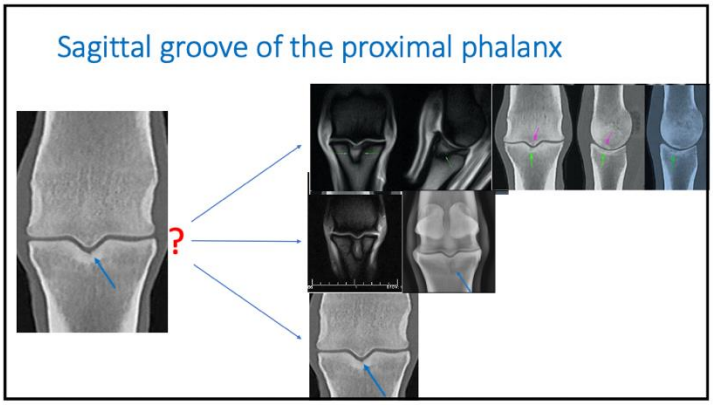

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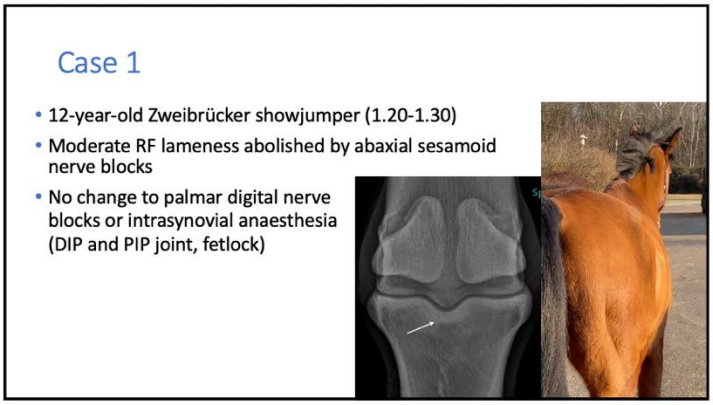

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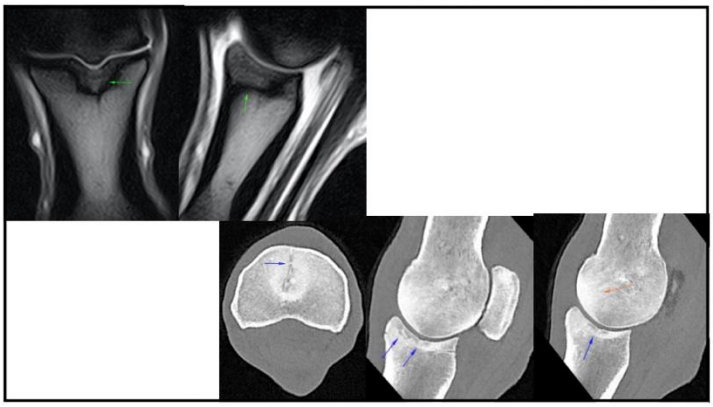

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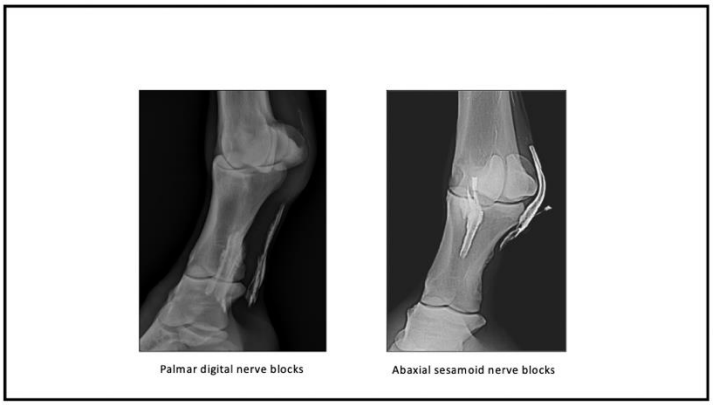

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Case 2

- 13-year-old dressage pony
- Referred for full limb MRI

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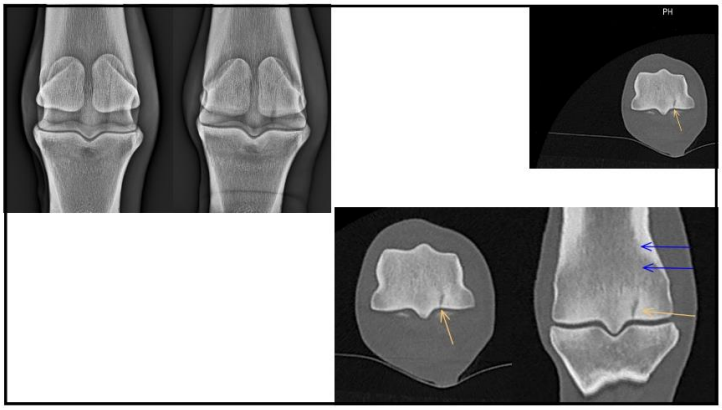

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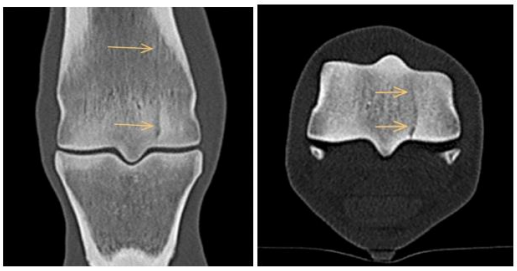


21

Case 3

- 9 yo Sports Horse eventer
- Mild RF lameness

22

Distal McIII stress fx

- Localised increased opacity
- Disruption to the outline of the periosteum
- Outward displacement of the button of the splint bone

GENERAL ARTICLE

Equine Veterinary Journal WILEY

Stress fracture of the palmar, distal cortex of the third metacarpal bone: A diagnostic challenge with a good prognosis

Ran Shan[1] | Anna S. Johnston[2] | Sarah M. Rosanowski[2,3] | John O'Shea[1] | Christopher M. Riggs[1]

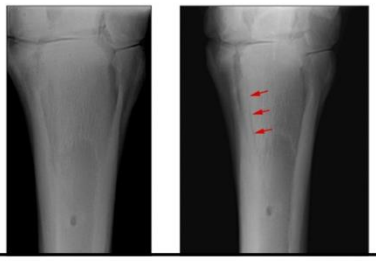
23

Proximal sesamoid bones

24

Dorsopalmar / dorsoplantar views

- Slightly oblique views to highlight lesions



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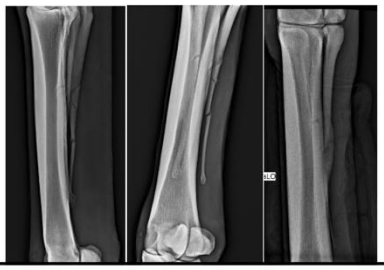
Oblique views

- Splint bones and interosseous spaces



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Case 4

- 5-month-old Warmblood colt

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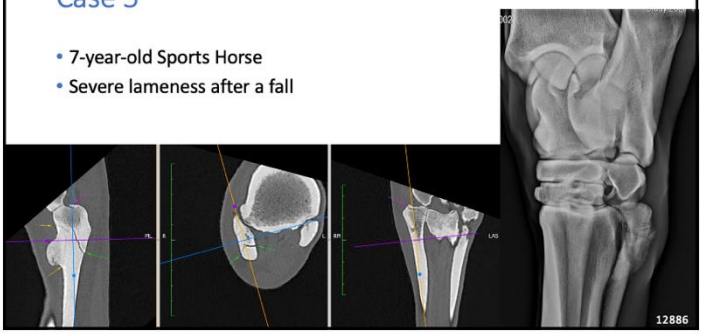
Case 5

- 7-year-old Sports Horse
- Severe lameness after a fall



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Case 6

- 6 yo TB National Hunt racehorse
- LF lameness
- Focal pain medial proximal aspect of palmar McIII

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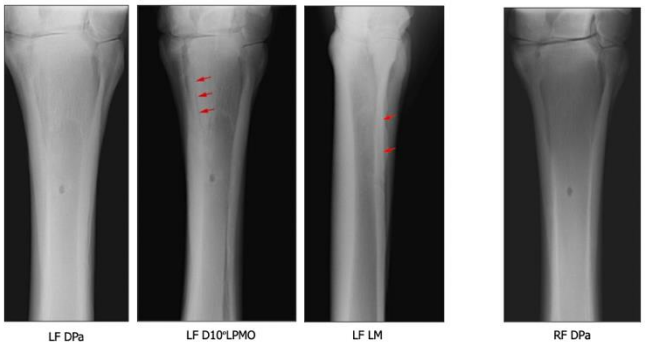

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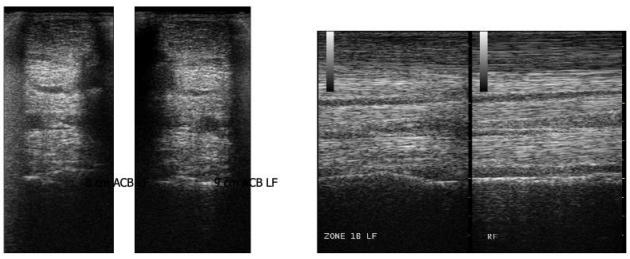

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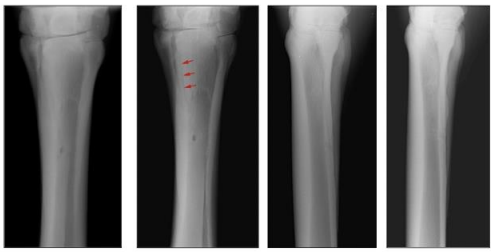
- After two months' of controlled exercise no LF lameness, but lame RF



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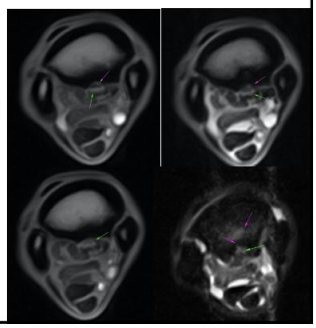
Case 7

- 5 yo Driving Horse
- Lameness mostly originating from the proximal metacarpal region and to a smaller degree from the fetlock region



39

Take home message

- Additional views of the fetlock can be useful – also in sports horses
- CT and MRI is valuable in many cases with fetlock region pain
  - CT is adding to / changing what we have learnt from MRI
- If advanced imaging is not available, slightly oblique dorsopalmar view can help diagnose osseous pathology in proximal McIII / MtIII
- With proximal metacarpal/metatarsal pain the distal carpus/tarsus should also be imaged

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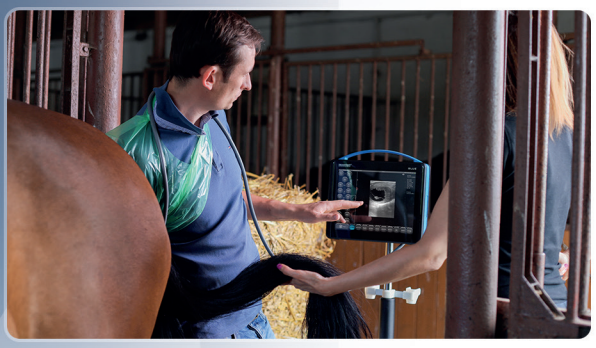
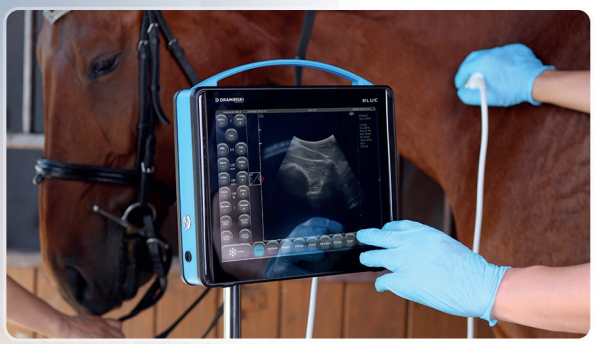
DRAMIŃSKI
TECHNOLOGY





BLUE

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- High Quality Imaging
- Advanced Technologies
- Efficient Battery
- Precise Diagnostics

PORTABLE ULTRASOUND SCANNER

FOR EQUINE DIAGNOSTICS

see more

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Carpus & Antebrachium – Tips, Tricks & Case-Discussions

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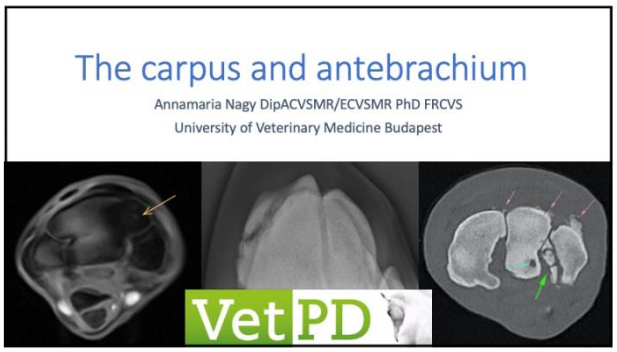

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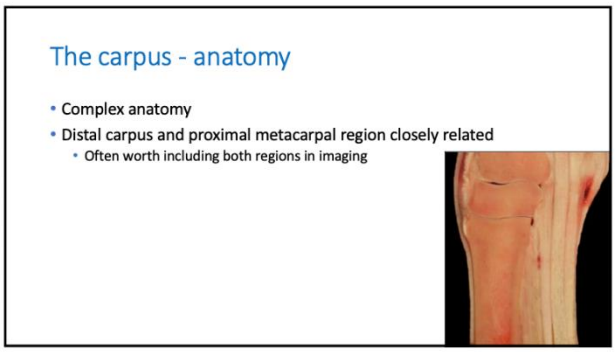

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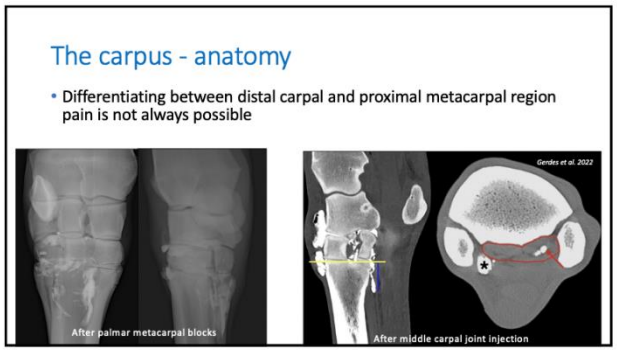

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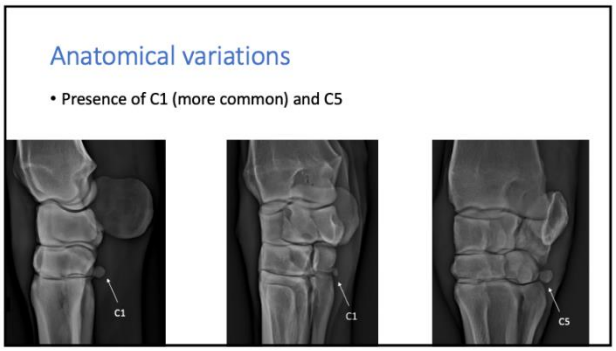

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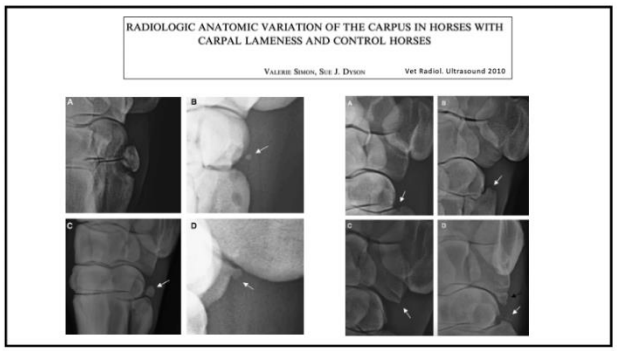

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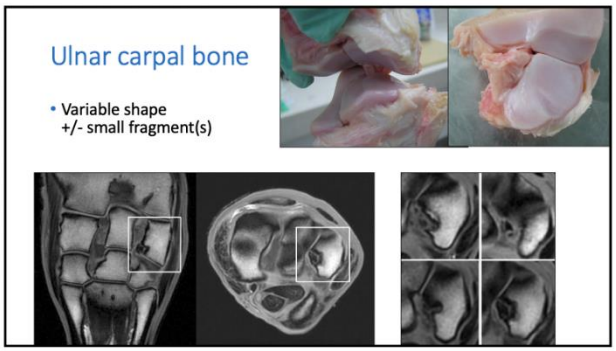


6

Lateromedial view

- A true LM of the carpus is may not be perfect for palmar McIII

7

Flexed lateromedial view

- To highlight the articular surfaces

8

Dorsopalmar view

- Worth including a meaningful part of the proximal metacarpal region

9

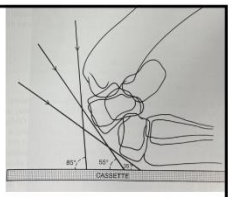
Oblique views

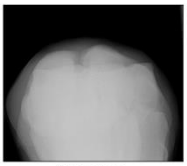
- Standard: 45 degrees
- Other angles can help in specific cases (especially DL-PaMO view)

10

Skyline views

- Aim for horizontal McIII
- Not only in racehorses





Proximal row

Distal row

11

Radius

- Lateromedial view to assess the distal caudal aspect
- Multiple views to assess traumatic injuries, (incomplete) fractures

12

Effusion of the carpal joints

- Infrequent without clinical significance
- Osteoarthritis: usually periarticular modelling

13

Case 1

- 3 yo TB racehorse, acute LF lameness
- Carpal swelling, pain on flexion

14

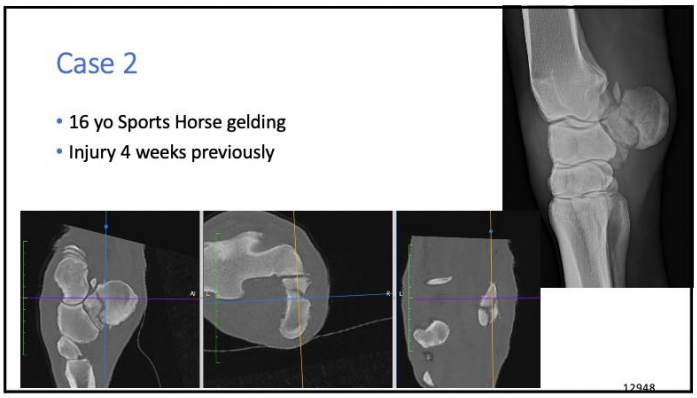
Case 1

- 3 yo TB racehorse, acute LF lameness

15

Case 2

- 16 yo Sports Horse gelding
- Injury 4 weeks previously



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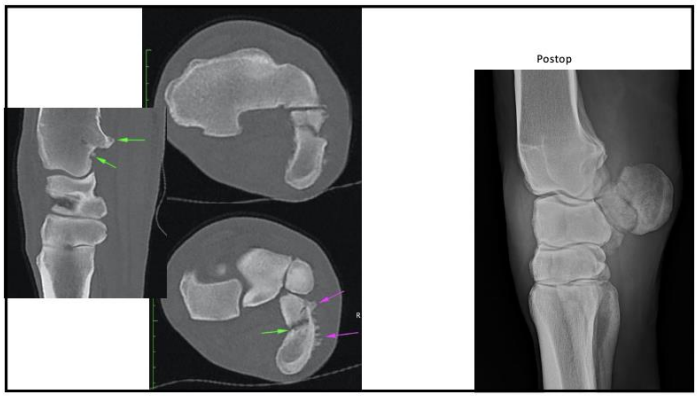

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Case 3

- 11 yo paint mare
- Severe LF lameness

18

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Case 6

- 14 yo eventer
- Admitted for suspected common digital flexor tendon injury
- No gait abnormalities
- No pain/lameness on carpal flexion

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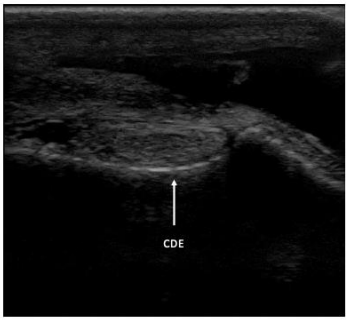


Hygroma

27

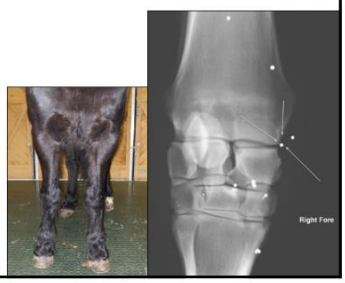
Case 7

- 6 yo National Hunt racehorse
- Underwent upper airway surgery under GA
- Severe LF lameness the following day
- Moderate antebrachiocarpal joint effusion
- Very painful on carpal flexion

28

Case 8

- 16 yo pony
- Moderate RF lameness
- Admitted for carpal arthroscopy
- Very difficult to block



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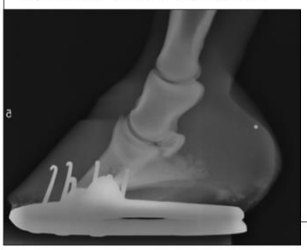
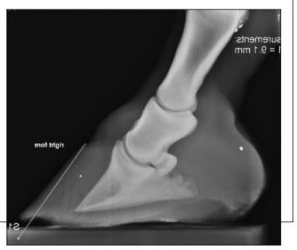
- Blocked to palmar (AS) blocks





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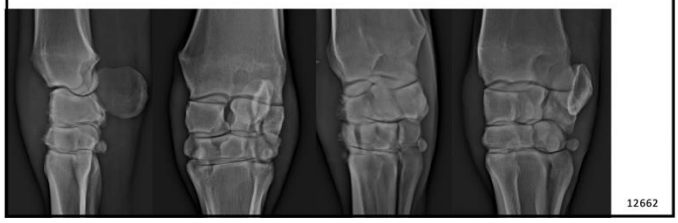
Case 9

- 11 yo mare
- Traumatic injury to the carpus 3 months ago



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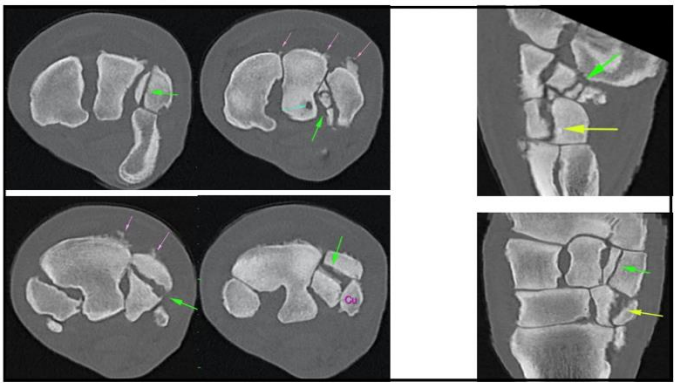

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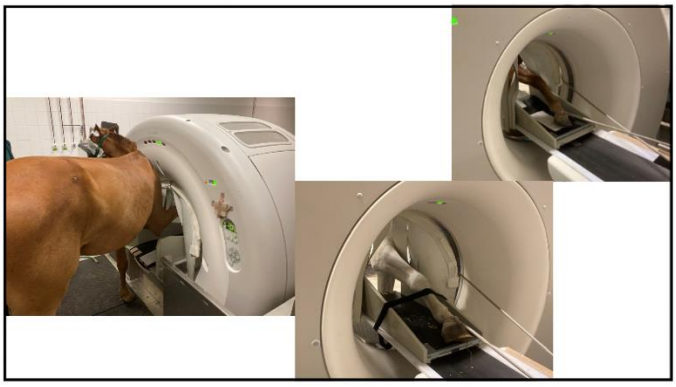

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Case 10

- 5 yo Sports Horse mare
- Kick injury to the distal medial antebrachium
- Non-healing draining tract

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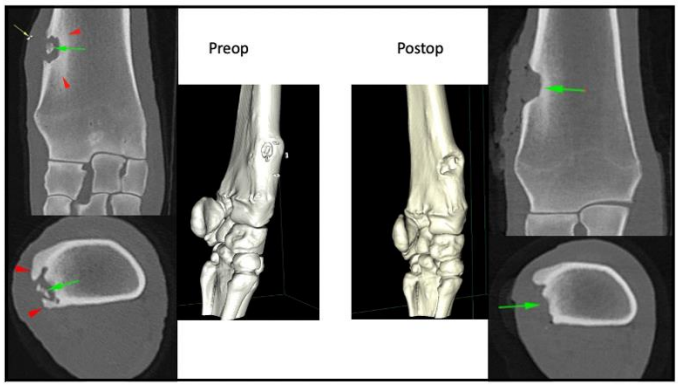

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Case 11

- 1.5 yo filly
- Osseous swelling in the medial aspect of the distal radius

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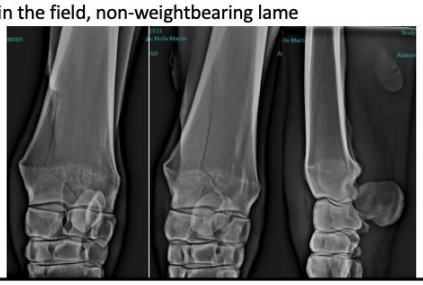
Case 12

- 1 yo colt
- Severe LF lameness

37

Case 13

- 14 yo Lipizaner
- Trauma in the field, non-weightbearing lame



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Case 13

- Cast sleeve and Robert-Jones bandage for 2 weeks, put in a sling

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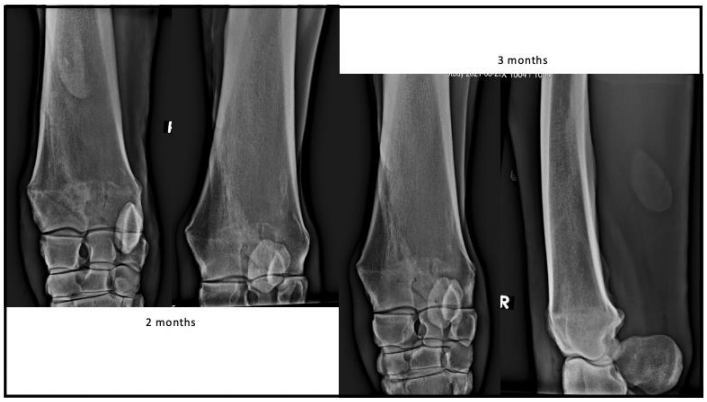

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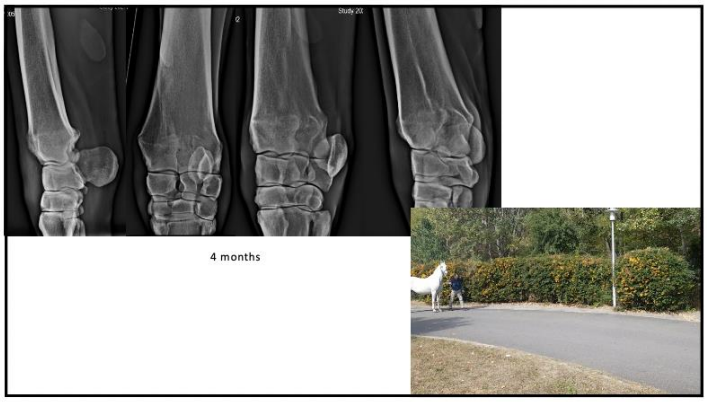

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Case 14

- 21 yo sports horse mare
- Trauma 3 weeks prior to admission

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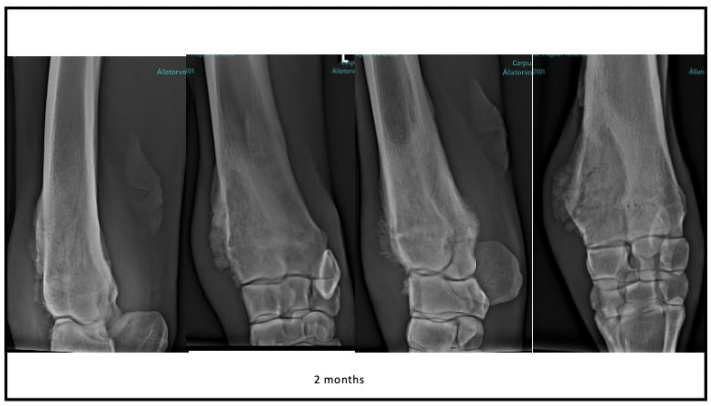

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- Things can go wrong during transport

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Case 15

- 16 yo CEI 3* level endurance horse
- Carpi and proximal metacarpal regions examined in a research project

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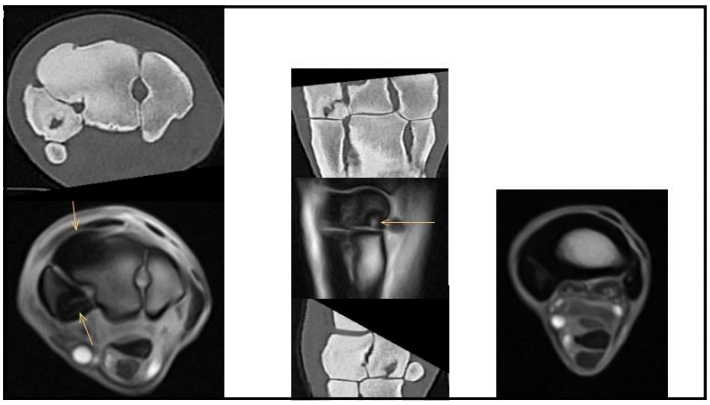

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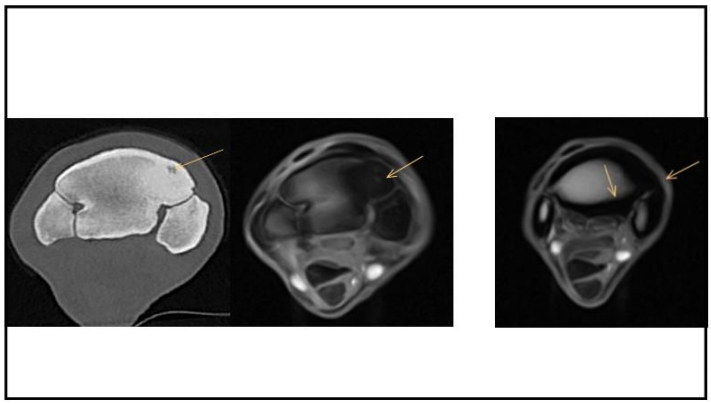

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Take home messages

- Comprehensive diagnostic anaesthesia
- Consider including the proximal aspect of proximal metacarpal region when imaging the carpus
  - And the distal aspect of the carpus when doing advanced images
- Skyline views are not only for racehorses

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Tarsus & Tibia – Tips, Tricks & Case-Discussions

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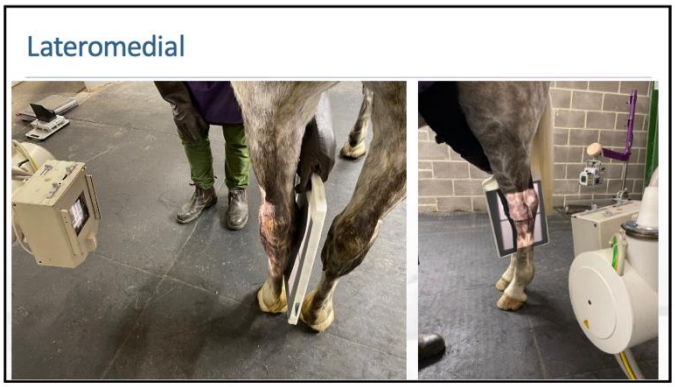
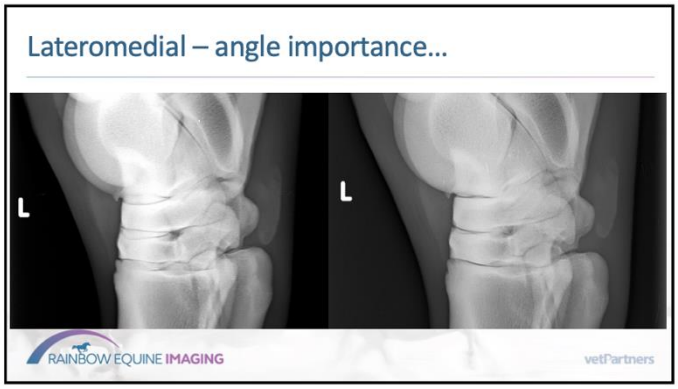
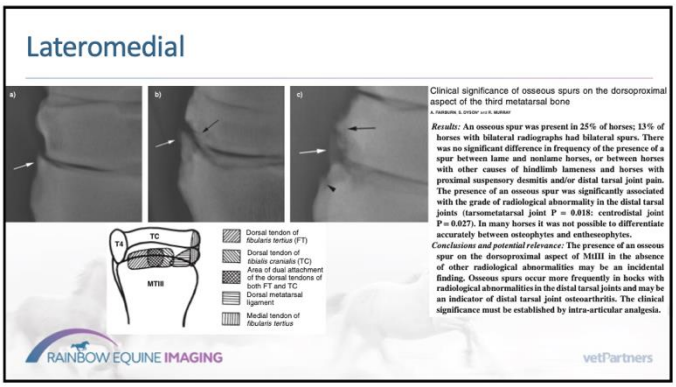
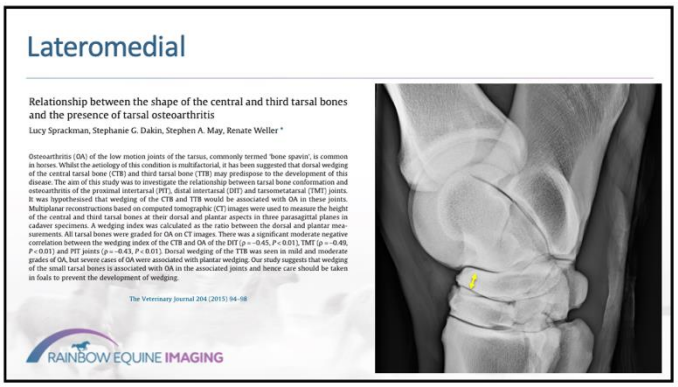








Lateromedial

Relationship between the shape of the central and third tarsal bones and the presence of tarsal osteoarthritis

Lucy Sprackman, Stephanie G. Dakin, Stephen A. May, Renate Weller *

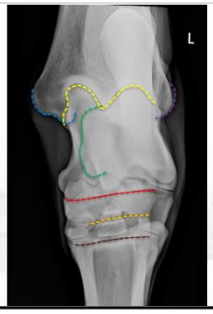
Osteoarthritis (OA) of the low motion joints of the tarsus, commonly termed 'bone spavin', is common in horses. Whilst the aetiology of this condition is multifactorial, it has been suggested that dorsal wedging of the central tarsal bone (CTB) and third tarsal bone (TTB) may predispose to the development of this disease. The aim of this study was to investigate the relationship between tarsal bone conformation and osteoarthritis of the proximal intertarsal (PIT), distal intertarsal (DIT) and tarsometatarsal (TMT) joints. It was hypothesised that wedging of the CTB and TTB would be associated with OA in these joints. Multiplanar reconstructions based on computed tomographic (CT) images were used to measure the height of the central and third tarsal bones at their dorsal and plantar aspects in three parasagittal planes in cadaver specimens. A wedging index was calculated as the ratio between the dorsal and plantar measurements. All tarsal bones were graded for OA on CT images. There was a significant moderate negative correlation between the wedging index of the CTB and OA of the DIT ($\rho = -0.45$, $P < 0.01$), TMT ($\rho = -0.49$, $P < 0.01$) and PIT joints ($\rho = -0.43$, $P < 0.01$). Dorsal wedging of the TTB was seen in mild and moderate grades of OA, but severe cases of OA were associated with plantar wedging. Our study suggests that wedging of the small tarsal bones is associated with OA in the associated joints and hence care should be taken in foals to prevent the development of wedging.

The Veterinary Journal 204 (2015) 94–98

RAINBOW EQUINE IMAGING

Dorsoplantar

Dorsoplantar



RAINBOW EQUINE IMAGING

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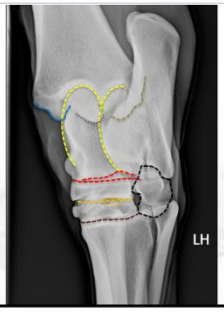
Dorsolateral-plantaromedial oblique

Dorsolateral-plantaromedial oblique



RAINBOW EQUINE IMAGING

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Dorsolateral-plantaromedial oblique

Detection of early osteo
Icelandic horses: Evaluat
resonance imaging

C. J. LEVY, S. BJÖRNSDÓTTIR, S. EKMAN,

RAINBOW EQUINE IMAGING

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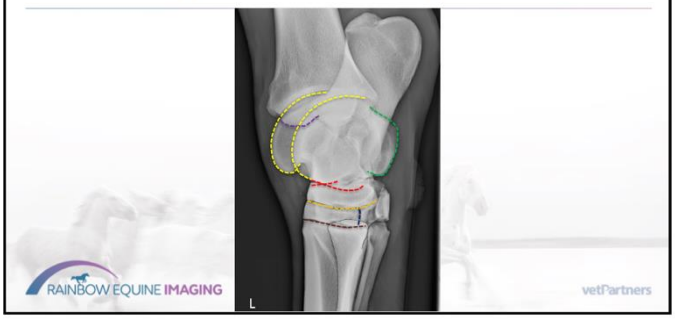
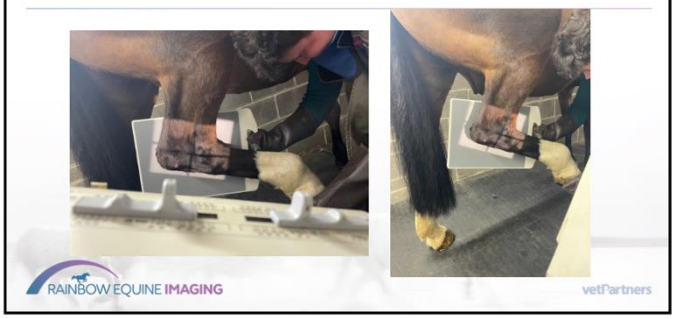
Dorsomedial-plantarolateral oblique

Dorsomedial-plantarolateral oblique



Flexed lateromedial



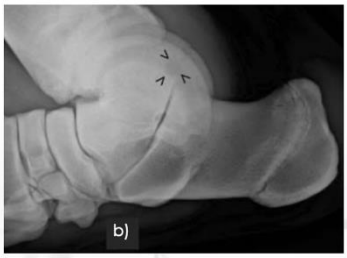
Flexed lateromedial

Flexed lateromedial

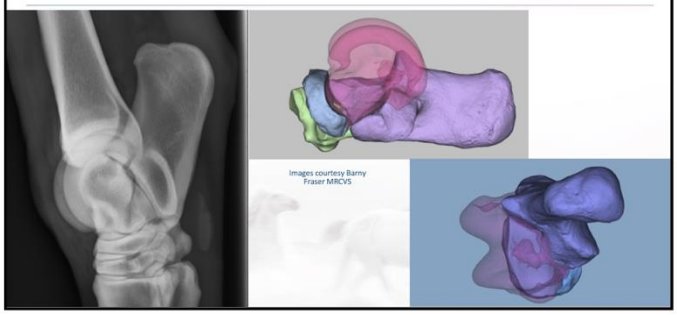
Occult Subchondral Osseous Cyst-like Lesions of the Equine Tarsocrural Joint

Subchondral cyst-like lesions in the talus of four horses

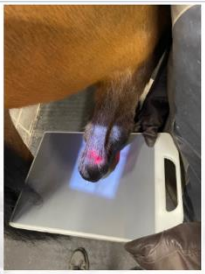
L. J. Montgomery* and J. S. Juzwiak



Flexed lateromedial



Flexed plantaroproximal-plantarodistal oblique



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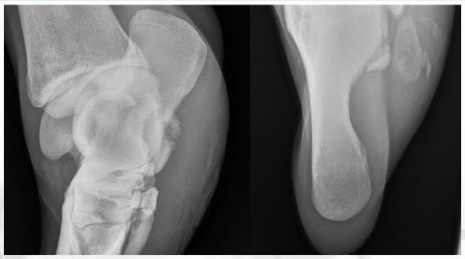
Flexed plantaroproximal-plantarodistal oblique



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Anatomic variants / fragments MTR

Medial trochlear ridge

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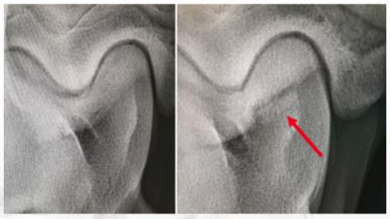
Shallow oblique – distal tibia



D10L-PIMO

Description of a rare osteochondrosis lesion of the medial aspect of the distal intermediate ridge of the tibia in seven Thoroughbred horses (2008-2018)

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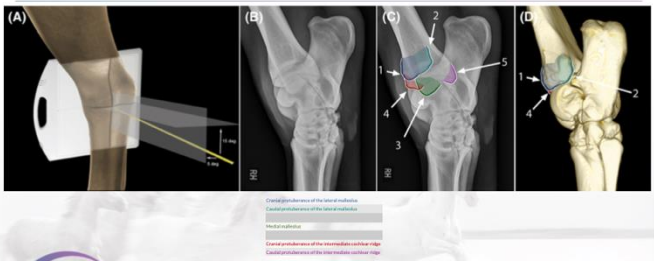
Shallow oblique – distal tibia



Radiographic anatomy of the equine distal tibia

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What lesions to expect

Tarsal Radiographic Abnormality	Breed	Prevalence
Any	Warmbloods	31.4%
Any	Quarter Horse	68.2%
OCD of DIRT	Thoroughbred	3.4–5%
OCD of DIRT	Quarter Horse	3.8%
OCD of DIRT	Standardbred	14.5–17.7%
OCD of medial malleolus of tibia	Thoroughbred	0.4–1.8%
OCD of medial malleolus of tibia	Quarter Horse	1.10%
OCD of medial malleolus of tibia	Standardbred	2.5%
OCD of lateral malleolus of tibia	Thoroughbred	0.5%
OCD medial trochlear ridge of talus	Thoroughbred	0.1–2.4%
OCD medial trochlear ridge of talus	Quarter Horse	0.8%
OCD lateral trochlear ridge of talus	Thoroughbred	1–2.6%
OCD lateral trochlear ridge of talus	Quarter Horse	2.3%
OCD lateral trochlear ridge of talus	Standardbred	1.6–3.8%
Dorsal osteophytes PIT, DIT, TMT	Thoroughbred	20.1–25%
Dorsal osteophytes PIT, DIT, TMT	Quarter Horse	47.9%
Fractures	Thoroughbred	0.1%
Lucency DIT, TMT	Thoroughbred	2.30%
Wedging of T3 or T central	Thoroughbred	0.6–1.6%
Wedging of T3 or T central	Quarter Horse	6.9%

How to Interpret Radiographs of the Carpus and Tarsus of the Young Performance Horse

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Distal tarsal osteoarthritis

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Distal tarsal osteoarthritis

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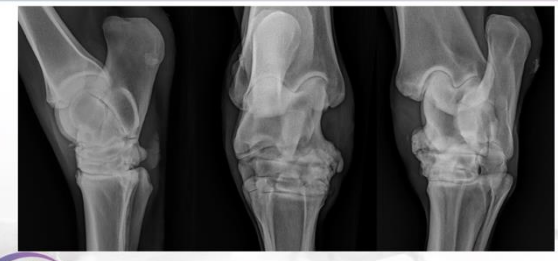
Proximal intertarsal osteoarthritis



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Proximal tarsal osteoarthritis + …

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Osteochondritis dissecans (OCD)

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Osteochondritis dissecans (OCD)

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Osteochondritis dissecans (OCD)

Shallow obliques can help

D15°L-PMO

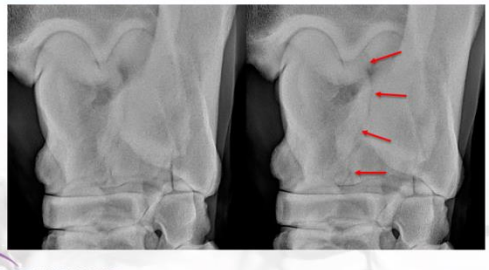
Medial malleolus

OC / OCD

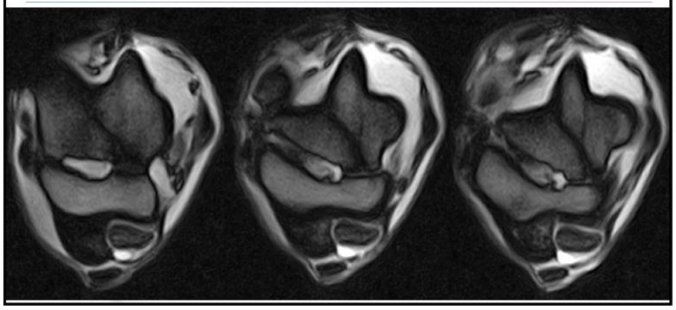
Shallow oblique – lateral malleolus

Consider applying stress…

Shallow oblique – incomplete talus fracture



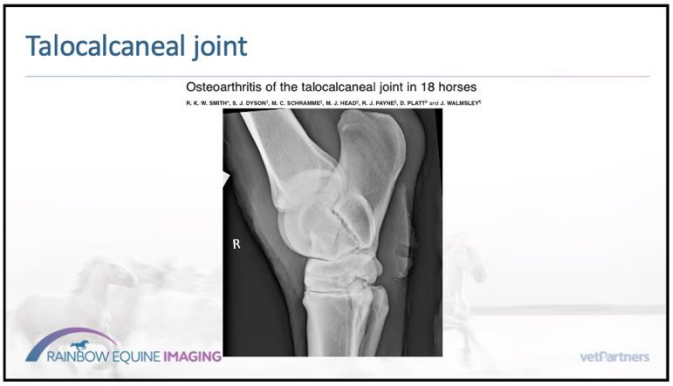
Shallow oblique – incomplete talus fracture



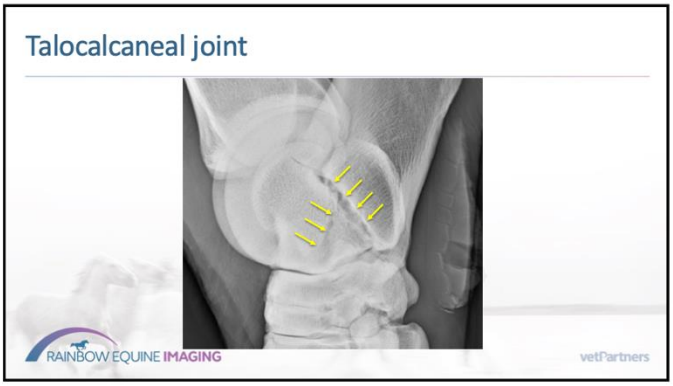
Fragmentation of the proximal medial tubercle

Fragmentation of the proximal medial tubercle +?

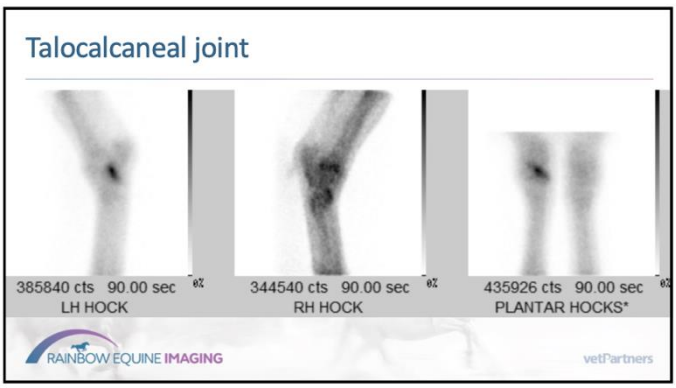
Talocalcaneal joint



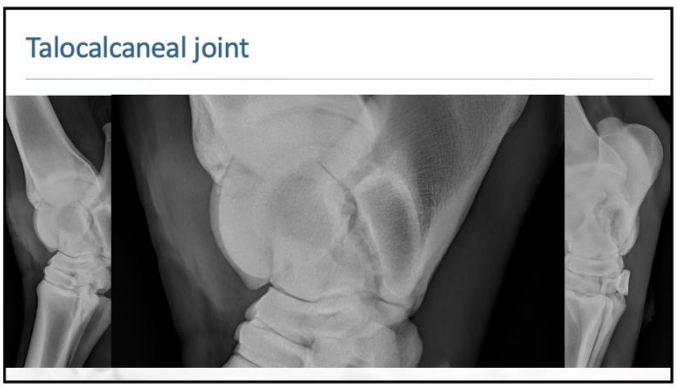
Talocalcaneal joint



Talocalcaneal joint

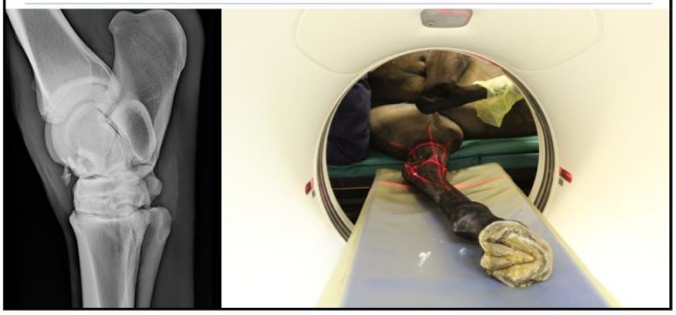


Talocalcaneal joint

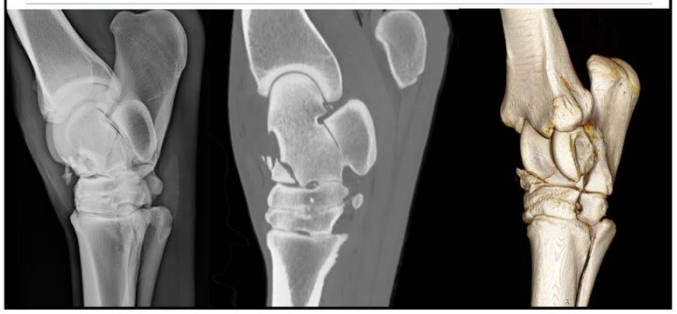


Talocalcaneal joint…

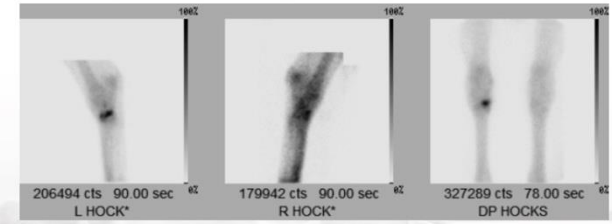
Complexity easily misread



Complexity easily misread



Marked lameness

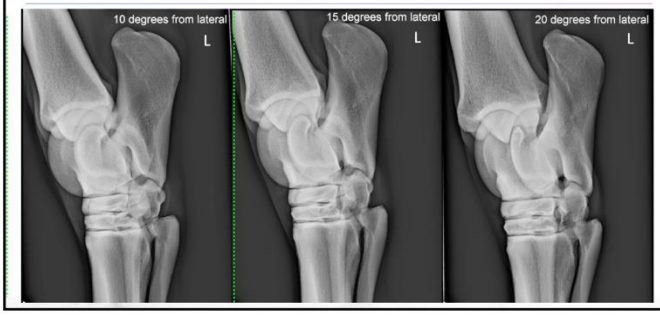


Marked lameness

Marked lameness

Marked lameness

Marked lameness – another horse



Marked lameness – young racehorse

Marked lameness

Marked lameness

Sustentaculum tali

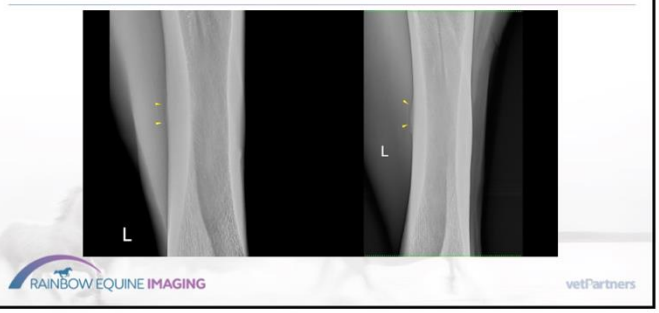
Sustentaculum tali

Sustentaculum tali

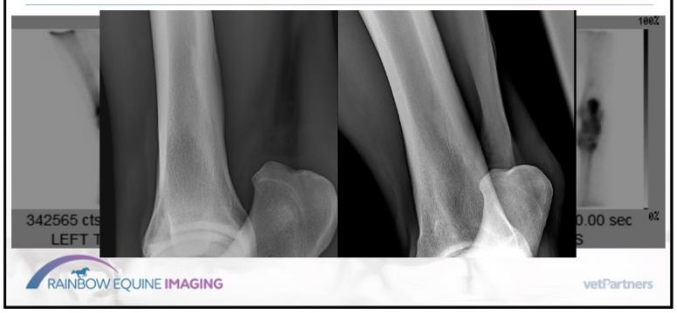
Sustentaculum tali

Soft tissue mineralisation

Tibia



Tibia



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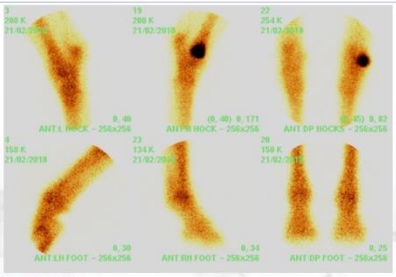

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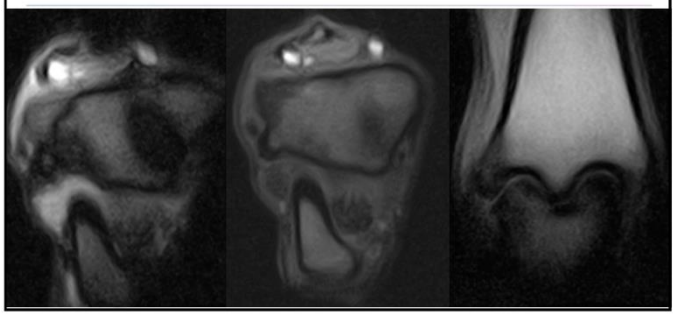
Tibia

Tibia



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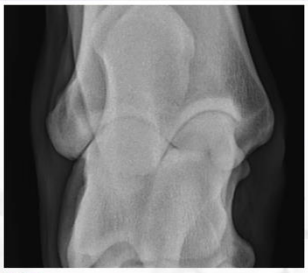

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Proximal metatarsus

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The truth...?

Comparison of radiography, nuclear scintigraphy, and magnetic resonance imaging for detection of specific conditions of the distal tarsal bones of horses: 20 cases (2006–2010)

Alexander J. Daniel, BVetMed; Carter E. Judy, DVM, DACVS; Mark C. Rick, DVM; Travis C. Saverald, DVM, DACVR; Douglas J. Herthel, DVM

....“Radiography was unreliable for the detection of pathological changes related to osseous hyperintensity identified with MRI, fracture, and subchondral bone sclerosis in the equine tarsus. Nuclear scintigraphy was effective in localizing pathological changes, but MRI provided superior anatomic detail.”

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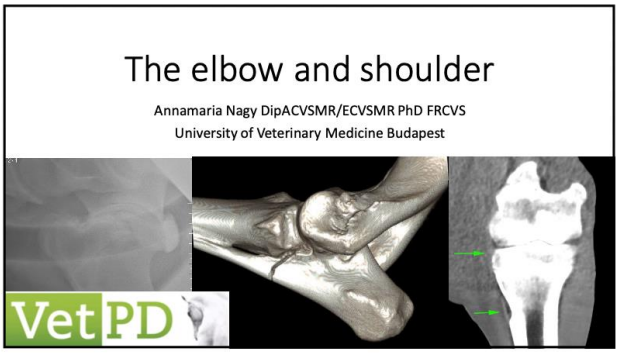
Questions
RAINBOW EQUINE IMAGING
vetPartners

Elbow & Shoulder Joint – Tips, Tricks & Case-Discussions

Annamaria Nagy PhD, Dipl.ACVSMR, Dipl.ECVSMR,
American & European Specialist in Equine Sports Medicine & Rehabilitation

E-mail: nagy.annamaria@univet.hu



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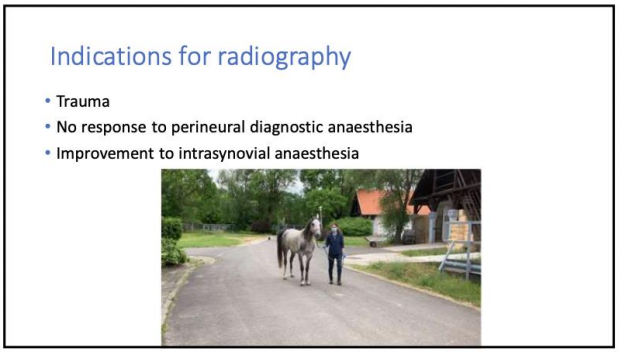

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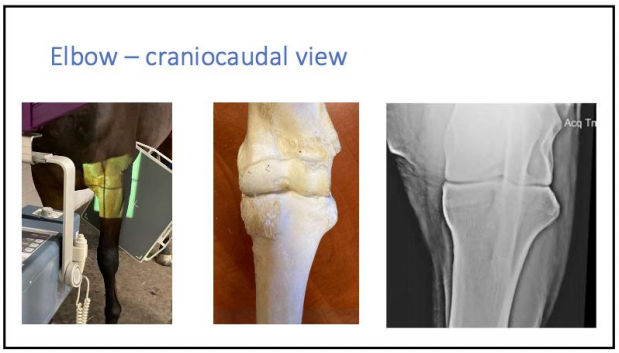

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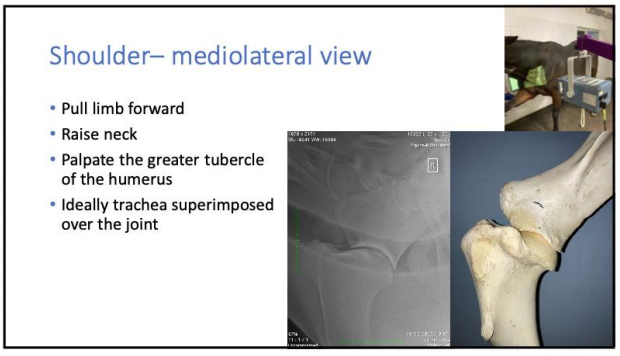

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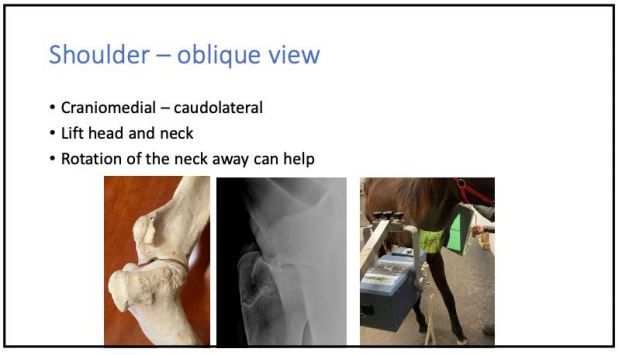
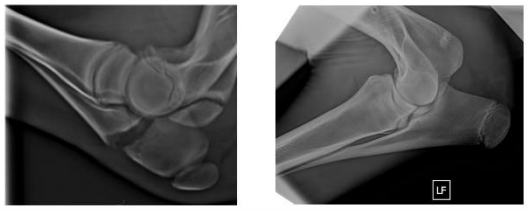


6

Foals and young horses

- Separate centres of ossification open physes



7

Foals and young horses

- 2-month-old pony foal
- Collided with another pony in the field

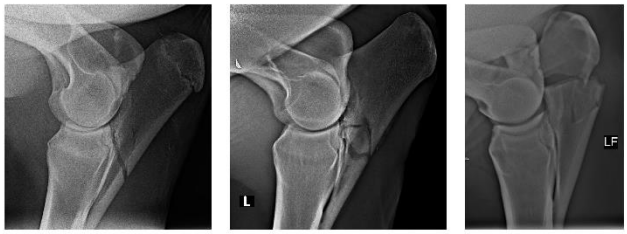
8

CT of the elbow and shoulder regions

- Only after comprehensive ultrasonographic examination
- Under general anaesthesia
- Possible even in large Warmbloods
- Surgical planning for fracture repair

9

Olecranon fracture



10

Case 1

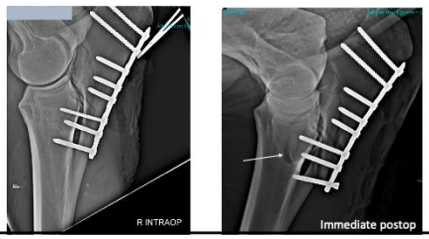
- 16-year-old Sports Horse mare
- Severe LF lameness
- Swelling in the elbow region and proximal antebrachium

11

12

Case 1

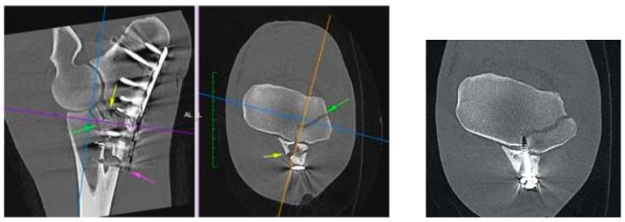
- One screw got pulled out during (assisted) recovery



13

Case 1

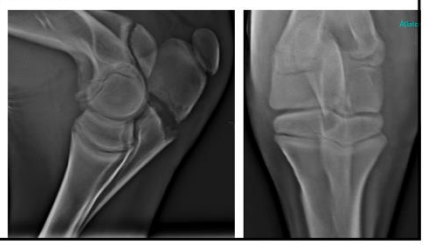
- CT for planning revision



14

Case 2

- 6 week old Freisian filly
- Had been stepped on by the mare



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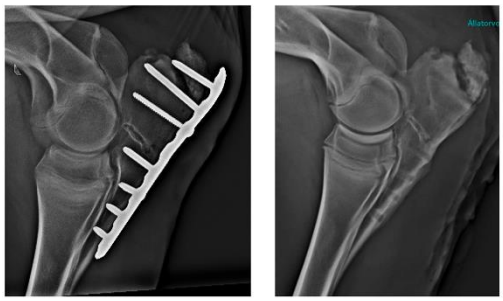


2 months

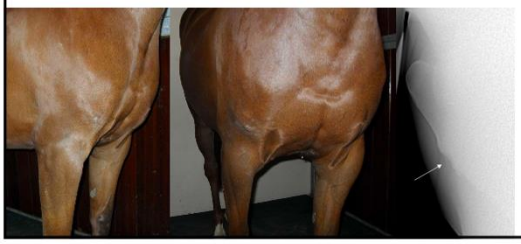
16

Case 3

- 13 yo showjumper
- Lameness could not be localised with diagnostic anaesthesia

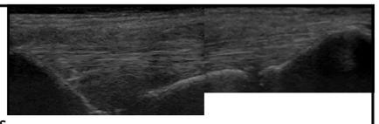
17

Case 4

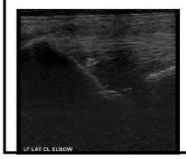


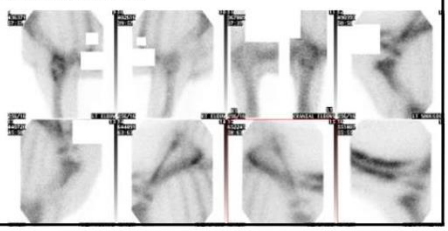
18

Case 5



- Sudden onset of severe LF lameness
- Resents retraction and abduction of the limb
- Radiography, ultrasound NAD





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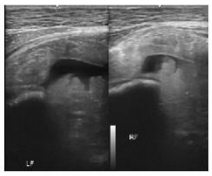
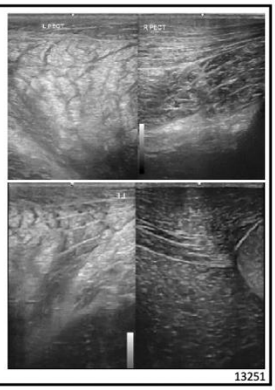
Case 6

- 9-month-old colt
- Severe LF lameness, atrophy of the shoulder muscles





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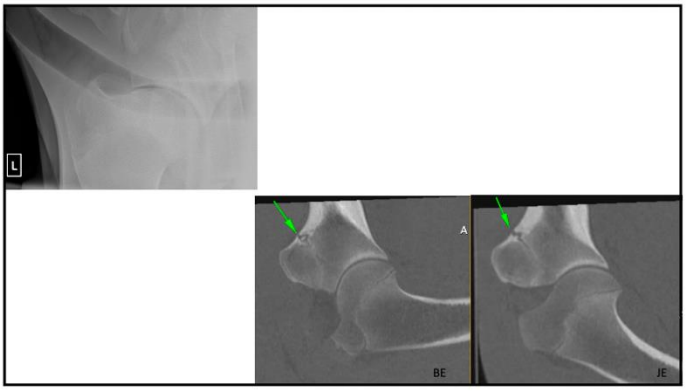

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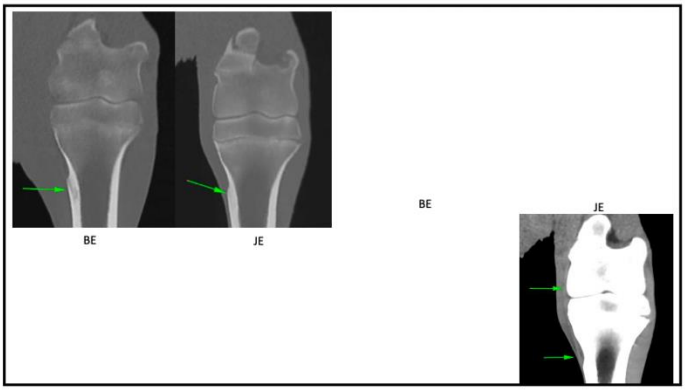

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Case 7

- 1 year old colt
- Severe LF lameness of 3 months' duration

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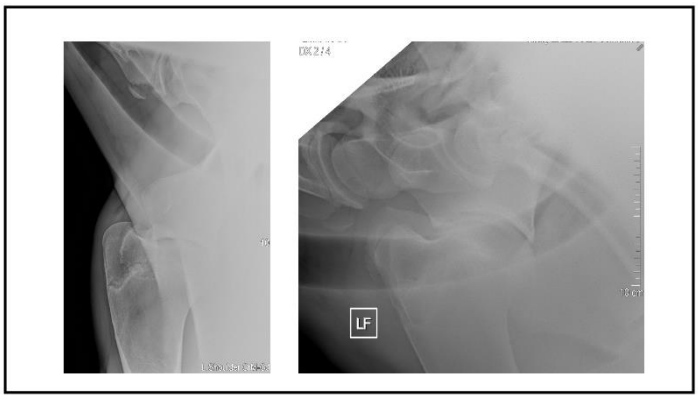

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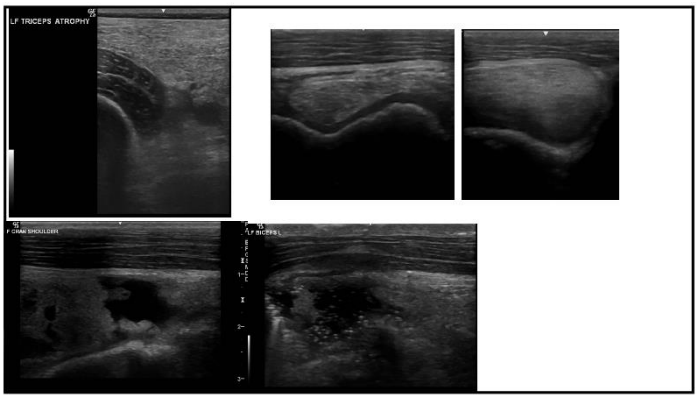

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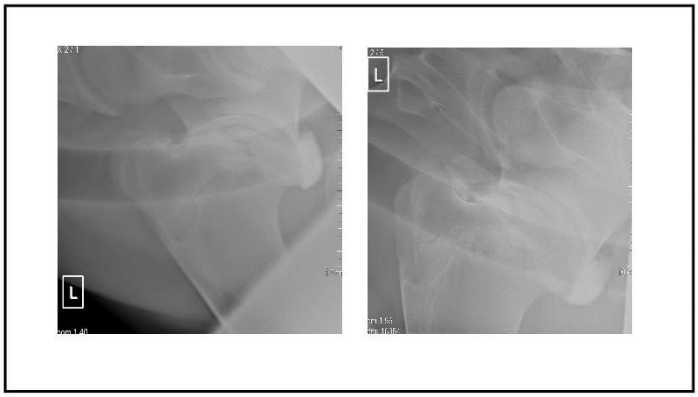

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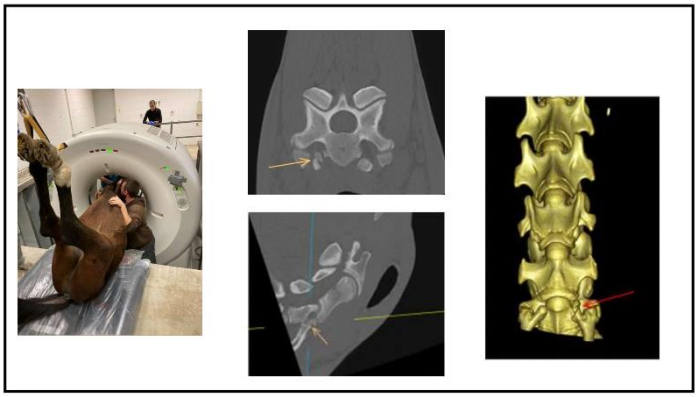

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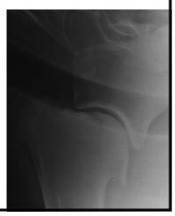
Take home message

- Elbow and shoulder pain don't always improve to diagnostic anaesthesia
- ‚Unblockable' lameness – consider imaging
  - Proximal limb
  - Caudal neck
  - First thoracic vertabrae and ribs
- Pain can make radiographic examination challenging



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Stifle Joint – Tips, Tricks & Case-Discussions

Jonathon Dixon BVetMed, MVetMed, Dipl.ECVDI, MRCVS
European Specialist in Veterinary Diagnostic Imaging

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Stifle radiography: tips, tricks and case discussions

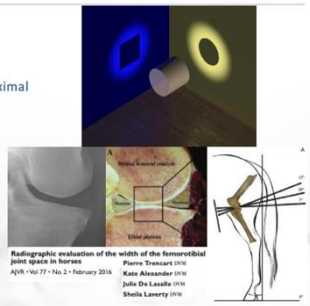
Jonathon Dixon BVetMed MVetMed DipECVDI MRCVS
RCVS & EBVS® European Specialist in Veterinary Diagnostic Imaging

VetPD Hannover February 2023

Equine Stifle Radiography

What are the MUSTS?

- At least 2 orthogonal projections, ideally 3...
- Collimation to include the patella, distal femur, proximal tibia and cranial – caudal entire margins of the articulation
- Visibility of the osseous and soft tissue structures
- Absence of artefacts (positional, exposure...)
- Maintenance of radiation safety principles



Radiographic evaluation of the width of the femorotibial joint space in horses
AJVR • Vol 77 • No 2 • February 2016
Pierre Trencart DVM, Kate Alexander DVM, Julie De Lasalle DVM, Sheila Laverty DVM

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Equine Stifle Radiography

Common lesions	"Expected" radiographic visibility
Osteochondritis dissecans (OCD) • Lateral trochlear ridge > medial trochlear ridge	High for fragment detection • Slightly less specific for MTR fragments
Osseous cyst-like lesions (OCLL) • Medial > lateral femoral condyles	High • Variability from shallow depressions - cavities
Osteoarthritis • Medial compartment most frequently	Moderate • Variable based on location / severity
Cartilage lesions (including OC)	Low if no SCB lesion
Soft tissue lesions (menisci, collateral ligaments, meniscotibial ligaments, patellar ligaments etc.)	Low for soft tissue lesions only, can see entheseous changes on occasion / fragmentation, 2° joint distension
Articular effusion	Moderate (high impact of image quality)
Fractures	Generally good – may require additional projections, may underestimate extent

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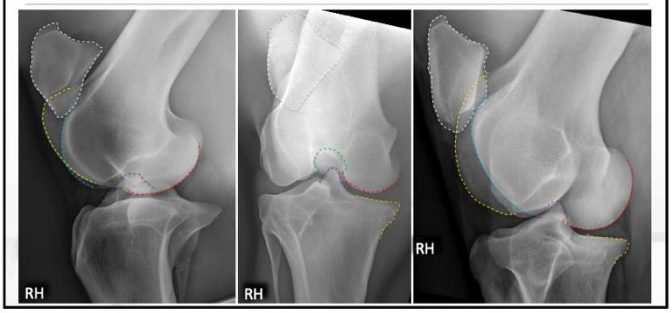
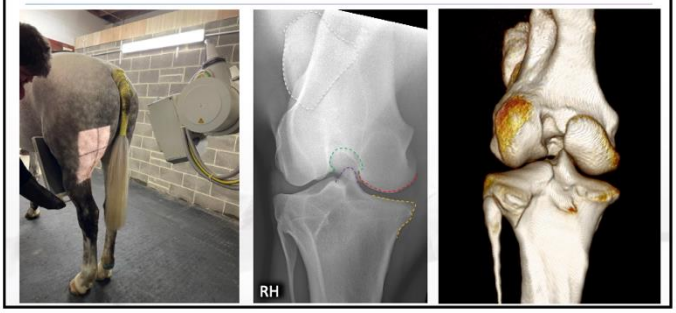
Equine Stifle Radiography



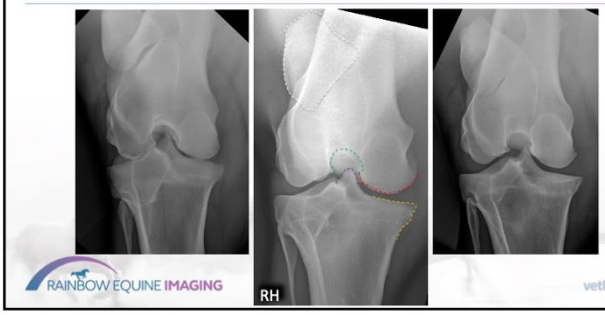
Lateromedial

Caudocranial



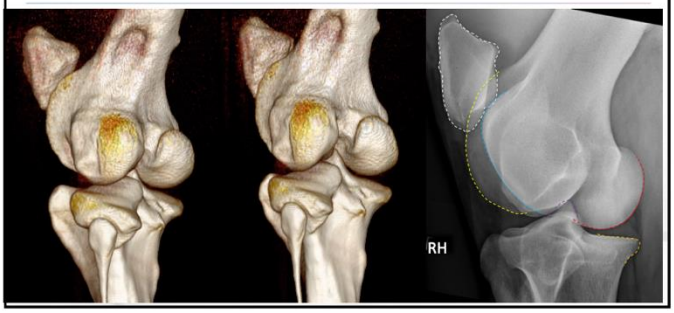
Caudocranial

Caudocranial

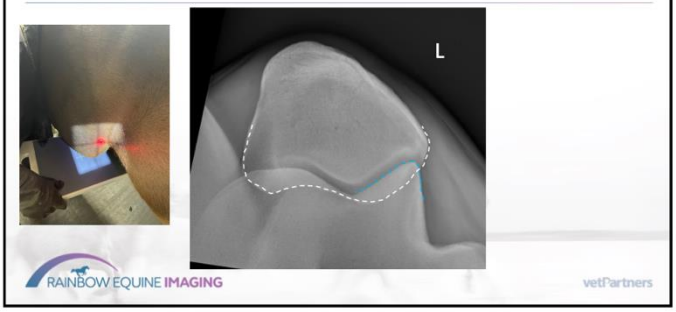


Caudolateral-craniomedial oblique

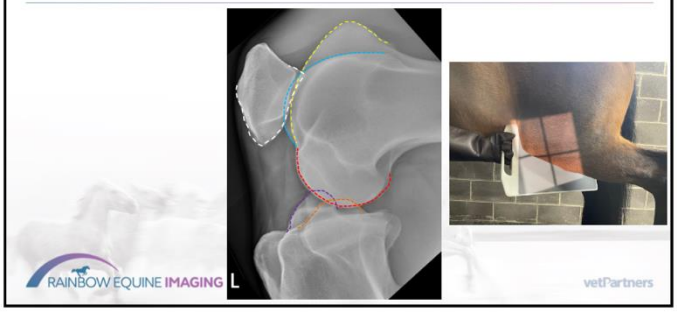
Caudolateral-craniomedial oblique



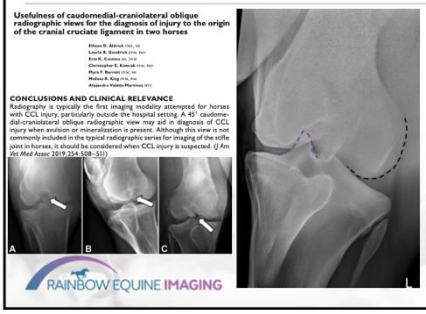
Cranioproximal-craniodistal oblique



Flexed lateromedial



Caudomedial-craniolateral oblique



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Equine Stifle Radiography

Comparison of radiography and ultrasonography for the diagnosis of osteochondritis dissecans in the equine femoropatellar joint

Osteochondritis dissecans (OCD)

- Lateral trochlear ridge (++++) middle third
  - Sens 84%, Spec 100%, PPV 100%, NPV 50%
- Medial trochlear ridge (+)
  - Sens 88%, Spec 89%, PPV 70%, NPV 96%
- Trochlear groove & patella (+/-)
- In general: ultrasound > radiographs
- Ultrasound κ-values 0.81-0.87 c.f. arthroscopy *severity* grading
- Radiography κ-values 0.64-0.78 c.f. arthroscopy *severity* grading
- Can improve up to 18m of age, care with radiographs <12 months old

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Equine Stifle Radiography

Concurrent or sequential development of medial meniscal and subchondral cystic lesions within the medial femorotibial joint in horses (1996–2006)

Osseous cyst-like lesions / subchondral 'lucencies'

- **Medial** femoral condyle +++ (cranial 1/3)
- Lateral femoral condyle +/-
- RH > LH
- Vary from focal "dimples" / depressions, to large concave OCLL with subchondral plate defects → consider differently…
- 3.4% - 19% of juvenile TBs affected
- In juvenile TBs 48% arise >6 months of age, after endochondral ossification has ceased → ? spontaneous ? traumatic
- < 6m old most often axial, > 6m old central
- Some shallow (**1-3mm**) lesions can resolve from 6m → 18m… >80% persist

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Equine Stifle Radiography

Concurrent or sequential development of medial meniscal and subchondral cystic lesions within the medial femorotibial joint in horses (1996–2006)

Osseous cyst-like lesions / subchondral lucencies

- In TBs most subchondral lucencies **<3mm** deep remained unchanged (41%), some enlarged, some reduced in size
- Articular cartilage **not** radiographically visible
- Possible aetiology secondary to medial FTJ OA, medial meniscal lesions, and documented following experimental surgical trauma
- Association (OCLL) <3 (64%) V >3 (35%) years old on outcome following debridement
- Concurrent meniscal damage ↓ prognosis

Progression of shallow medial femoral condyle radiographic lucencies in Thoroughbred repository radiographs and their influence on future racing careers

Effect of age at presentation on outcome following arthroscopic debridement of subchondral cystic lesions of the medial femoral condyle: 85 horses (1993–2003)

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Equine Stifle Radiography

Osseous cyst-like lesions / subchondral lucencies

- Occasionally proximal tibial lesions seen
- In one series 14/17 were associated with lameness
- Often seen with concurrent MFC OCLL and OA within the medial FTJ

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Equine Stifle Radiography

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Equine Stifle Radiography

Osteoarthritis (OA)

- Medial FTJ > lateral FTJ > FPJ / patella
- Proximal medial tibial plateau osteophytes
- Subchondral sclerosis / resorption
- Abaxial margins of femoral condyles (Cr-MFC)
- Axial margins of the intercondylar fossa
- Intercondylar eminences of tibia
- Soft tissue mineralization (particularly post IA steroids)
- CdCr and CdLCrMO most important
- With good quality rads, and moderate - large osteophytes present: likely that OA is genuine

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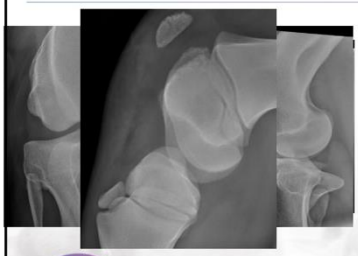
Equine Stifle Radiography



Severe OA

- Tibial erosions of the plateau can be present, and infrequently of the femoral condyles
- True articular collapse and meniscal prolapse
- Think about concurrent soft tissue injury…

Erosive arthropathy

- Foals – likely indicative of septic process
  - Femoral condyles should be smooth in contour at all ages
  - Trochlear ridges in neonates are normally irregular
- Adults – think:
  - Chronic septic arthritis
  - Meniscal prolapse
  - Articular collapse

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Septic foci

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Septic foci

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Equine Stifle Radiography

Articular cartilage lesions (i.e., chondromalacia, osteochondrosis)

- Articular cartilage not radiographically visible without use of IA contrast media – £££
  - Role for CT / CTA?
- Can have extensive cartilage thinning over trochlear ridges when radiographically normal (40% of joints)
- Subchondral flattening / concavities give a clue as to likely overlying cartilage lesions
- US helpful > radiographs
- Femoral condyle chondromalacia often unexciting on radiographic examination → arthroscopy, ? US

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Equine Stifle Radiography

Soft tissue lesions: Cranial cruciate ligament

- Ligament unlikely to be visible radiographically
- Look primarily for fragments at the entheses, or osseous resorption / OCLL formation
- Can consider CdMCrLO radiograph
- Attaches craniodistal onto the MICET

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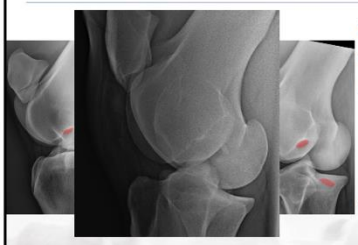
Equine Stifle Radiography



Soft tissue lesions: Caudal cruciate ligament

- Less frequently implicated
- Caudoproximal tibial avulsions / fragments possible, mid substance dystrophic mineralization, origin - insertion entheseopathy also possible.
- Radiographic examination limited to overt osseous lesions only unless stifle unstable

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Equine Stifle Radiography

Meniscal tears in horses: an evaluation of clinical signs and arthroscopic treatment of 80 cases

Soft tissue lesions: Menisci

- Articular space narrowing – uncommon – most frequently a positional / primary beam artefact
- If truly narrowed joint space, then meniscal disruption / protrusion and / or cruciate rupture
- Most frequent radiographic feature is OA (38/80) – MICET and FTJs
- Meniscal mineralization not uncommon with chronic tears

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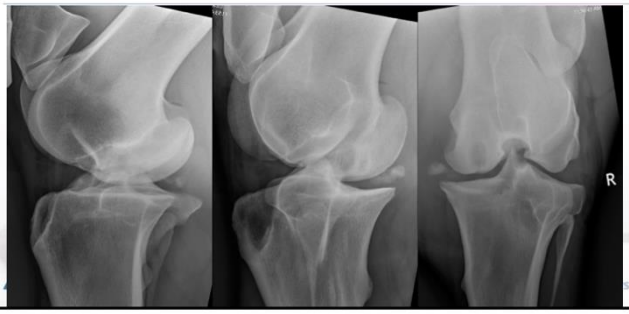
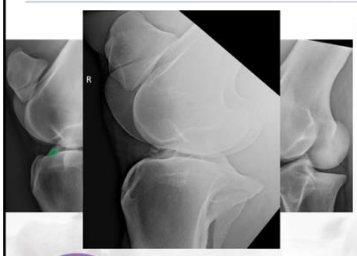
Meniscal mineralization and prolapse + OCLL / OA

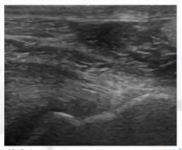


Equine Stifle Radiography



Soft tissue lesions: Meniscotibial / meniscofemoral ligaments

- Osseous resorption / OCLL formation
- Surrounding sclerosis
- Avulsions / fragmentation
- Consider ultrasound



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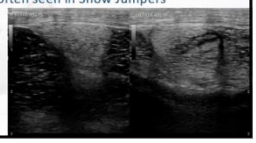
Equine Stifle Radiography

Soft tissue lesions: Patellar ligaments

- Mostly looking for entheseous remodelling or signs of instability on radiographs
- Fragmentation of the distal pole of patella
- Focal remodelling of tibial tuberosity
- Occasionally tibial tuberosity avulsion fracture
- Periligamentous soft tissue swelling / fibrosis
- More often seen in Show Jumpers



Diagnosis and management of acute stifle injury in adult horses

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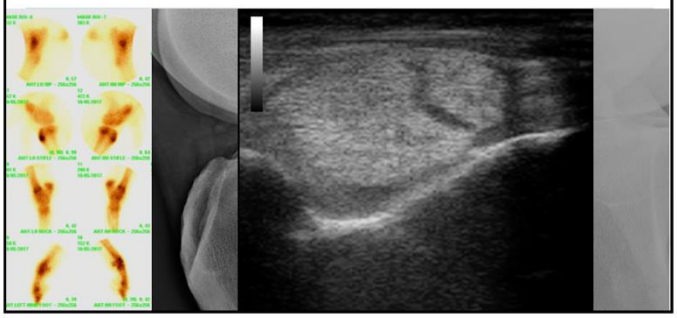
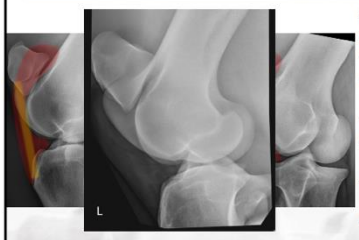
Patellar ligament lesions



Equine Stifle Radiography



Soft tissue lesions: Articular effusion

- Radiographic exposure must allow visibility
- Often seen in juveniles with OCD
- Femoropatellar recesses most readily identifiable
- Synovial sepsis (foals)
- Medial compartment distension not easy to appreciate radiographically (OA)
- Look for concurrent gas (often rises proximally above patella)
- Post diagnostic anaesthesia effects

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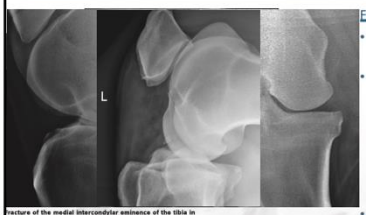
Equine Stifle Radiography



Conservative management of 17 horses with nonarticular fractures of the tibial tuberosity

Fractures

- Distal femoral and tibial diaphyseal fractures are readily identifiable
- Tibial tuberosity fractures easily missed
  - May need to obtain additional projections, shallow oblique angles (CdLCrMO) or add flexed LM (if not too painful)
  - Soft tissue lesions concurrently ↓ prognosis (otherwise 80% +ve)
- Medial intercondylar eminence of tibia (MICET)
  - Fracture often proximal to cranial cruciate attachment

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Equine Stifle Radiography

Osteomyelitis of the Patella in Eight Foals

Patella lesions: Fractures

- Can be missed on standard 3 views
- Must add in CrPrCrDiO ("skyline")
- Often medial pole, sometimes displaced
- Can be proximal margin, or mid body
- Look for wounds – gas, skin surface disruption
- Fragmentation can accompany

Patella lesions: Septic osteitis

- Adults – following wounds
- Foals – haematogenous spread
- Focal – regional osteolysis +/- surrounding sclerosis, occasional sequestra

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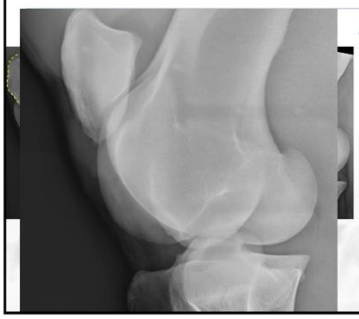
Equine Stifle Radiography



Patellar lesions: Entheseopathy / fragmentation

- Medial patellar ligament desmotomy
- Seen within 3 months
- (likely articular cartilage lesions not visible)
- Can also relate to chronic entheseopathy

Patellar lesions: Subluxation - luxation

- More frequent in miniature breeds (lateral – dysplasia of trochlear ridges)
- Digital palpation often helpful
- Dynamic!

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Equine Stifle Radiography

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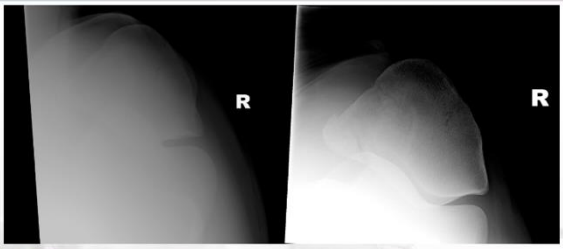
Patellar lesions are easy to miss...



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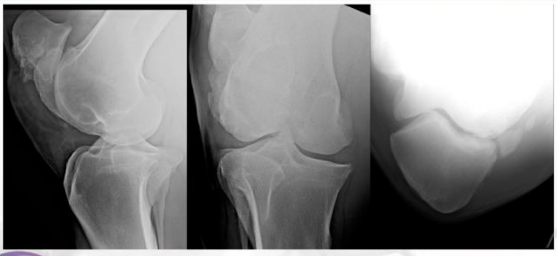
Extensive pathology



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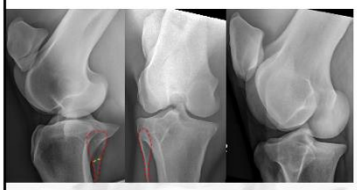
Equine Stifle Radiography



Fibula

- The famed fracture diagnosis
  - Often formed of separate (multiple) ossification centers
- Significant overlap with appearance of actual fractures
  - Palpation
  - Soft tissue swelling
  - Appropriate presenting history / lameness
  - Nuclear scintigraphy

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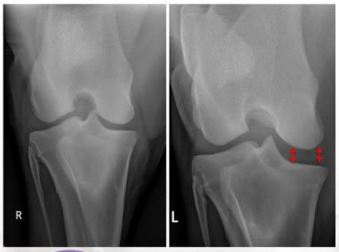
Equine Stifle Radiography



Use of ancillary techniques

- Stressed projections: collateral ligament rupture (acquire NWB)
- Flexed LM: cranial aspect of the intercondylar eminences – cranial meniscotibial ligaments / cruciate ligaments
- Arthrography: contrast media use to demonstrate articular – wound communication

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Calcinosis circumscripta

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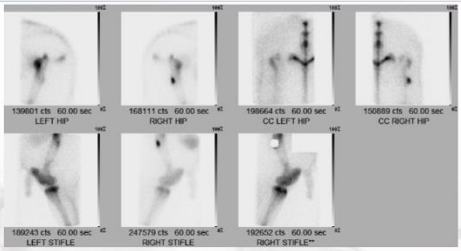
Third trochanter of the femur



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Any questions?

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Pelvis & Hip Joint – Tips, Tricks & Case-Discussions

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American & European Specialist in Equine Sports Medicine & Rehabilitation

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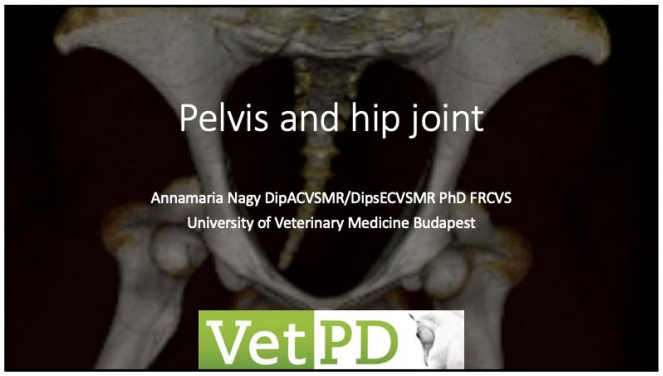


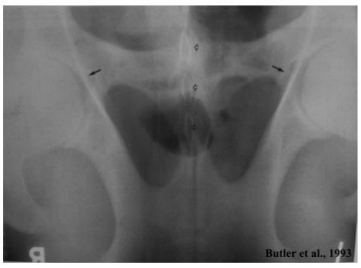
1

Radiography of the pelvis

- Challenging in a mature horse
- Valuable information can be gained in selected cases
  - In a standing horse
  - Sometimes with a portable generator
- Ultrasound is very useful addition in most cases
- Scintigraphy
  - Useful for stress fractures, trauma
  - Otherwise questionable value
- CT can be done

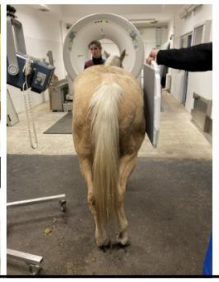
2

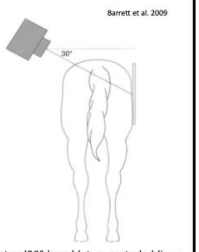
Ventrodorsal view in the standing horse



3

Oblique view in the standing horse





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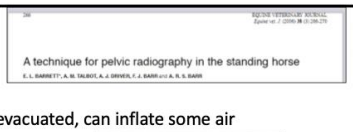
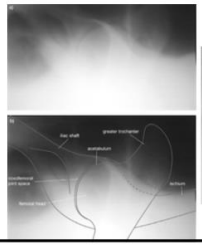
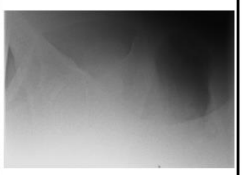


- Rectum evacuated, can inflate some air





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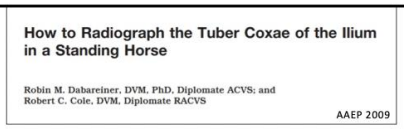
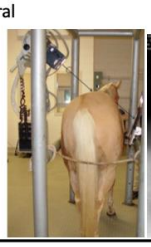


- Left50-dorsal – right ventral



6

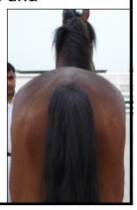
Oblique view in the standing horse

- High output generator
  - Good quality images even in large (600 kg) horses
- Portable generator
  - Ponies
  - Diagnostic information on the position of the head of the femur in ~400-450 kg horses

7

Pelvis case 1

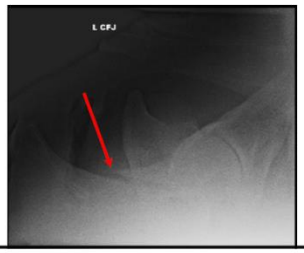
- 8 yo Arabian gelding, history of a fall
- Initially non-weight-bearing LH lameness
- Negative radiographs of the distal limb, no response to up to and including tibial and peroneal nerve blocks
- On admission
  - Moderate LH lameness at the walk
  - Pain over the left gluteal area
  - Pain to abduction and caudal extension of the limb
- Negative scintigraphy



Driver and Nagy EVE 2006

8

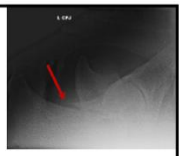
Pelvis case 1

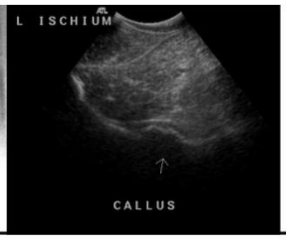


9

Pelvis case 1

- 12 weeks post injury





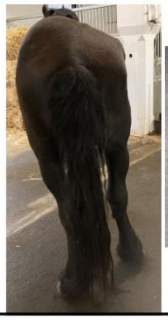
10

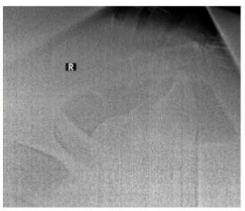
Pelvis case 2

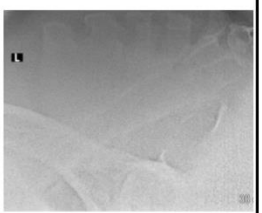
- 12 yo Friesian stallion
- Went lame 3 months ago

11

Pelvis case 2







12

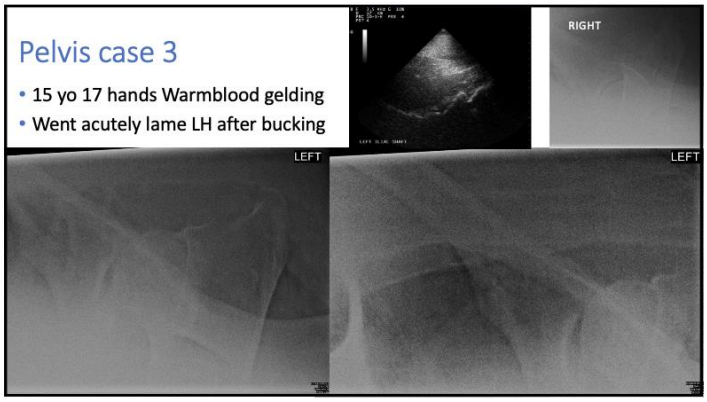
Pelvis case 3

- Hit by a car

13

Pelvis case 3

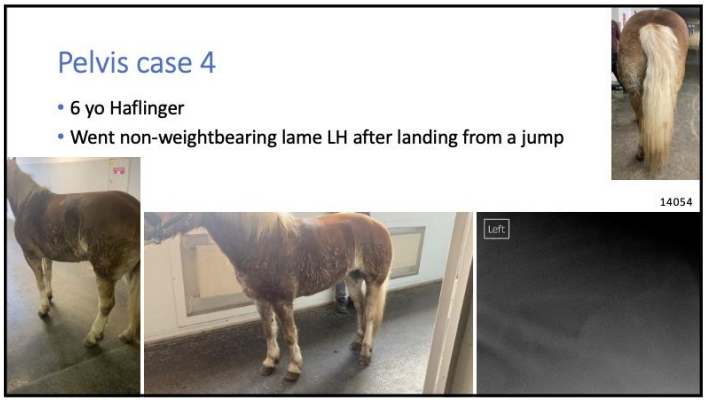
- 15 yo 17 hands Warmblood gelding
- Went acutely lame LH after bucking



14

Pelvis case 4

- 6 yo Haflinger
- Went non-weightbearing lame LH after landing from a jump



15

Pelvis case 5

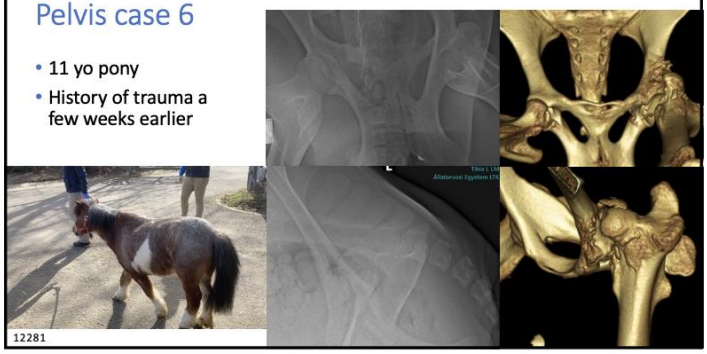
- 2.5 yo Appalosa gelding
- Severe RH lameness of 4 weeks' duration

16

17

Pelvis case 6

- 11 yo pony
- History of trauma a few weeks earlier



18

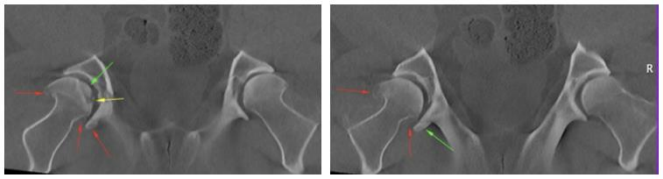
Pelvis case 9

- 15 yo KWPN driving horse
- Moderate LH lameness
  - IA anaesthesia of the stifle: 50% improvement
  - IA anaesthesia of the coxofemoral joint: lameness deteriorated within half an hour
- Radiography and ultrasonography of stifle and coxofemoral joint NAD

13020

25

Pelvis case 9

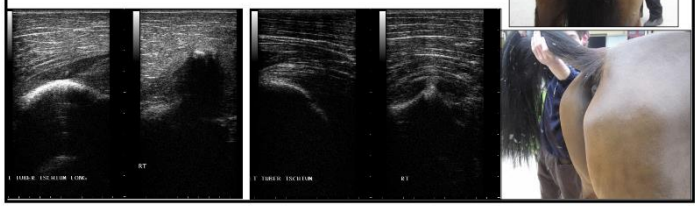


13020

26

Tuber ischii

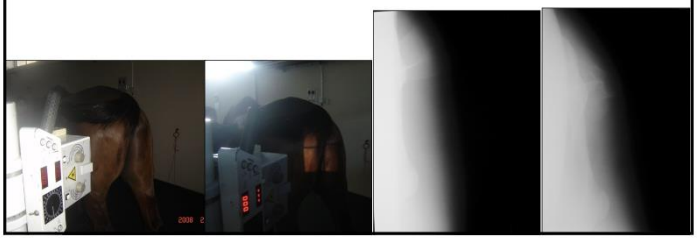
- Easier and quicker to ultrasound
- But can take radiographs



27

Tuber ischii

- Caudomedial–craniolateral oblique view



28

Pelvis case 10

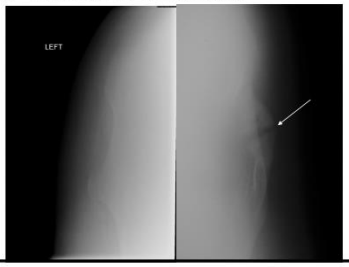
- 23 yo WB mare
- Draining tract at the level of the tuber ischii

13075

29

Third trochanter of the femur

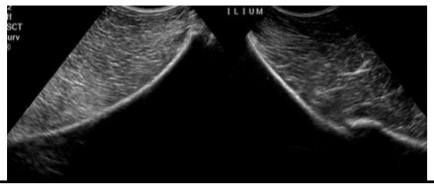
- Caudomedial – craniolateral oblique view



30

Ilial wing

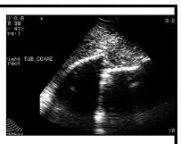
- Stress-related injuries
- History of trauma

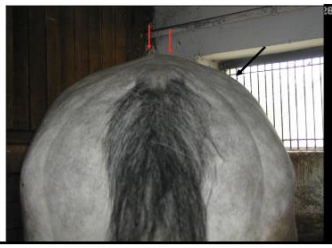


31

Pelvis case 11

- 10 yo gelding, found lame in the stable

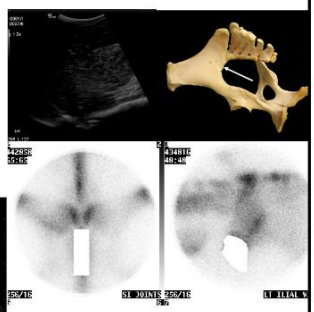




32

Pelvis case 12

- 8 yo National Hunt racehorse
- Recurrent ilial wing stress fracture



33

Take home message

- Imaging the pelvis is fun
- State of the art equipment is ideal
- A lot can be done with a portable generator and ultrasound
  - Be inventive
  - Radiation safety, especially when imaging large horses without a bucky

34

The Neck – Tips, Tricks & Case-Discussions

Jonathon Dixon BVetMed, MVetMed, Dipl.ECVDI, MRCVS
European Specialist in Veterinary Diagnostic Imaging

E-mail: imaging@rainbowequinehospital.co.uk

RAINBOW EQUINE IMAGING VetPD vetPartners

The equine neck – tips, tricks and case discussions

Jonathon Dixon BVetMed MVetMed DipECVDI MRCVS
RCVS & EBVS® European Specialist in Veterinary Diagnostic Imaging

VetPD Hannover February 2023

Why?

VIDEOS

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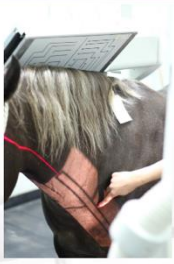
Principles of neck radiography

- Complete study – include all of the relevant anatomy
- Obtain all necessary projections
- Avoid significant obliquity / artefacts / normal variants
- Manage radiation exposure
- Critically assess images - ensure diagnostic
- Perform any required measurements…
- Consider ancillary techniques (contrast media, US, CT)
- **Are there differences between FIELD / HOSPITAL?**



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What needs to be included?

- Laterolateral radiographs from occiput – T1 → Count the bones!
- Dorsal limits of vertebral canal
- Ventral margin around level of trachea → Collimation
- Several **slightly** overlapping projections
- As few radiographs as possible
- Ideally orthogonal projections…
  - Oblique (from **both** sides) → Confirm any findings
  - VD? Lesion orientated views?

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"In the field" tips

- **Emergencies:**
  - Look for "life-threatening" fractures, luxations, disc space collapse **FIRST** which may require immediate intervention. After this, take some time to evaluate carefully **EVERYTHING**
  - **AVOID** satisfaction of search bias
- **Non-emergencies:**
  - Obtain all views, check can count all vertebrae, assess vertebral alignment, APJ size and shape, IVD spaces, surrounding soft tissues, check exposures appropriate
- **Quality:**
  - If not good enough to make the decision you need to make, say so – don't be tempted to 'over / under read' poor quality
  - Refer when needed – maybe for specific views i.e. obliques, or large horses
  - **SEDATE** the horse
- **Reviewing:**
  - Consider briefly **DEFERRING** a clinical decision until can examine the images in a darker room, consult with colleagues, look in a book, seek external opinions
  - Measurements?

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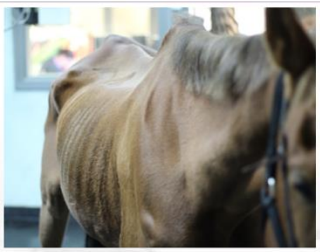
Patient derived limitations - size



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Equipment derived limitations – radiation exposure


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Portable versus gantry generator


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Overall limitation - Underexposure


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Technique limitations – radiation safety

Image courtesy Prof Renate Weller

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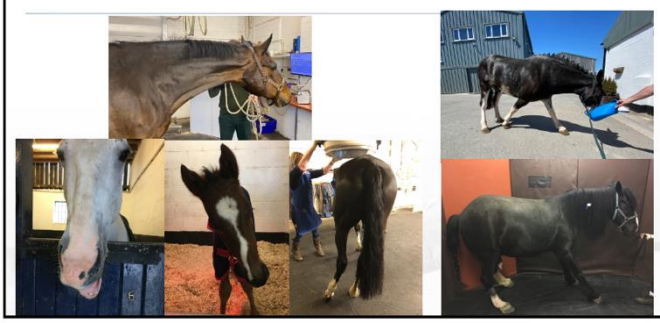
Horse derived limitations – neck positioning



Horse derived limitations - positioning

- Neuro / lameness exam pre-radiography
- Sedate
- Stand square
- Appropriate **PPE** for the team
- Horse holder ensures whole spine aligned straight, head neutral (lead gloves and hold / use head stand), no head tilt
- Rope headcollar ideal (no metal)
- Consider marker use on patient

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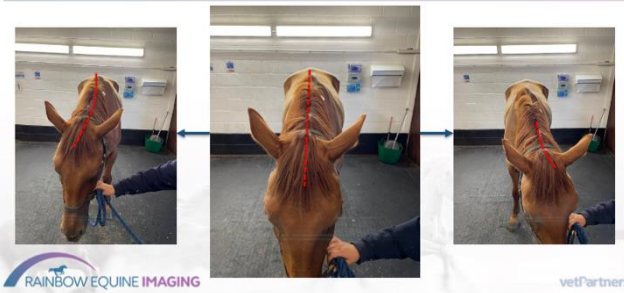
Patient derived limitations - positioning



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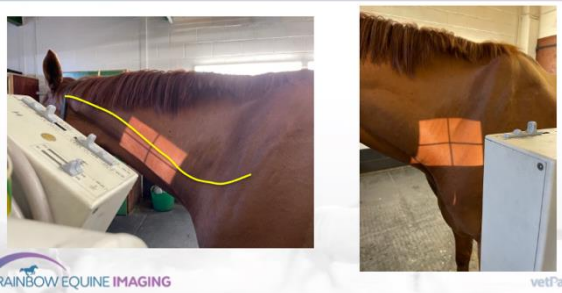
Laterolateral radiographs



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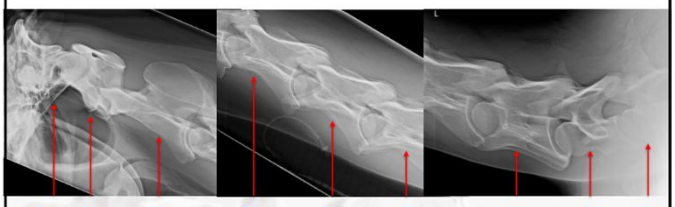
Laterolateral radiographs – the results



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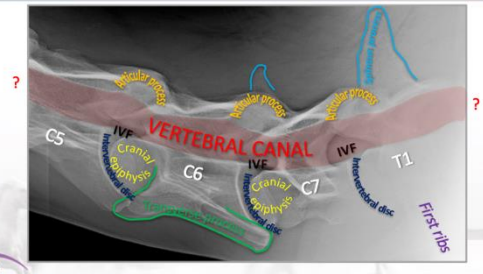
Laterolateral radiograph – anatomy



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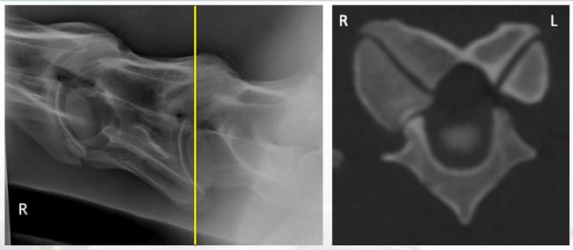
Cannot lateralize lesions readily



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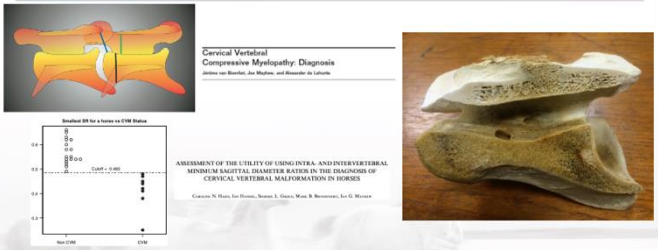
Measurements



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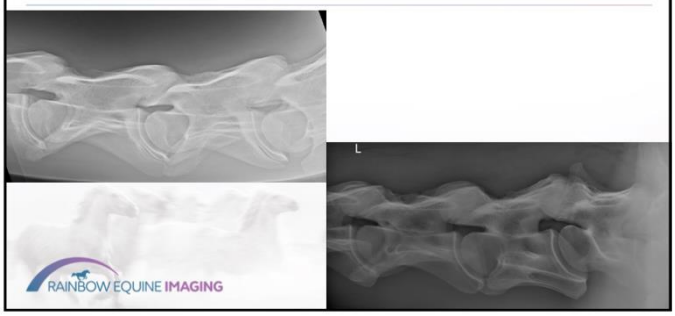
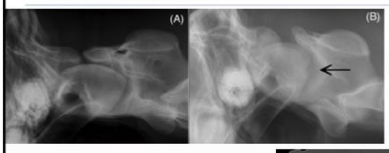
Is it too narrow?



RAINBOW EQUINE IMAGING

Anatomic variations



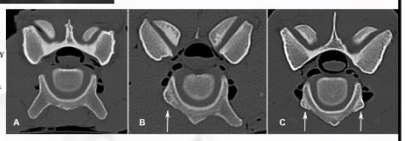
Occipital condyle defects assessed by radiography or CT can be a normal finding in foals

Sophie Elena Sage† | Julien Olive†‡ | Jean-Pierre Lavoie†

>156 days on radiographs
> 550 days on CT

EX VIVO COMPUTED TOMOGRAPHIC EVALUATION OF MORPHOLOGY VARIATIONS IN EQUINE CERVICAL VERTEBRAE

Stefanie Vilka, Wilhelmina Bergmans, Antoon-Jan van den Belt, Ingi Weinberg, Willem Back



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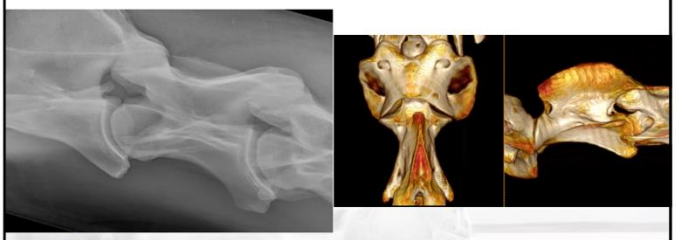
Anatomic variations



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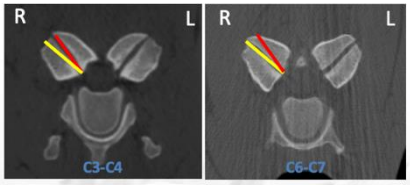
Oblique radiographs

45-55 degrees

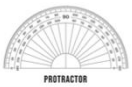
Radiographic anatomy of the articular process joints of the caudal cervical vertebrae in the horse on lateral and oblique projections

RAINBOW EQUINE IMAGING vetPartners

Oblique radiography – angle selection



45-55 degrees



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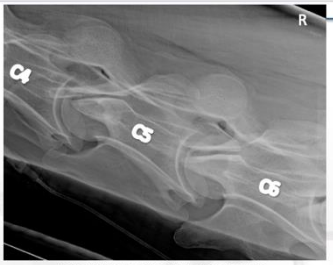
Oblique radiographs - anatomy

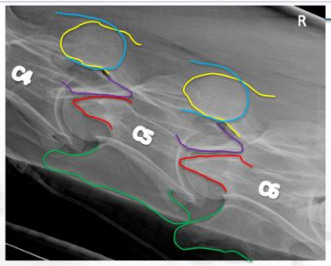


L45-55V-RDO

Radiographic anatomy of the articular process joints of the caudal cervical vertebrae in the horse on lateral and oblique projections

RAINBOW EQUINE IMAGING vetPartners

Oblique radiographs - anatomy



L45-55V-RDO

Cd articular processes L

Cr articular processes L

Cr articular processes R

Cd articular processes R

Transverse processes R

Radiographic anatomy of the articular process joints of the caudal cervical vertebrae in the horse on lateral and oblique projections

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If the angle is incorrect however…

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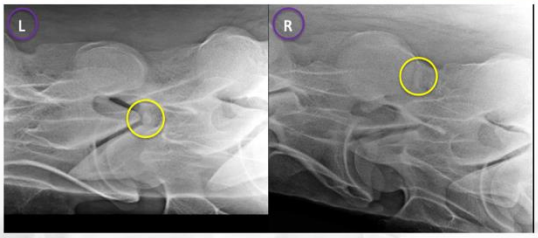
Oblique radiographs – clinical use



Left sided O.F

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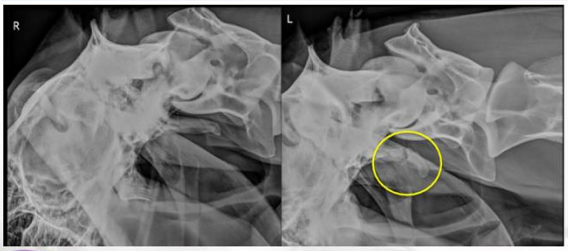
Oblique radiographs – other anatomy



Left sided paracondylar process fracture

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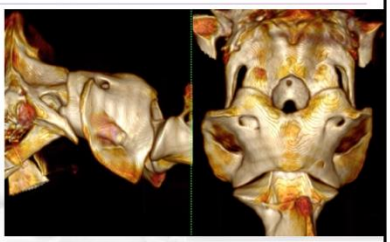
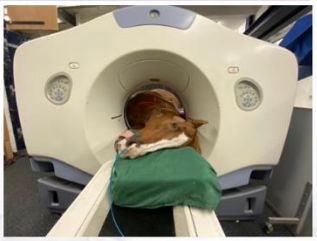
Myelography

VIDEO



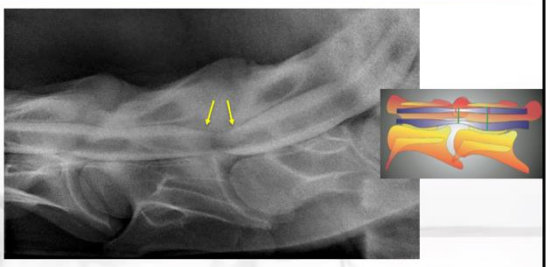
RAINBOW EQUINE IMAGING vetPartners

Myelography



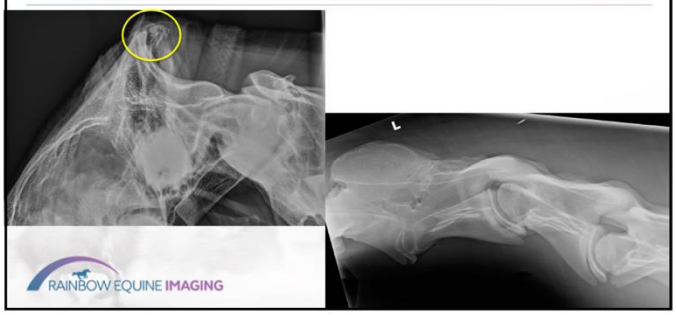
RAINBOW EQUINE IMAGING vetPartners

Myelography



RAINBOW EQUINE IMAGING vetPartners

Rule out the oddities

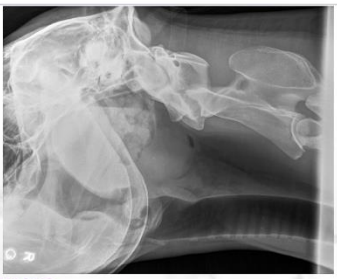


RAINBOW EQUINE IMAGING

Rule out the oddities

RAINBOW EQUINE IMAGING vetPartners

Rule out the oddities



RAINBOW EQUINE IMAGING vetPartners

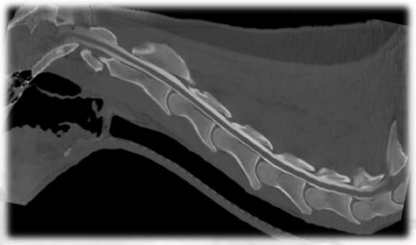
What do we think of these facets?

RAINBOW EQUINE IMAGING vetPartners

What do we think of these facets?

RAINBOW EQUINE IMAGING vetPartners

Cervical CT can help us



RAINBOW EQUINE IMAGING vetPartners

Cervical spine

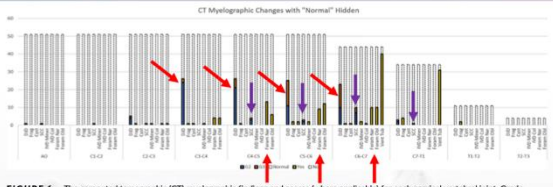


FIGURE 6 The computed tomographic (CT) myelographic findings and scores (where applicable) for each cervical vertebral joint. Grade 0 = normal and grade 1 = mild; these have been combined together and depicted by the dotted line with no in-fill; grade 2 = moderate; grade 3 = marked are depicted by color in-fill. Cyst, cyst within the bone; DJD, degenerative joint disease; Foram Nar, narrowing of the intervertebral foramina; Foram Obl, obliteration of the intervertebral foramina; Frag, fragment of bone; IVD Col, collapse of the intervertebral disc; IVD Miner, mineralization of the intervertebral disc; SCC, spinal cord compression; Vet Tub, presence of the ventral tubercle. The x-axis pertains to the number of horses

RAINBOW EQUINE IMAGING

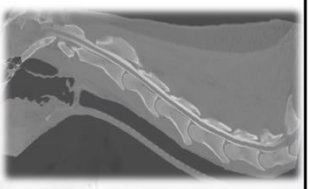
Computed tomographic cervical myelography in horses: Technique and findings in 51 clinical cases

Sarah L. Gough | Jonathan D. C. Anderson | Jonathon J Dixon

vetPartners

Cervical spine – frequent findings

- Osteoarthritis of APJs
- Osteochondral fragments (OF) / osteochondritis (OCD/OC)
- Spinal cord impingement / compression
- Intervertebral foramina impingement
- Fractures
- Congenital / acquired malformations



RAINBOW EQUINE IMAGING vetPartners

Cervical spine

Computed tomographic cervical myelography in horses: Technique and findings in 51 clinical cases

Sarah L. Gough | Jonathan D. C. Anderson | Jonathon J Dixon

- 11/51 = 22%
- 'OCLL' = 8%

Computed tomography and myelography of the equine cervical spine: 180 cases (2013–2018)

C. M. Lindgren, L. Wright, M. Kristoffersen and S. M. Puchalski

- 6.5% (Fragment / fractures)

EVJ-GA-20-166R1

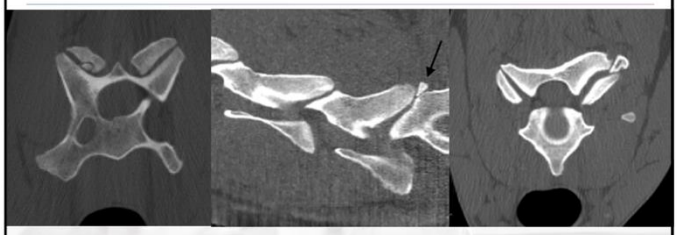
Osteochondral fragmentation of the cervical articular process joints; prevalence in horses undergoing CT for investigation of cervical dysfunction

Rachel Tucker*, Yvonne S. Hall, Thomas K. Hughes and Russel A. Parker

- 13/55 = 24%

RAINBOW EQUINE IMAGING vetPartners

Cervical spine - OF



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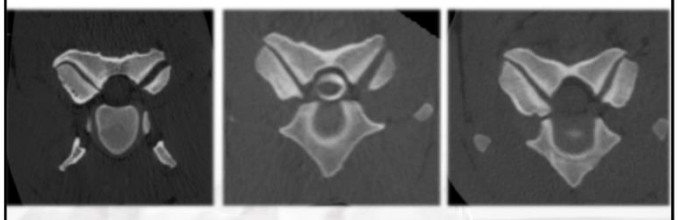
Cervical spine - OA

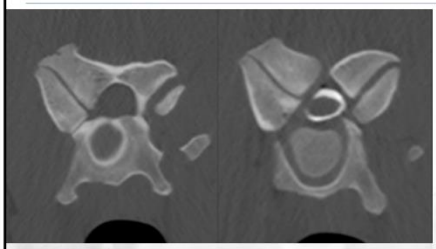


RAINBOW EQUINE IMAGING vetPartners

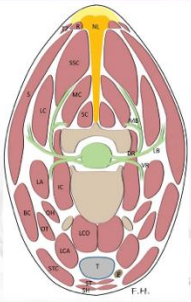
Cervical spine

RAINBOW EQUINE IMAGING vetPartners

Cervical spine

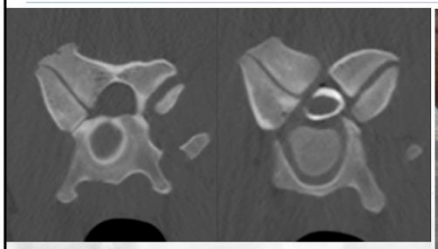


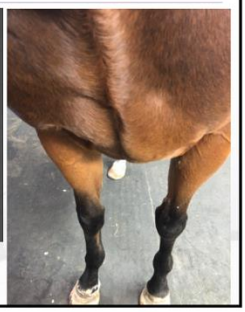
Anatomy and Ultrasound-Guided Injection of the Medial Branch of the Dorsal Ramus of the Cervical Spinal Nerves in the Horse: A Cadaveric Study



RAINBOW EQUINE IMAGING

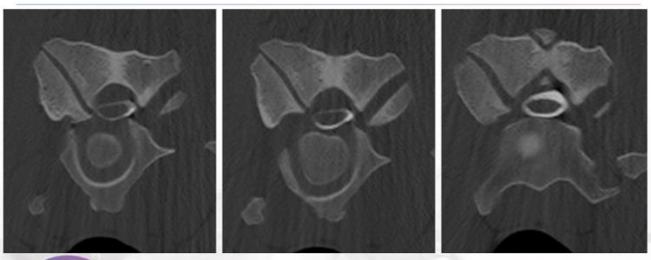
Cervical spine





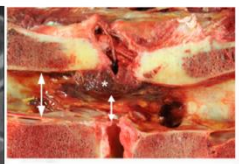
RAINBOW EQUINE IMAGING

Cervical spine



RAINBOW EQUINE IMAGING vetPartners

Cervical spine



CT myelographic diagnosis of ligamentum flavum hypertrophy in a Warmblood Gelding with progressive ataxia

RAINBOW EQUINE IMAGING vetPartners

Case 1 – "Ken"

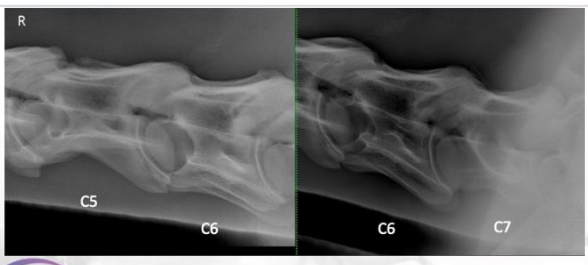
- 5-year-old
- Thoroughbred
- Gelding
- Pertinent history:
  - Multiple limb lameness most evident RF and LH (3/5)
  - Bilateral pectoral atrophy
  - Abnormal head-neck posture, held slightly to the left and extended
  - Abnormal FL postural reflexes with delayed-absent crossing and wide base reflexes, hypermetria on an incline (HL > FL), bilateral weakness on walking tail pull (straight line).
  - Markedly stiff neck, DV and laterally to left and right (30% normal ROM), with muscle spasm

RAINBOW EQUINE IMAGING vetPartners

Case 1

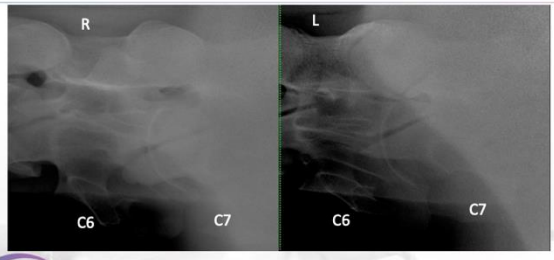
RAINBOW EQUINE IMAGING vetPartners

Case 1



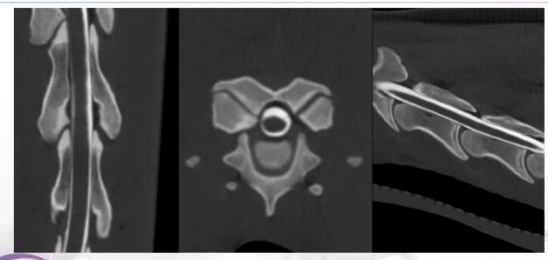
RAINBOW EQUINE IMAGING vetPartners

Case 1



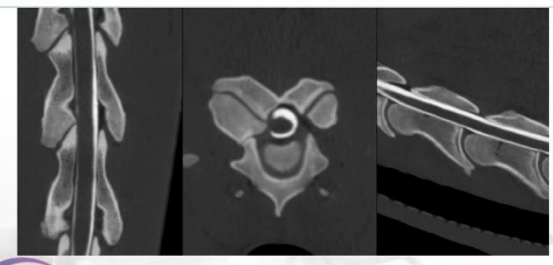
RAINBOW EQUINE IMAGING vetPartners

Case 1 – C3-C4



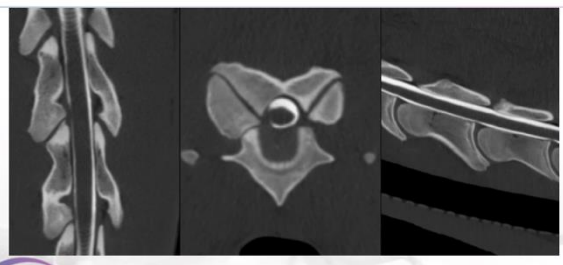
RAINBOW EQUINE IMAGING vetPartners

Case 1 – C4-C5



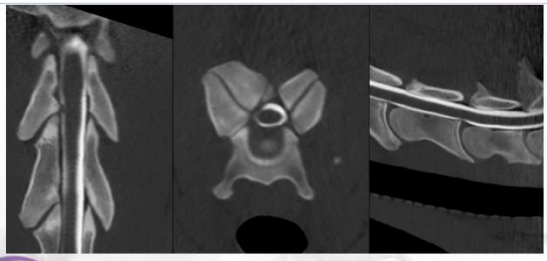
RAINBOW EQUINE IMAGING vetPartners

Case 1 – C5-C6



RAINBOW EQUINE IMAGING vetPartners

Case 1 – C6-C7



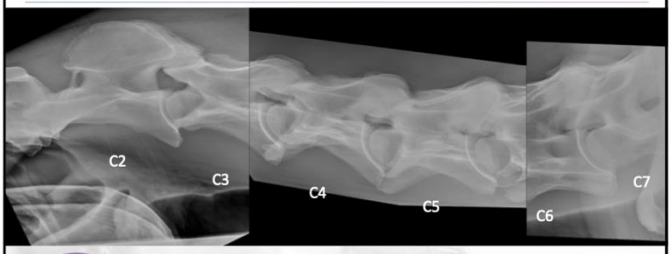
RAINBOW EQUINE IMAGING vetPartners

Case 2 – "El"

- 10-year-old
- Warmblood
- Mare
- Pertinent present complaints:
  - Returned from competition 9d previously, not quite right, seemed lame HLs, ref vet did not see any lameness. Bloods – elevated inflammatory markers → antibiotics
  - Found in stable staggering, almost falling over, acute onset.
  - EHV negative.
  - Neuro exam – no cranial nerve deficits, clear grade 3/5 FL and HL ataxia, initially stabilized with medical treatment (NSAIDS, Vit E), tail pull weaker to R > L.
  - Standing US guided CSF tap obtained (C1-C2) mild elevated lactate, otherwise WNL

RAINBOW EQUINE IMAGING vetPartners

Case 2

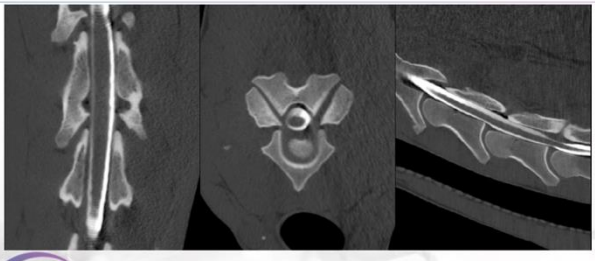


RAINBOW EQUINE IMAGING vetPartners

Case 2 – C3-C4

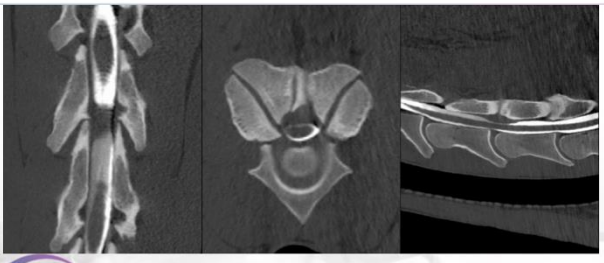
RAINBOW EQUINE IMAGING vetPartners

Case 2 – C4-C5



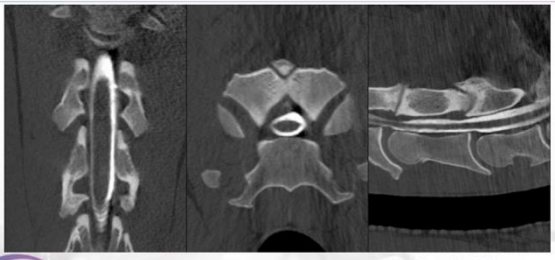
RAINBOW EQUINE IMAGING vetPartners

Case 2 – C5-C6



RAINBOW EQUINE IMAGING vetPartners

Case 2 – C6-C7



RAINBOW EQUINE IMAGING

Right of midline

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Case 2 – C6-C7

RAINBOW EQUINE IMAGING

Midline

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Any questions?

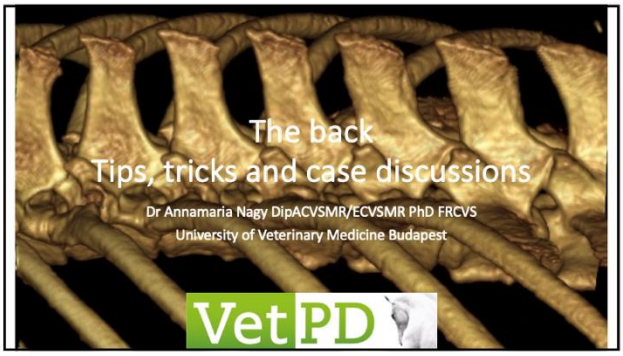
RAINBOW EQUINE IMAGING

vetPartners

The Back – Tips, Tricks & Case-Discussions

Annamaria Nagy PhD, Dipl.ACVSMR, Dipl.ECVSMR,
American & European Specialist in Equine Sports Medicine & Rehabilitation

E-mail: nagy.annamaria@univet.hu



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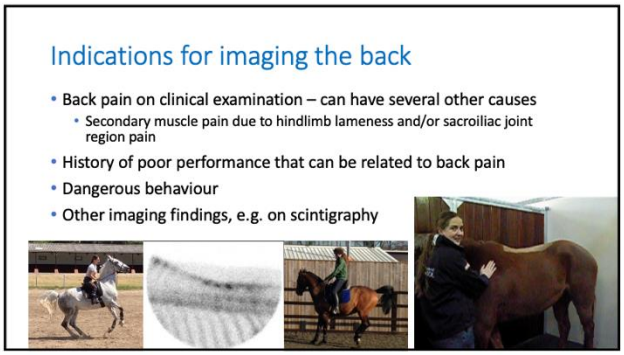

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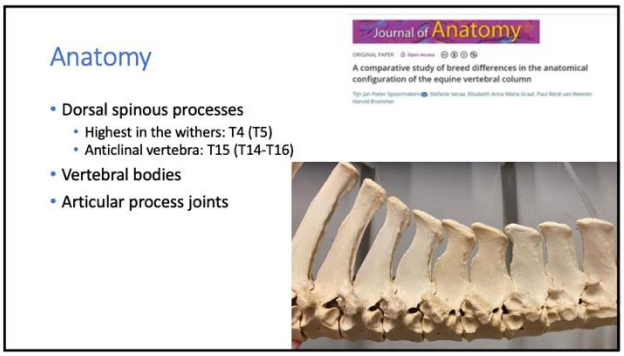

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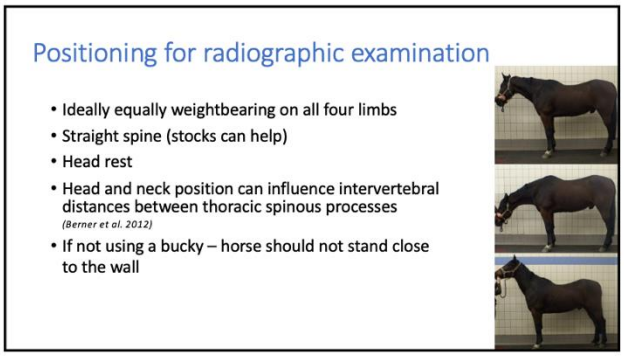

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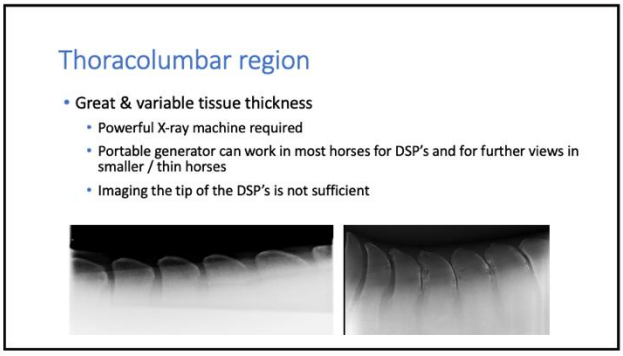

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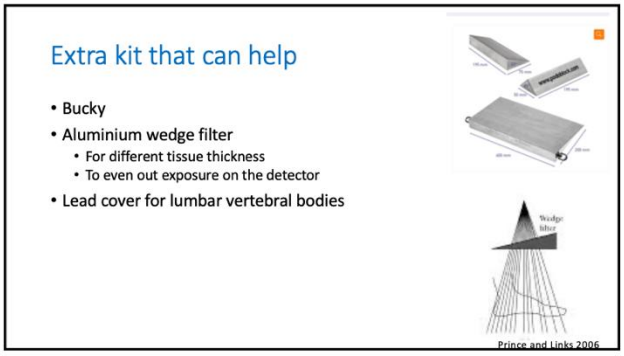


6

Thoracolumbar region

- Radiation safety
  - High exposures
  - Cassette should not be hand-held
  - If possible, use the exposure button (on a cable or in the viewing room)

7

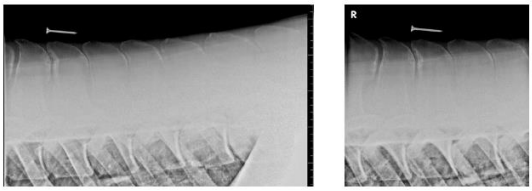
Thoracolumbar region

- Comprehensive evaluation – 9-11 images
- To include
  - Dorsal spinous processes (DSP's) – latero-lateral images
  - Vertebral bodies - latero-lateral images
  - Articular process (facet) joints (APJ's) – ventral to dorsal oblique views

8

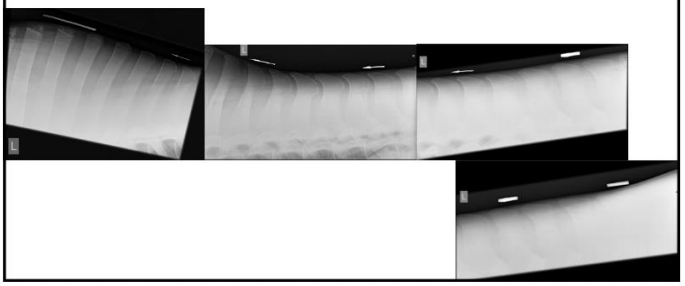
Impinging dorsal spinous processes

- A more collimated view might help
- Especially if not working with a high output generator



9

Dorsal spinous processes



10

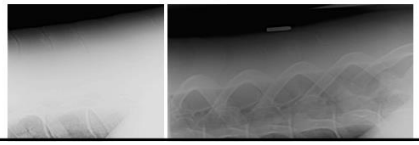
Impinging dorsal spinous processes

- Intervertebral distance
  - No clear cut off for normal distance between DSP's
- Osseous reaction (lytic and/or sclerotic lesions)

11

Impinging dorsal spinous processes

- Can be seen in horses without back pain
- Diagnostic analgesia crucial to establish significance
- The more severe changes & the greater number of DSP's involved, the more likely to be significant *(Zimmermann et al. 2012)*
  - Greatest likelihood of clinical signs if concurrent APJ OA present



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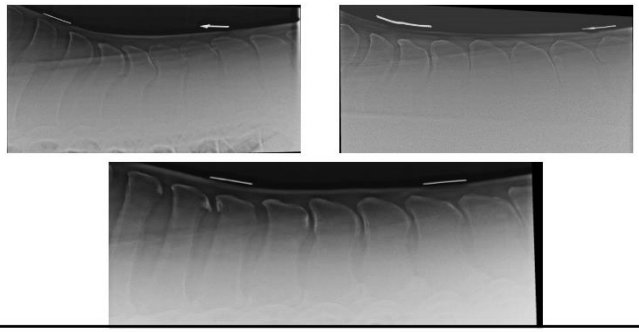
Impinging dorsal spinous processes



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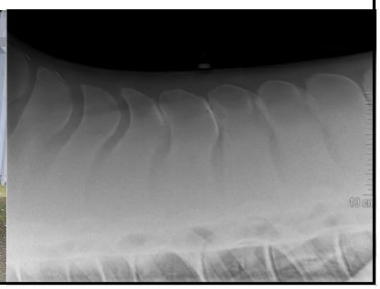
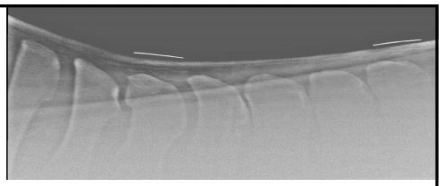
Impinging dorsal spinous processes



14

Case 1



15

After diagnostic anaesthesia

16

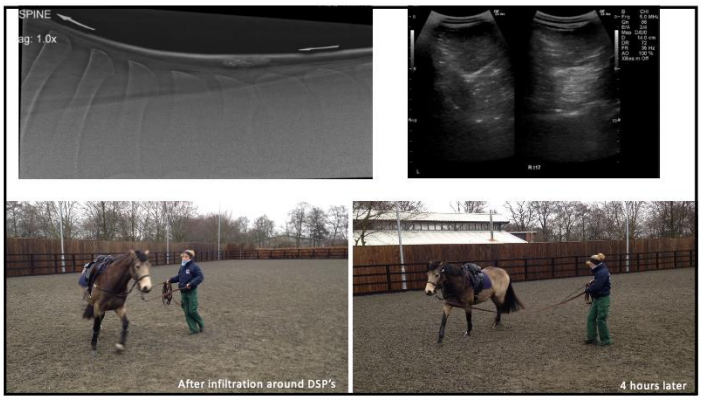
Case 2

- 5 yo Connemara cross
- Dangerous to mount

17

With weighted saddle

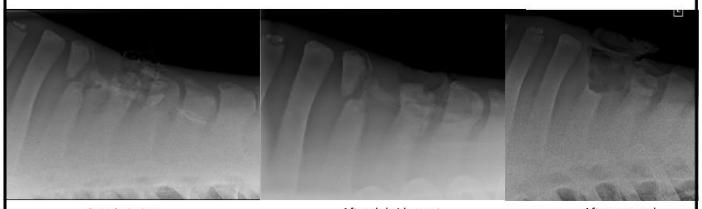
18



19

Case 3 - Traumatic injury

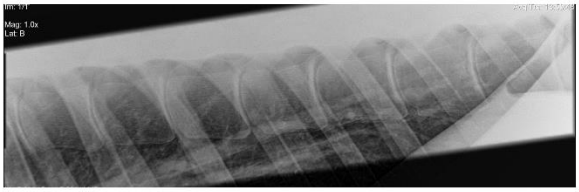
- Draining wound, injury 3 weeks earlier



20

21

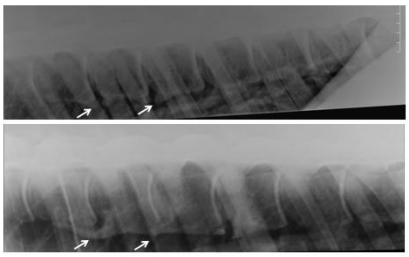
Thoracic vertebral bodies



22

Vertebral bodies

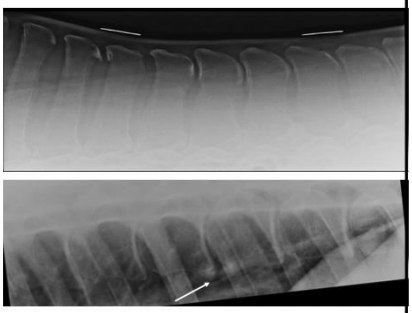
- Spondylosis
  - Difficult to assess clinical significance



23

Case 4

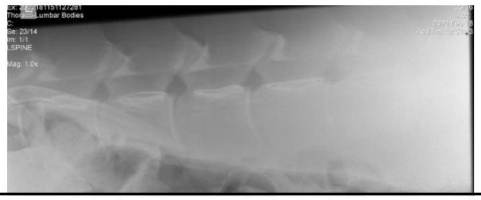
- 12 yo pony
- Stiff gait, poor hindlimb impulsion
- No response to diagnostic anaesthesia



24

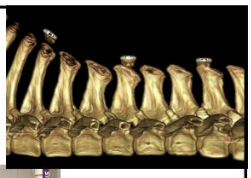
Lumbar vertebral bodies

- Also to assess lumbar APJ's
  - Oblique view not possible
  - Ultrasound easier and no radiation



25

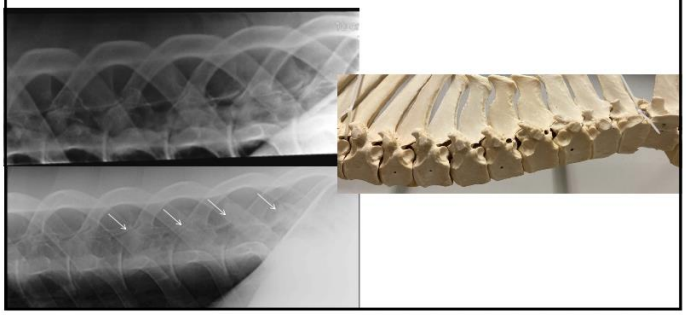
Articular process (facet) joints



Right20Ventral-LeftDorsal

26

Articular process (facet) joints



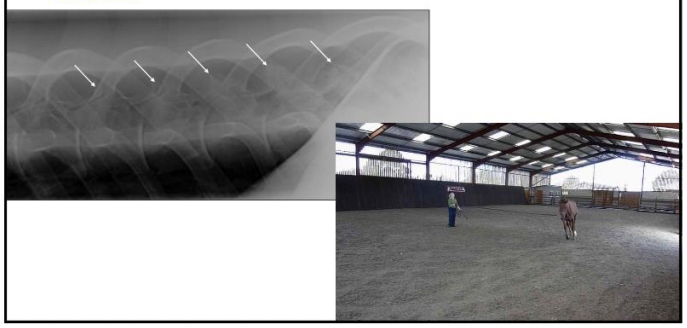
27

Case 5

- 7 yo Irish Sports Horse mare
- History of rushing in canter
- Poor HL impulsion
- No change to subtarsal blocks
- SI joint region blocks:
  - Moved more freely but still disunited

28

Case 5



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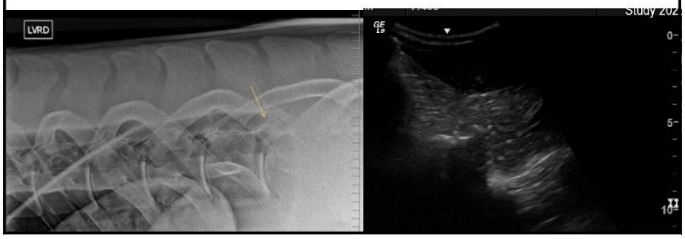
Case 6

- 8 yo Warmblood, stiff to the left, does not react to left leg



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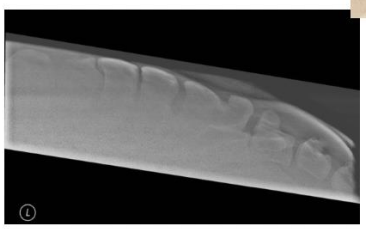
Sacrum



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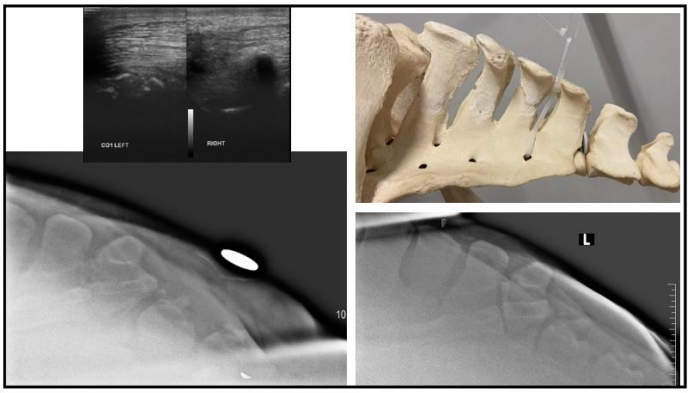
Case 7

- 14 yo Furioso mare
- History of falling, reduced tail tone

32



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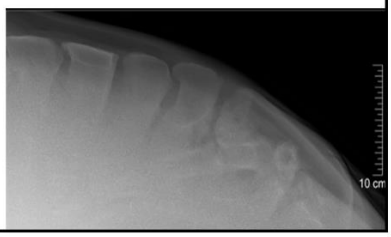
Case 8

- History of fall
- Placid tail



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Take home message

- With the equipment and settings the thoracic vertebrae can be comprehensively radiographed in most horses
- Lumbar vertebrae more challenging
- Radiation safety
- Ultrasound can be a very useful addition

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Prepurchase Examination – To buy or not to buy?

Henk van der Veen DVM, Cert.ISELP
Lingehoeve Diergeneeskunde, The Netherlands

E-mail: hveen@delingehoeve.nl

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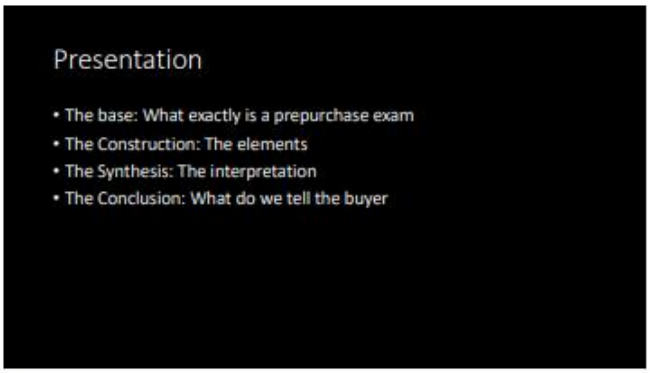

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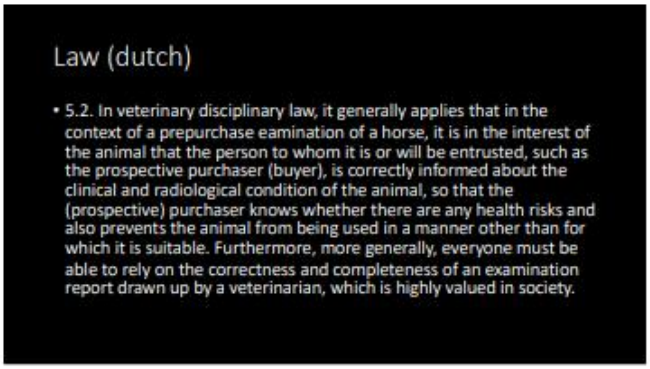

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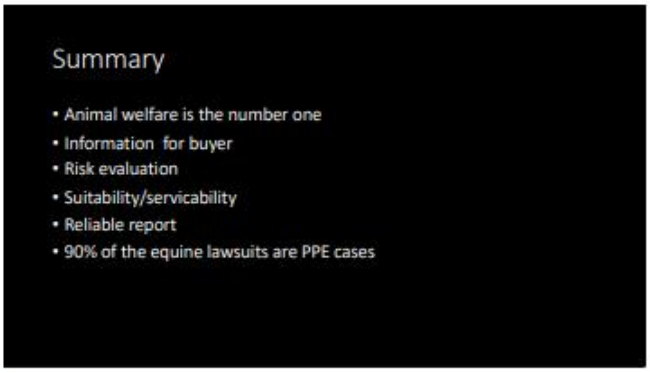

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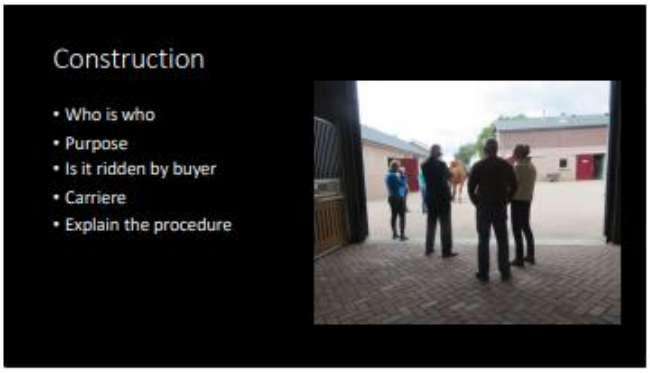

6

Ridden

- Not usual in the Netherlands
- Common in other countries
- Riding is purpose of the horse
- Who is the rider
  - Seller
  - Buyer
  - Rider from clinic
- Not everywhere possible
- Good clinical evaluation has good correlation with riding (exept cranial neck issues)

7

Case One

- KWPN black gelding
- V. Toto Junior
- Promising dressage horse
- PPE 4 months before: positive
- Purpose: High level dressage
- Price: expensive

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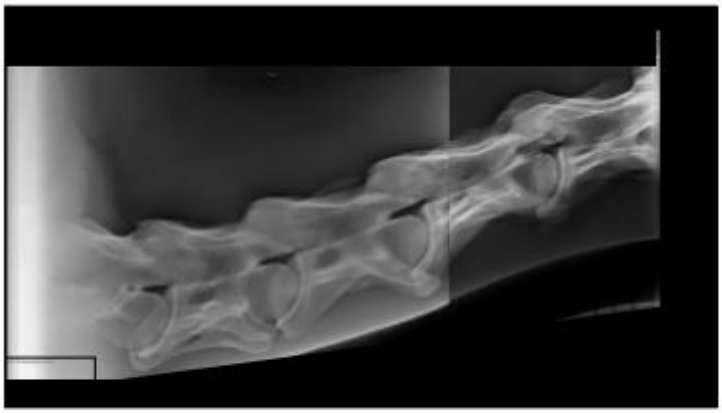

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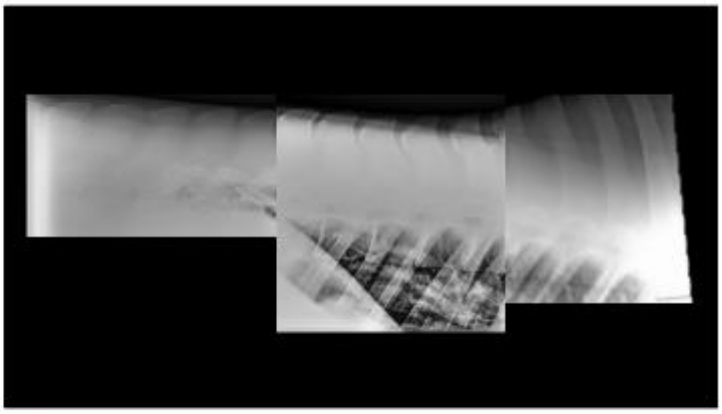

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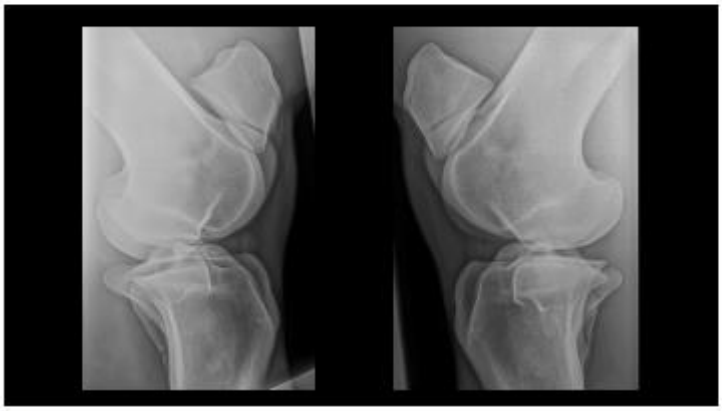

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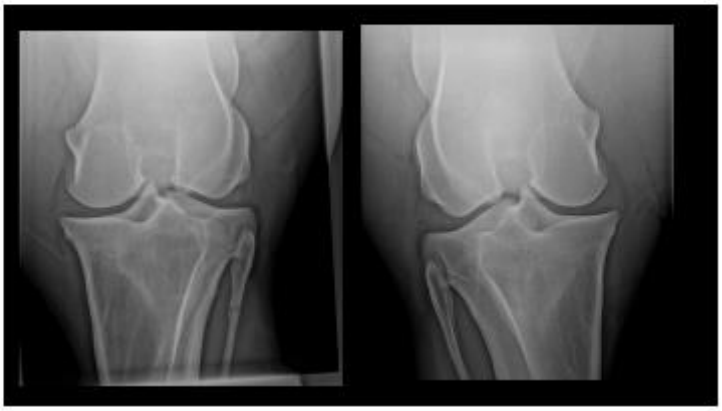

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Synthesis

- Right turn less lateroflexion the left turn
- Canter change on both sides
- Right canter less propulsion
- What is your advice:
  - Pass
  - Fail
- Further examination

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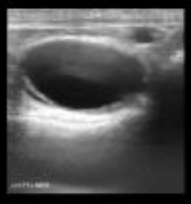
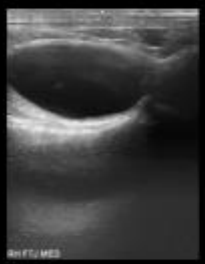
Ultrasound





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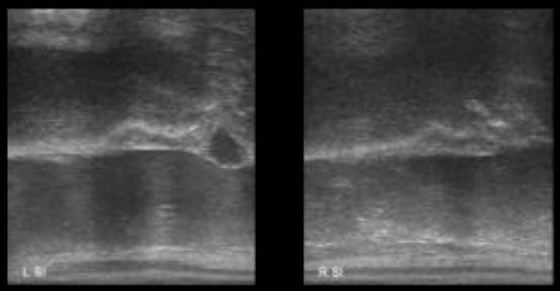
Transrectal Ultrasound



19

Conclusion

- Based on clinical and ultrasonografical finding is there an mild increased risk problems related with the SI region.
- Management & training is important to influence those risks

- Buyer bought the horse and is happy with it for now 1,5 year.

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Synthesis: evalution

- Clinical
- Radiographs
- Ultrasound

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Clinical

- How much lack of lateroflexion is acceptable
- How much lack of lumbosacral flexion is acceptable
- Abnormal Gait
- Stride lengths
- Asymmetric strides
- Balance in young horses
- Changing Canter

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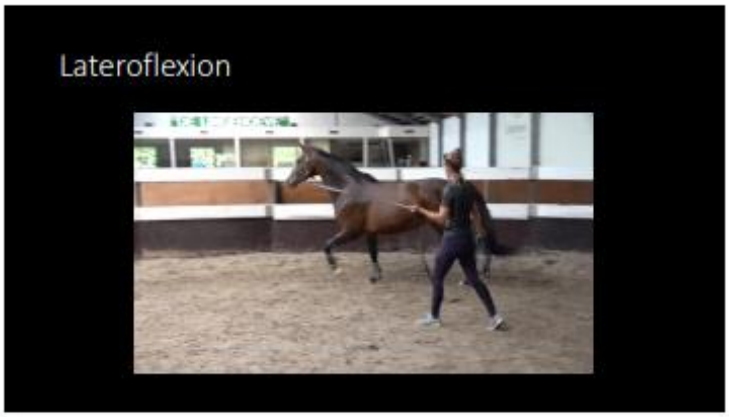
Lateroflexion

23

Lateroflexion

24



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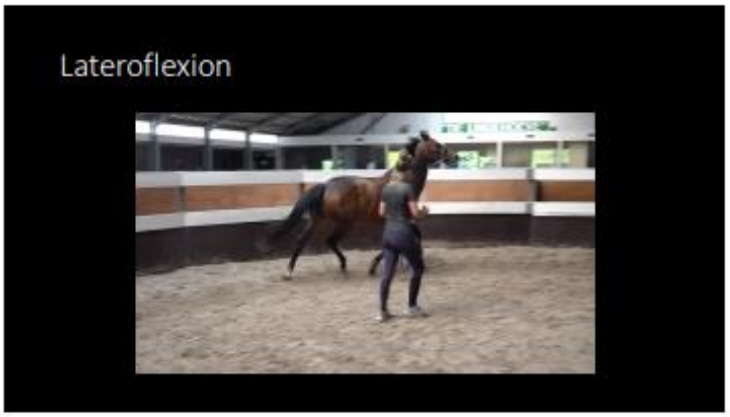

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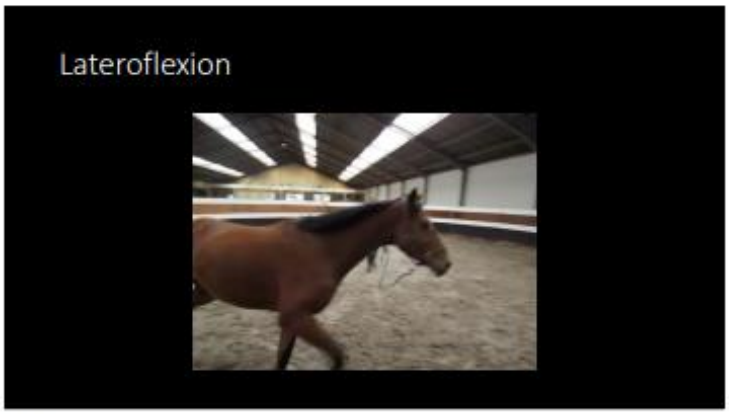

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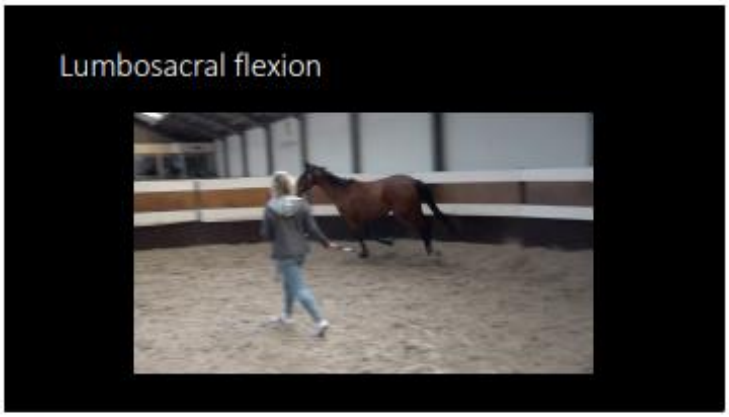

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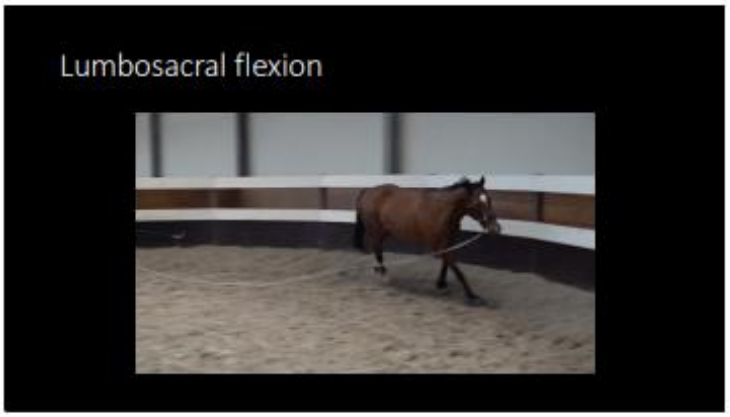

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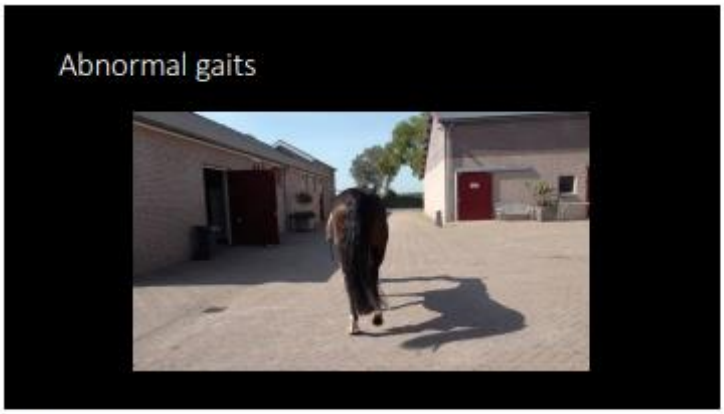

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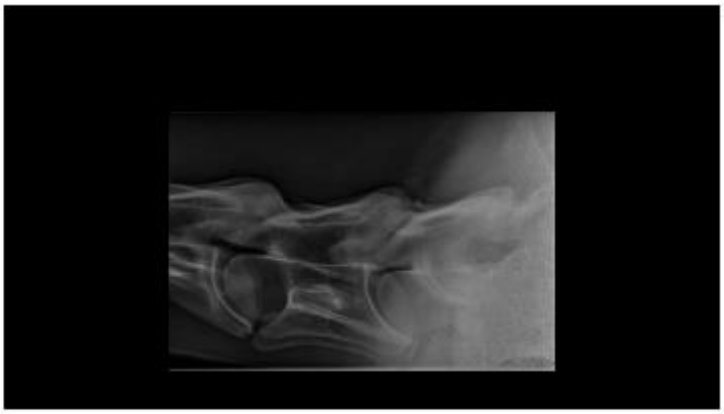

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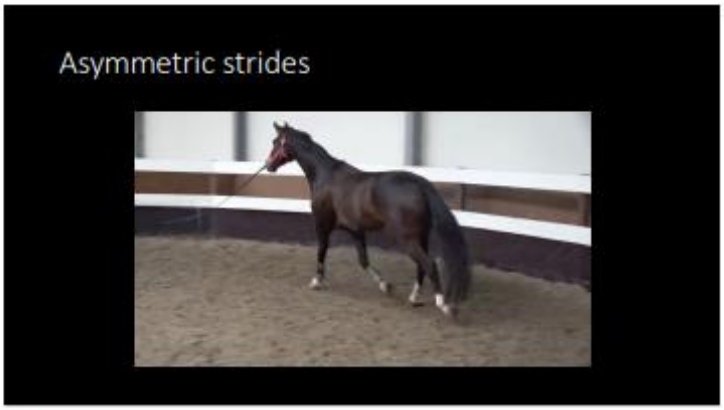

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Balance

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Changing Canter

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Radiographs

- Occiput
- C5-7
- Back
- Fragments

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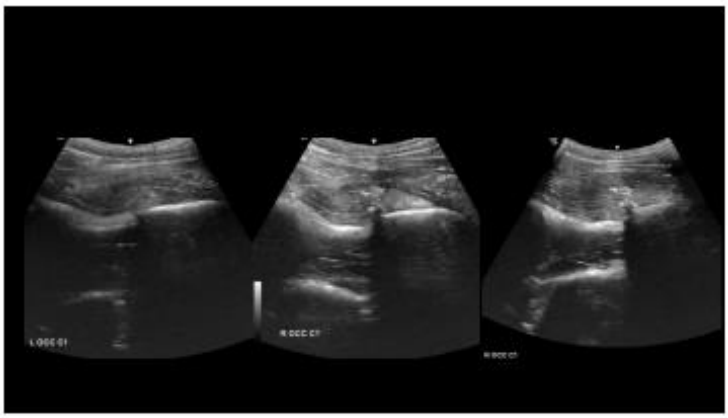

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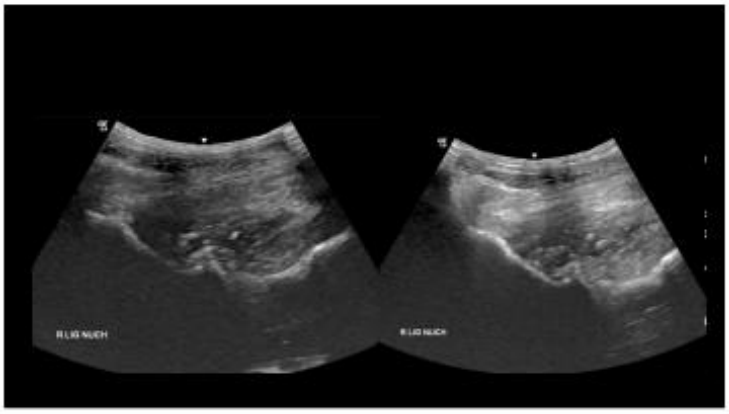

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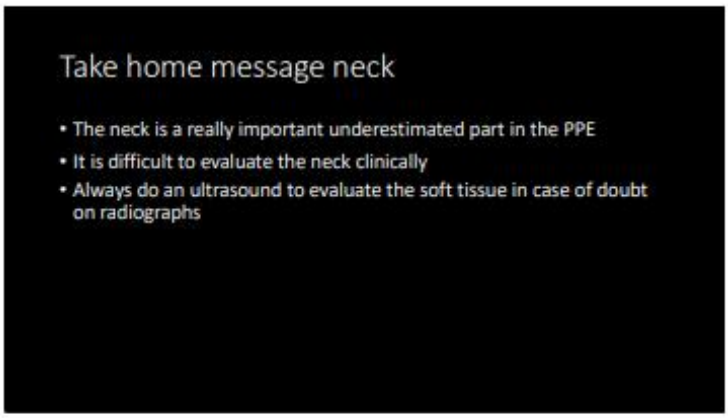

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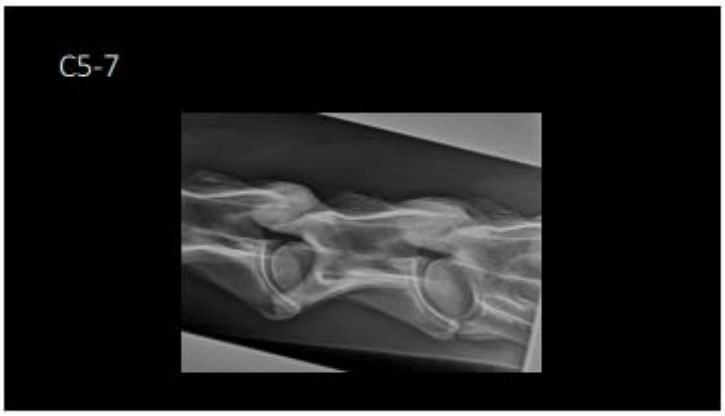

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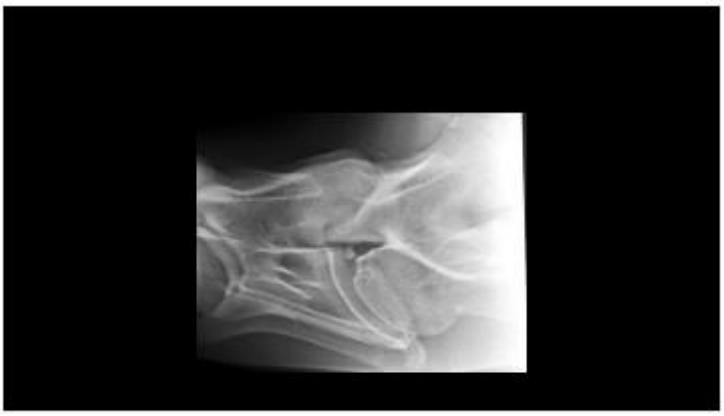

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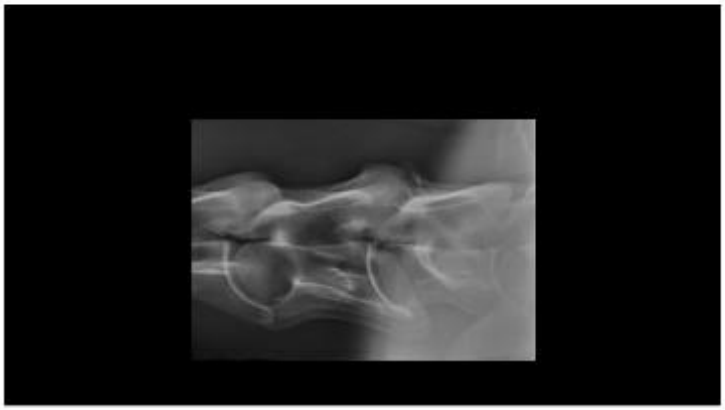

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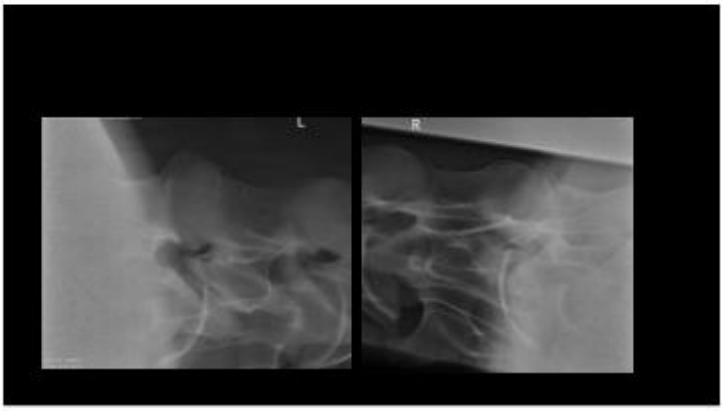

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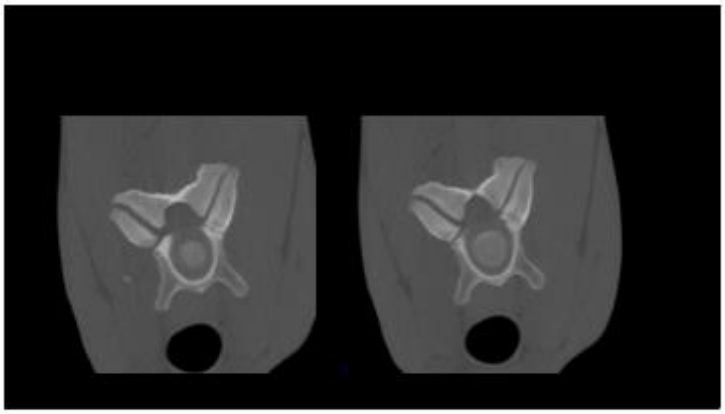

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ECVM

- Equine Complex Vertebral Malformation.
  - Transposition ventrocaudal tubercle of C6 tot C7
  - Hypertophy Facet
  - Step in the dorsal enlinement of the C6 and C7 vertebra (incongruent)
  - Arhrosis
  - Fragments Costovertebral joint
  - Absent or not fully developed rib

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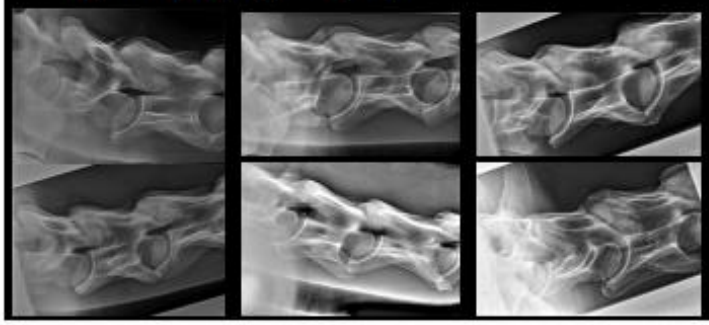
Hypertrophy/Hypotrophy



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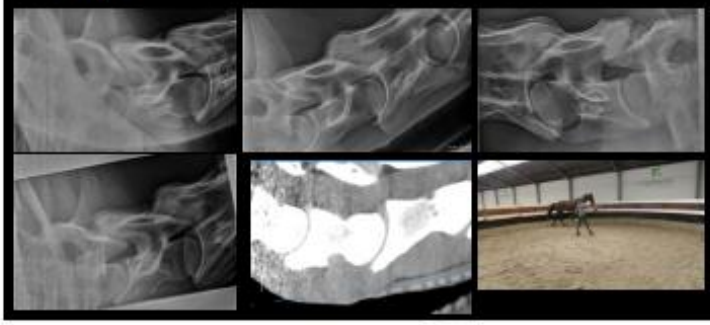
Step



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Ribs

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Take home message ECVM

- Accept that we don't know al the clinical consequenses
- There are a lot of variations and with a different impact on the clinical signs
- Tel the buyer your idea about the findings on radiographs and tell them about the discussion

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Back

- Spinous processes
- Vertebral
- Facet joints
- (costovertebral joints)
- (ribs)
- (thoracal facet joints)

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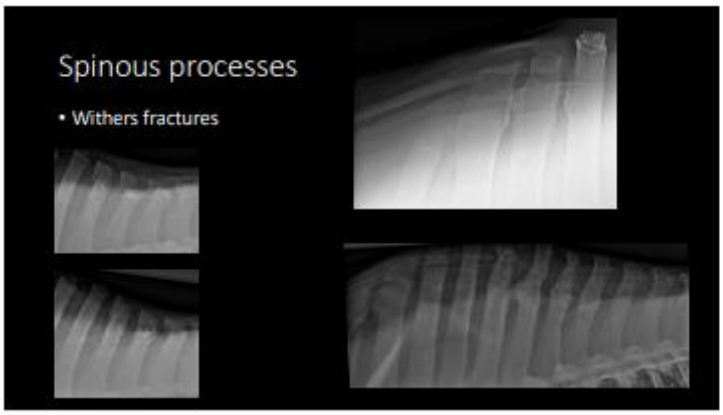

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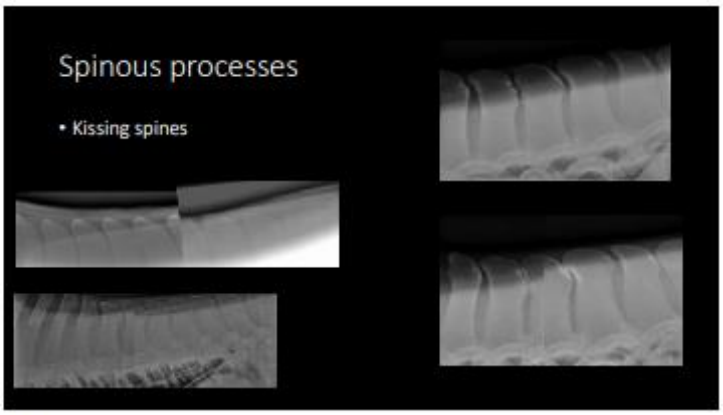

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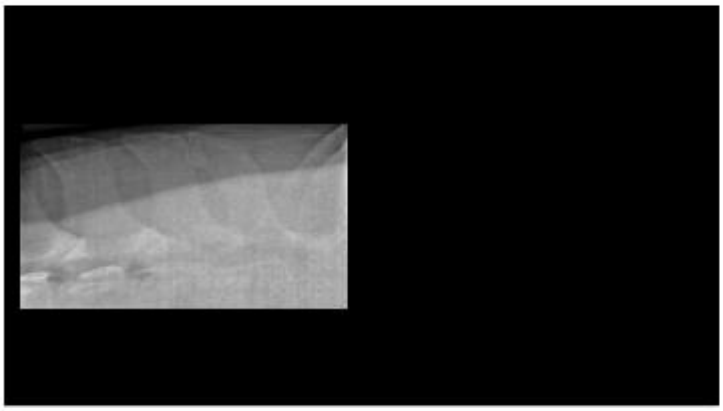

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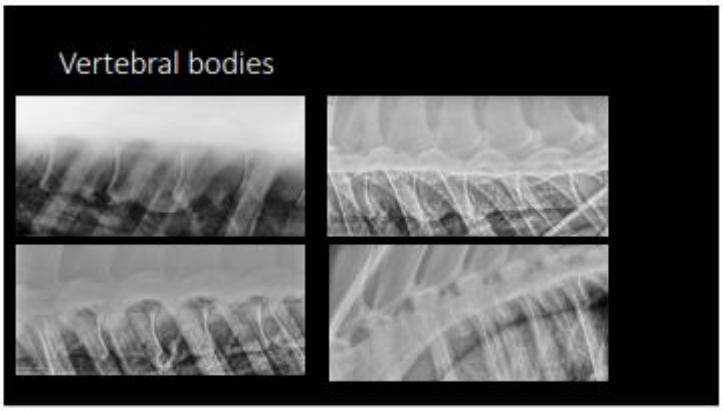

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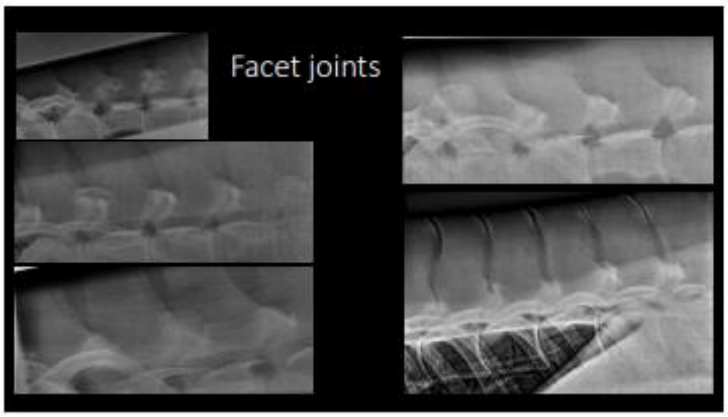

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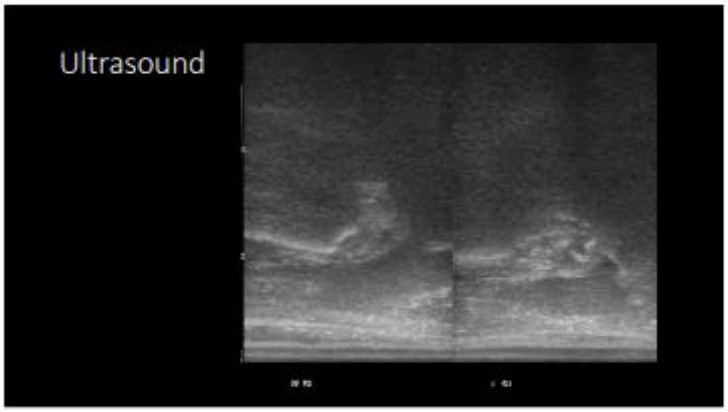

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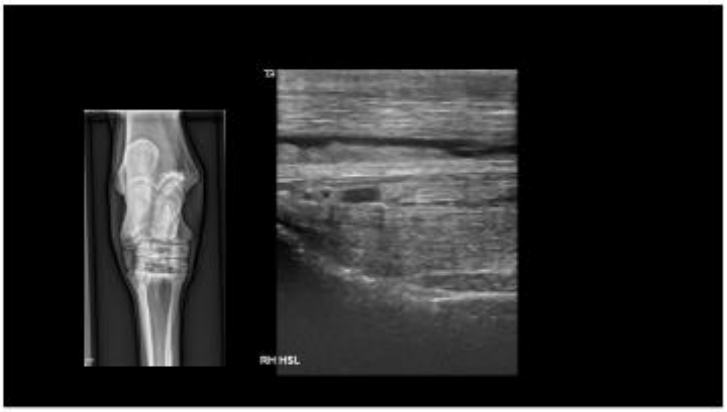

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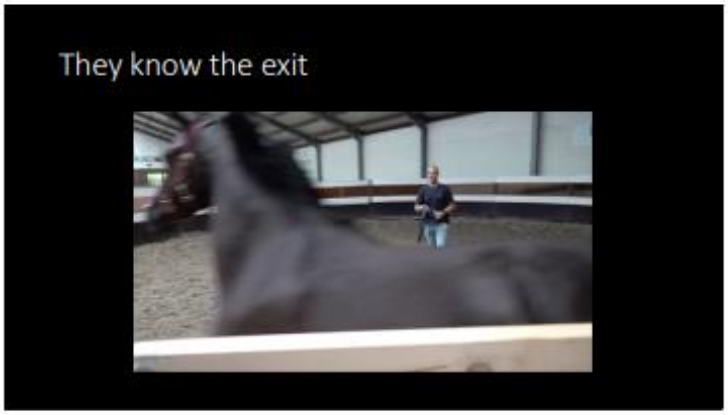

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Conclusion

- Only describe what you have looked at (back or kissing spines)
- Write down everything that does not fit into a "normal" appearance even if there is, in your opinion, no clinical significance. That is a prove that you have seen it.
- Be critical on the clinical part
- Think biomechanical when there is a abnormal finding
- Be honest, let someone else do the PPE if you know to much of the horse

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Take home messages

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