



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2014

Veterinary Radiology Paper 1

Perusal time: **Twenty (20)** minutes

Time allowed: **Three (3)** hours after perusal

Section A: Answer **ALL FOUR (4)** questions

Section B: Answer **ALL TWELVE (12)** questions

Section A: Answer **FOUR** essay-style questions each worth 30 marks..... total 120 marks

Section B: Answer **TWELVE** short-answer questions each worth 5 marks.....total 60 marks

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Paper 1: Veterinary Radiology

Section A: Answer ALL four (4) essay-style questions

1. With respect to a 1.5 Tesla magnetic resonance imaging scanner:
 - a) Describe in order the steps that occur during the acquisition of a single image slice for a two-dimensional spin-echo sequence. Include in your answer an explanation of the physical principles involved in **each** step of the acquisition and image localisation process. (26 marks)
 - b) Give examples of suitable timing parameters for T1 weighted and T2 weighted spin-echo images. (4 marks)

2. Answer **all** parts of this question:
 - a) Define image spatial resolution and explain how image spatial resolution is affected by signal-to-noise ratio. (6 marks)
 - b) For **each** of the following diagnostic imaging techniques list **twelve (12)** equipment and patient factors that affect image spatial resolution and signal-to-noise ratio and for **each** factor describe how spatial resolution and signal-to-noise ratio are affected:
 - i. two-dimensional magnetic resonance imaging (12 marks)
 - ii. planar gamma camera scintigraphy. (12 marks)

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3. Define and describe the appearance of the following computed tomography (CT) artefacts. Give **two (2)** methods by which **each** of these artefacts might be avoided or managed in a clinical setting:
- a) beam hardening (7.5 marks)
 - b) image noise (7.5 marks)
 - c) patient motion (7.5 marks)
 - d) stair step reconstruction artefact. (7.5 marks)
4. Discuss the role of phosphors and describe how they are used in screen-film, computed radiography (CR) and digital radiography (DR) (charge-coupled device (CCD) and flat-panel) imaging technologies.
- Include in your answer the specific chemical makeup of phosphors used in the above imaging modalities, how they have changed in chemical makeup over time, why phosphors are used **and** how the use of phosphors affects patient radiation dose and spatial resolution. (30 marks)

Section B starts on the next page

Section B: Answer ALL twelve (12) short-answer questions

1. Answer **all** parts of this question:
 - a) Briefly compare the chemistry of ionic and non-ionic iodinated contrast agents. *(3 marks)*
 - b) List any **two (2)** adverse reactions that can occur after giving intravenous contrast media. *(1 marks)*
 - c) List any **two (2)** contra-indications for administering non-ionic intravenous contrast media to a patient. *(1 mark)*

2. With respect to an x-ray beam:
 - a) Define attenuation. *(1 mark)*
 - b) List the **four (4)** factors that determine the degree of attenuation of an x-ray beam as it passes through matter. *(2 marks)*
 - c) Explain the term 'k-edge'. *(2 marks)*

3. With respect to scatter radiation when taking a radiograph of the abdomen of a 40 kg dog using a digital radiology system describe the physical processes that result in scatter radiation. *(5 marks)*

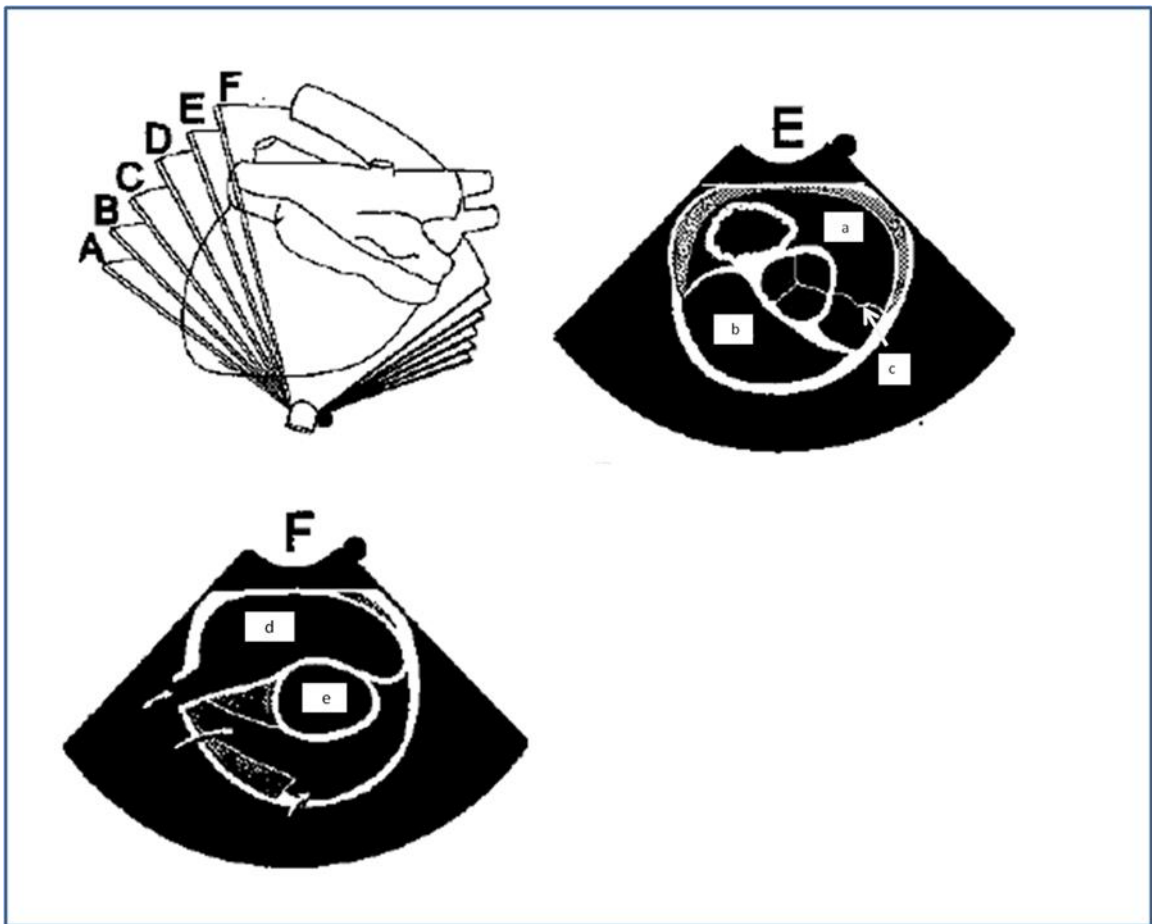
4. Describe the appearance of the 'magic angle artefact' in magnetic resonance images **and** under what conditions this artefact occurs. Include in your answer which fast-spin echo sequences are most and least sensitive to this artefact. *(5 marks)*

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5. Identify and describe **five (5)** measures that can be taken to minimise radiation exposure of clinic staff when handling horses for skeletal scintigraphy. (5 marks)
6. Describe how to calculate the 60-minute post injection percentage uptake of intravenously injected ^{99m}Tc - pertechnetate for a thyroid gland in a dog using planar gamma camera scintigraphy. (5 marks)
7. Briefly define and list **one (1)** major applications/advantages of the following CT tools:
 - a) maximum intensity projection reconstruction (2.5 marks)
 - b) variable thickness viewing of CT data. (2.5 marks)
8. Answer **both** parts of this question:
 - a) Draw a graph/figure that represents the dynamic range of screen-film combinations compared with digital detectors. Signal response/density should be on the y-axis with dose/exposure on the x-axis of the graph. (4 marks)
 - b) Describe the shape of the curve you have drawn for the response of film-screen combinations to increasing dose/exposure. (1 mark)
9. Briefly explain the physical principles behind the use of ultrasound contrast agents. Comment on chemical makeup of ultrasound contrast agents and their lifespan in the body. (5 marks)
10. Answer **all** parts of this question:
 - a) Write the Doppler equation to solve for flow velocity of the target. (1 mark)
 - b) Explain how accuracy of Doppler flow velocity measurement is affected by angle of the incident ultrasound beam relative to direction of flow within the blood vessel. (2 marks)
 - c) Briefly describe how data is obtained using pulsed wave versus continuous wave Doppler ultrasonography **and** identify the major difference(s) between these **two (2)** Doppler techniques. (2 marks)

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11. The following are representations of short-axis echocardiographic images obtained from a right parasternal location. Identify structures **a**, **b**, **d**, and **e** and valvular structure **c**. (1 mark per structure)



Images are modified from *Small animal diagnostic ultrasound*, Nyland & Mattoon, 2nd edn 2002.

12. With regard to tissue harmonic imaging:
- Briefly explain the physical principles of tissue harmonic imaging. (4 marks)
 - Give **one (1)** example of a clinical situation where it might be advantageous to use tissue harmonic imaging. (1 mark)

End of paper



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Paper 2

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Veterinary Radiology Paper 2

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Paper 2: Veterinary Radiology

Section A: Answer ALL four (4) essay-style questions

1. In regards to the diagnosis and detection of medial coronoid process malacia and fragmentation (medial coronoid process disease) in dogs.

Answer **all** parts of this question:

- a) Discuss the advantages and disadvantages of the following imaging modalities in making a diagnosis:
 - i. computed tomography (CT) (10 marks)
 - ii. magnetic resonance imaging (MRI) (10 marks)
- b) Describe the pathophysiology or possible mechanisms by which medial coronoid process disease develops in dogs. (10 marks)

2. With regard to the diagnosis of intestinal/alimentary lymphoma in a 12-year-old cat: Imaging modalities available are limited to:

- digital radiography
- colour and Doppler ultrasound with a 3–8 MHz curvilinear transducer
- colour and Doppler ultrasound with a 9–12 MHz linear transducer
- 4-slice CT scanner.

Answer **all** parts of this question:

- a) Discuss and justify your recommendations for imaging this patient with the available modalities. (10 marks)
- b) Comment on whether you can differentiate between low grade alimentary lymphoma and inflammatory bowel disease using the imaging modalities available. (5 marks)
- c) List the possible sonographic imaging findings in a cat with alimentary lymphoma. List any other differential diagnoses. (10 marks)
- d) Briefly describe any further diagnostics that might be needed to confirm a diagnosis of alimentary lymphoma in this patient. (5 marks)

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3. In regards to canine lung lobe torsion:
- a) List the predisposing factors. *(6 marks)*
 - b) Briefly describe the likely pathogenesis. *(6 marks)*
 - c) List any **six (6)** possible imaging findings for **each** of the following modalities:
 - i. plain radiology *(6 marks)*
 - ii. ultrasound *(6 marks)*
 - iii. computed tomography. *(6 marks)*
4. An eight-year-old eventing horse has a two out of five right hind leg lameness that has been present for two months. Lameness is abolished by perineural analgesia of the deep branch of the lateral plantar nerve.
- Discuss the advantages and disadvantages of the following imaging modalities in the diagnosis of this lameness:
- a) digital radiology *(10 marks)*
 - b) ultrasound using a 3-8 MHz curvilinear transducer and a 9-12 MHz linear transducer *(10 marks)*
 - c) 1.5 Tesla MRI. *(10 marks)*

Section B start on the next page

Section B: Answer ALL twelve (12) short-answer questions

1. List any **four (4)** the possible echocardiographic findings in a dog with moderate pulmonic stenosis and comment briefly on how severity of stenosis is assessed. *(5 marks)*

2. Answer **both** parts of this question:
 - a) List the possible radiographic findings for fibrous osteodystrophy in a guinea pig. *(2.5 marks)*

 - b) List the possible radiographic findings for septic phylitis in a two-week-old goat. *(2.5 marks)*

3. Answer **all** parts of this question:
 - a) List possible abdominal sonographic findings in a dog with pituitary-dependent hyperadrenocorticism. *(3 marks)*

 - b) Briefly describe how the sonographic appearance of adrenal glands might change over time in a patient with pituitary-dependent hyperadrenocorticism in response to:
 - i. Mitotane therapy
 - ii. Trilostane therapy.

4. With regard to sonographic findings in a pregnant bitch:
 - a) List any **two (2)** possible sonographic findings for embryonic resorption (<25 days) and any **two (2)** possible sonographic findings for foetal death (post 35 days). *(4 marks)*

 - b) List any **one (1)** sonographic finding that is an indication of distress in a full term foetus. *(1 mark)*

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5. Answer **both** parts of this question:
- a) List the steps involved in performing a dual phase CT study to investigate a canine patient with possible insulinoma. You have access to 16 slice CT, bolus tracking software and a power injector. (4 marks)
 - b) Identify the phase of the CT study in which an insulinoma would be expected to be most hyperattenuating. (1 mark)
6. List the steps involved in performing an upper gastrointestinal tract barium study in a dog.
Include patient preparation, dose of contrast media, route of administration of contrast media, timing of radiographic exposures, patient positioning and expected time of passage of contrast media through the gastrointestinal tract in a **normal** dog. (5 marks)
7. The ratio between maximal small intestine diameter and the height of the body of the fifth lumbar vertebrae in radiographs has been reported as a diagnostic test in dogs with intestinal obstruction.
Briefly discuss the use of this ratio when evaluating abdominal radiographs of dogs with a clinical suspicion of intestinal obstruction. (5 marks)
8. Regarding syringohydromyelia in Cavalier King Charles spaniels:
- a) Describe the expected MRI findings for syringohydromelia. (1 mark)
 - b) Briefly discuss the clinical relevance of the imaging findings. (4 marks)
9. List the possible ultrasonographic **and** plain radiography findings of stenosing tenosynovitis of the abductor pollicis longus muscle in dogs. (5 marks)
10. Briefly discuss the sensitivity of 1.5Tesla MRI for the diagnosis of meningeal disease in dogs. (5 marks)

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11. List the possible ultrasonographic findings in a two-week-old foal with omphalophlebitis. *(5 marks)*

12. Briefly describe the pathogenesis of osteochondrosis of the cranial aspect of the distal intermediate ridge of the tibia in a two-year-old Standardbred trotter horse. *(5 marks)*

End of paper