



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2016

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 markstotal 60 marks

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Paper 1: Veterinary Radiology

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

1. Image quality is determined by contrast resolution, spatial resolution and noise. Describe in detail these components of image quality and the factors that affect them with regards to digital radiography. *(30 marks)*

2. Answer **both** parts of this question:
 - a) Several computed tomography (CT) artefacts may result in streaks or fine lines across the image. Choose any **three (3)** CT artefacts, explain how they occur and outline the methods that may be used to minimise their occurrence. *(20 marks)*

 - b) With regards to CT, describe the effect the duration of injection of iodinated contrast has on peak enhancement and time to peak enhancement in the aorta of small animal patients, and briefly discuss its relevance in clinical imaging. *(10 marks)*

3. Describe how an ultrasound beam is attenuated as it passes through a patient. Explain what is meant by acoustic impedance in ultrasound, and explain how the acoustic impedance of tissue affects attenuation. *(30 marks)*

4. Inversion recovery is a process that forms the basis of several important pulse sequences in clinical magnetic resonance imaging (MRI).

Answer **both** parts of this question:

- a) Describe in detail the process of inversion recovery. *(10 marks)*

- b) Describe in detail **two (2)** important pulse sequences that use inversion recovery and discuss with examples their clinical application in veterinary diagnostic MRI. *(20 marks)*

Section B starts on the next page

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

1. Each of the images below shows an imaging artefact. For **each** image, name the artefact and briefly describe how it occurs.

Answer **both** parts of this question:

- a) Image 'A' (computed radiography (CR) image of a coxofemoral joint): the dark rim around the metallic implant between ball and stem. (2.5 marks)
- b) Image 'B' (MRI image): the distortion to the tissue dorsal to C5 & C6. (2.5 marks)



Image A

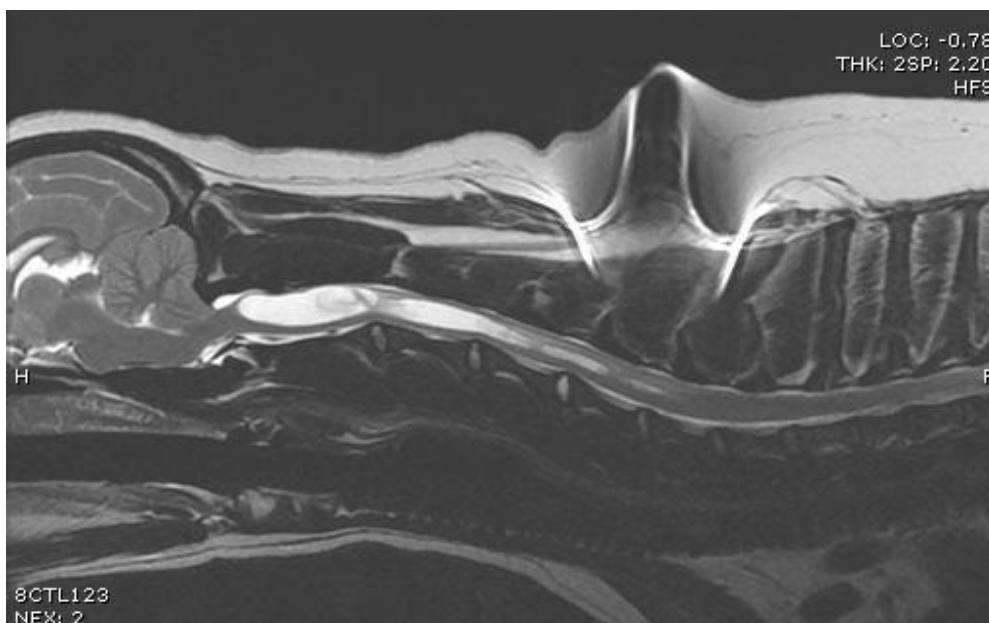


Image B

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2. With respect to MRI, describe the conditions under which the magic angle effect occurs and give an anatomic location in which its occurrence is of importance in clinical imaging. (5 marks)

3. List in point form an appropriate technique for nuclear scintigraphic evaluation of a three-year-old Thoroughbred horse with acute pelvic limb lameness after racing and suspected stress fracture proximal to the tarsus. (5 marks)

4. With respect to radiation biology:
 - a) Define stochastic effects. (2.5 marks)

 - b) Define effective dose. (2.5 marks)

5. List the clinical signs associated with cavernous sinus syndrome and the structures affected to cause this syndrome. (5 marks)

6. Answer **both** parts of this question:
 - a) Briefly describe or sketch a diagram representing the neuroanatomy of the sympathetic innervation of the feline eye. (2.5 marks)

 - b) List **five (5)** possible causes of Horner's syndrome in a cat. (2.5 marks)

7. You have been asked to formulate a technique chart for a nearby small animal veterinary practice that continues to use conventional film-screen radiography. The technique chart should vary with the thickness (in centimeters) of the part being radiographed and have a fixed film-focal distance.

Answer **both** parts of this question:

- a) Briefly outline how you would prepare such a chart. (2 marks)

- b) Briefly describe how the following factors will affect the exposures required:
 - i. use of a grid (1.5 marks)

 - ii. thoracic radiography vs abdominal radiography. (1.5 marks)

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8. Ionisation chambers and Geiger-Muller (GM) counters are both types of gas-filled detectors.

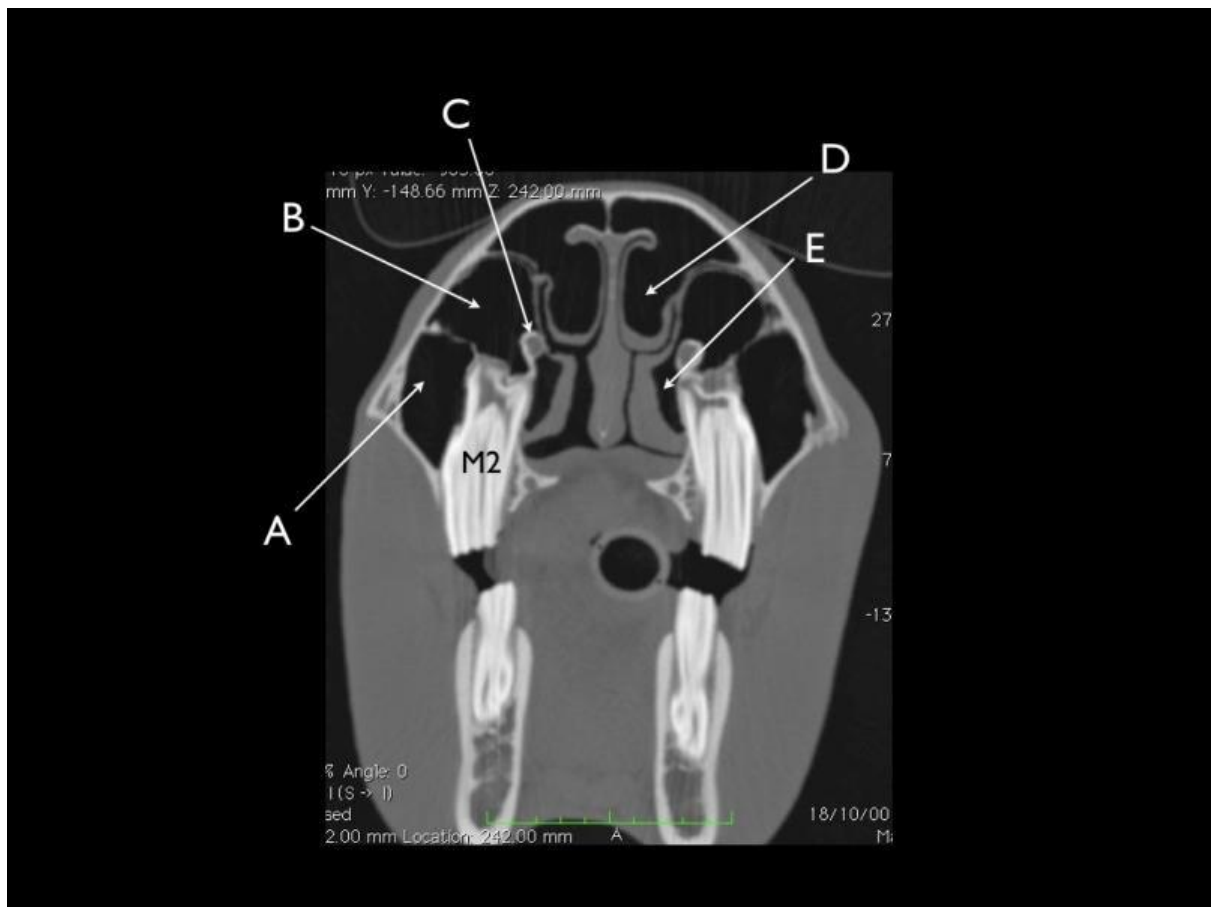
Answer **both** parts of this question:

- a) Briefly explain how a gas-filled detector works. (3 marks)
- b) Give **one (1)** use **each** for ionisation chambers and GM counters. (2 marks)
9. With regards to diagnostic radiography, define the photoelectric effect and describe its relationship with atomic number (Z) of the attenuating medium and energy of incident photon (E). (5 marks)
10. List **three (3)** mechanisms of pathogenesis of non-cardiogenic oedema and give an example of a cause associated with **each** of the mechanisms. (5 marks)
11. List **five (5)** methods that are incorporated into X-ray tube head design that reduce the risks of heat damage to the tube. (5 marks)

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12. Answer **both** parts of this question:

- a) Briefly describe (or sketch) the anatomy of the canine **and** feline pancreatic ducts and their relationship to the common bile duct and duodenum. (2.5 marks)
- b) Transverse CT image of an adult equine head at the level of the second molar tooth (5th cheek tooth). Identify the **five (5)** anatomic structures labelled **A - E**. (2.5 marks)



End of paper



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Paper 2

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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

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Paper 2: Veterinary Radiology

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

1. Discuss the strengths and weaknesses of radiography, computed tomography (CT), ultrasound and scintigraphy in the investigation and diagnosis of elbow dysplasia in the dog. (30 marks)
2. A Bengal cat breeder approaches you to screen their breeding stock for hypertrophic cardiomyopathy (HCM).

Answer **all** parts of this question:

- a) Discuss in detail the use of echocardiography to diagnose HCM in cats. (15 marks)
 - b) Discuss the specific challenges of echocardiographic screening for HCM in breeding cats. (5 marks)
 - c) Give specific recommendations for a screening programme including timing of examinations and recommendations for breeding. (10 marks)
3. An internal medicine colleague suspects a congenital portosystemic shunt in a 6-month-old Maltese terrier (body weight: 4 kg) and requires confirmation of this condition. You have access to ultrasound, a 16 slice CT and fluoroscopy.

Answer **all** parts of this question:

- a) List the changes to serum haematology and biochemistry that would support the diagnosis of a portosystemic shunt. (2 marks)
- b) Briefly describe the typical shunt anatomy in this breed of dog. (3 marks)
- c) Discuss the strengths and weaknesses of each of the listed, available imaging modalities in this particular patient. (15 marks)
- d) Outline an appropriate imaging protocol when using a 16 slice CT to image this patient. (10 marks)

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4. Palmar hoof pain is often a chronic and progressive condition affecting horses. It has historically been difficult to diagnose the cause or causes of this pain.

Discuss in detail the use of imaging in the diagnosis of palmar hoof pain relating to the navicular bone and adjacent structures, the advantages and disadvantages of the various imaging modalities and the imaging findings which would support a diagnosis of pain related to the navicular bone and adjacent structures. (30 marks)

Section B start on the next page

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

1. Describe the central nervous system (CNS) magnetic resonance imaging (MRI) features of *Angiostrongylus vasorum* infection in the dog. (5 marks)
2. Describe the MRI characteristics of intracranial *Neospora caninum* in the dog. (5 marks)
3. List the radiographic signs of enlargement of the tracheobronchial lymph nodes and give **three (3)** differential diagnoses for enlargement of these nodes in the dog. (5 marks)
4. Comment on the use and usefulness of ultrasonographic adrenal gland measurements in the diagnosis of Cushing's disease. (5 marks)
5. Contrast the MRI criteria for diagnosis of acute non-compressive nucleus pulposus disk extrusion and ischemic myelopathy (fibrocartilagenous embolism) in dogs. (5 marks)
6. List the computed tomography (CT) features of temporohyoid osteoarthropathy in horses. (5 marks)
7. Comment on the usefulness of fine needle aspirate cytology for diagnosis hepatic disease in small animals. (5 marks)
8. Briefly contrast the most common reported triple phase CT angiography features of hepatic nodular hyperplasia, hepatocellular carcinoma and metastatic neoplasia within the liver. (5 marks)

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9. Abdominal ultrasound on a cat with chronic vomiting demonstrates diffuse small intestinal wall thickness of 2.9–3.5 mm, increased muscularis mucosae thickness and normal jejunal lymph nodes. Provide your differential diagnoses and salient recommendations to the referring veterinarian. (5 marks)

10. Describe (or sketch and label) the blood supply to the femoral head in small animals and name **one (1)** important difference in this anatomy between cats and dogs. (5 marks)

11. Ventilation and perfusion scintigraphic studies are used in the diagnosis of exercise induced pulmonary haemorrhage in horses. Name a radiopharmaceutical used for **each** and briefly describe the method of localisation. (5 marks)

12. Briefly explain the process by which Doppler ultrasound is used to measure right ventricular systolic pressures, and give the parameters that would indicate the presence of pulmonary hypertension in small animals. (5 marks)

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