



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2021

Veterinary Emergency Medicine and Critical Care

Paper 1

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

Time allowed: **Four (4)** hours after perusal

Section A: Answer **ONE (1)** question

Section B: Answer **ALL FIVE (5)** questions

Section C: Answer **ALL TEN (10)** questions

Section A: Answer **ONE (1)** essay-style question, worth 60 marks..... total 60 marks

Section B: Answer **FIVE (5)** short-answer questions, each worth 24 marks total 120 marks

Section C: Answer **TEN (10)** short-answer questions, each worth 6 marks..... total 60 marks

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Paper 1: Veterinary Emergency Medicine and Critical Care

Section A: Answer one (1) question

1. Answer **all** parts of this question:

- a) In your answer booklet, draw a normal left-ventricular volume-pressure loop. Label the diagram and describe the key events of the cardiac cycle. Include units and numbers on the Y axis only. *(12 marks)*
- b) Add a second loop to your drawing in a) for a cat with congestive heart failure secondary to hypertrophic cardiomyopathy and include a brief explanation for the changes indicated in the context of the pathophysiology of this condition. *(14 marks)*
- c) For each of the compensatory or counter-compensatory systems listed below describe how they are activated in congestive heart failure, the consequences of their activation, and resultant beneficial and adverse effects:
 - i. renin-angiotensin-aldosterone system *(15 marks)*
 - ii. sympathetic nervous system *(10 marks)*
 - iii. natriuretic system. *(6 marks)*
- d) List **three (3)** factors that are associated with a particularly high risk of arterial thromboembolism in cats with cardiomyopathy, according to the ACVECC consensus on the rational use of antithrombotics in veterinary critical care (CURATIVE) guidelines. *(3 marks)*

Section B starts over page

Section B: Answer ALL five (5) short-answer questions

1. Answer **all** parts of this question:

- a) Define cerebral perfusion pressure and use an equation to show its components as they relate to one another. (2 marks)
- b) In your answer booklet, draw and explain the cerebral compliance curve including a description of the Monroe-Kellie doctrine, and its implications in patients with traumatic brain injury. (10 marks)
- c) Describe the **two (2)** main mechanisms by which intracranial pressure is regulated. (5 marks)
- d) List the **three (3)** categories of the modified Glasgow coma scale (MGCS), noting which component has the best predictive performance, and describe the neurologic signs associated with a score of 3/18. (7 marks)

2. Answer **all** parts of this question:

- a) Write out the Starling-Landis equation, including a description of each component of the equation. (8 marks)
- b) Regarding the endothelial glycocalyx and the endothelial surface layer, describe:
(12 marks)
 - i. its main components (including the broad categories of component molecules as well as specific examples)
 - ii. how they interact with one another
 - iii. why the healthy EG is anti-inflammatory and anti-coagulant.
- c) Describe the recent modification of our understanding of the Starling equation.
(4 marks)

Section B continued over page

3. Answer **all** parts of this question:

- a) Explain the current definitions of sepsis and multiple organ dysfunction (including individual organ dysfunctions) used in human medicine compared to veterinary medicine. *(15 marks)*
- b) Do you think that the human sepsis definition should be adopted in veterinary medicine? List **four (4)** reasons to support your choice. *(4 marks)*
- c) Compare and contrast the pathophysiology of the initial immune response (in the first minutes to hours after exposure) to non-infectious versus infectious insults, giving examples of specific insults and molecular patterns sensed by the host. *(5 marks)*

4. Answer **all** parts of this question:

- a) Use a table to compare pre-synaptic and post-synaptic neurotoxins from Elapid snakes with regard to their mechanism of action and therapeutic implications. *(4 marks)*
- b) Compare and contrast snake envenomation, tick paralysis, idiopathic polyradiculoneuritis and acquired fulminant generalised myasthenia gravis as differential diagnoses for flaccid paralysis in dogs in Australia. Include discussion of their mechanism of action, clinical syndrome, and the diagnostic approach. *(16 marks)*
- c) What is the prognosis for dogs and cats with ascending flaccid paralysis requiring mechanical ventilation? Draw your conclusions by analysis of the current veterinary literature from Australia and overseas. *(4 marks)*

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5. Answer **all** parts of this question:
- a) List the **three (3)** most common arrest rhythms in small animal patients in order of occurrence, and the additional arrest rhythm that has been recognised in humans. (2 marks)
 - b) List the equation that denotes myocardial perfusion pressure, and describe how this influences your choice of whether to administer IV fluids during cardiopulmonary resuscitation (CPR). (4 marks)
 - c) Name and describe in detail the **two (2)** theories by which cardiac output is achieved during cardiopulmonary resuscitation (CPR) and how these are associated with compression technique. (6 marks)
 - d) Describe why end-tidal carbon dioxide is monitored during CPR and its prognostic significance. (3 marks)
 - e) Assuming other components of basic and advanced life support are occurring appropriately, describe the technique specifically for performing open chest CPR. (5 marks)
 - f) Briefly explain the theoretical rationale for therapeutic hypothermia or targeted temperature management (TTM) after cardiopulmonary arrest. (2 marks)
 - g) Summarise the recommendations of the reassessment campaign on veterinary resuscitation (RECOVER) guidelines for use of TTM in post-arrest veterinary patients. (2 marks)

Section C starts over page

Section C Answer ALL ten (10) short-answer questions

1. Describe the structure and function of neutrophil extracellular traps (NETs), and how NETosis occurs. (6 marks)
2. Explain the potential spectrum of neurologic consequences of traumatic sacrocaudal luxation in cats with reference to the types of nerve injury, specific nerves involved and resultant clinical signs. (6 marks)
3. Briefly describe the pathophysiology of acute coagulopathy of trauma/shock (ACOTS). (6 marks)
4. Describe the **three (3)** broad mechanisms of non-cardiogenic pulmonary oedema, providing at least **two (2)** examples of each in a dog. (6 marks)
5. Describe the pathophysiology and clinical manifestations of humoral hypercalcaemia of malignancy. (6 marks)
6. Describe the **three (3)** phases of normal primary haemostasis (adhesion, activation, aggregation) under low shear conditions. (6 marks)
7. Describe the toxic mechanisms of sodium monofluoroacetate (compound 1080), and the clinical signs that result in dogs. (6 marks)
8. List and describe the **four (4)** main mechanisms of heat dissipation from the body, and denote that mechanism which is most important in dogs when environmental temperature approaches body temperature. (6 marks)
9. Describe the **three (3)** arrhythmogenic mechanisms that may affect ventricular myocytes. (6 marks)
10. List and describe the features of the Berlin definition of acute respiratory distress syndrome (ARDS), and how severity is incorporated into this definition. (6 marks)

End of paper



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**Veterinary Emergency Medicine and
Critical Care**

Paper 2

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

Time allowed: **Four (4)** hours after perusal

Answer **ALL FIVE (5)** questions

All five (5) questions are of equal value.

Answer **FIVE (5)** questions, each worth 48 markstotal 240 marks

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Paper 2: Veterinary Emergency Medicine and Critical Care

Answer all five (5) questions

1. Answer **all** parts of this question:
 - a) Define the term status epilepticus. (2 marks)
 - b) Describe how seizures can be classified, according to their aetiology. Include examples of underlying aetiologies within each classification. (10 marks)
 - c) Describe the different concepts used to explain the pathophysiology of seizures at the level of the cerebral cortex. (10 marks)
 - d) According to the 2015 ACVIM Small Animal Consensus Statement on Seizure Management in Dogs, list the indications for starting antiepileptic drug therapy in dogs. (4 marks)
 - e) Briefly discuss the use of benzodiazepines in the treatment of seizures in dogs and cats. (6 marks)
 - f) Describe the use of **three (3)** long-acting antiepileptic drugs in dogs and cats. For each drug, provide the following information: (12 marks)
 - i. whether it is recommended for use as a monotherapy drug, or add-on drug in dogs
 - ii. **one (1)** benefit of this drug over other antiepileptic drugs
 - iii. possible adverse effects in dogs or cats
 - iv. dosing information, including 'loading' and 'maintenance' doses where applicable, maintenance dosing intervals, and route of administration.
 - g) List **one (1)** drug that has been used for the treatment of refractory status epilepticus/seizures in dogs, describe an appropriate dosing protocol, and any special considerations for the drug. (4 marks)

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2. A three-year-old, female spayed French bulldog presents with tetraparesis. Physical examination identifies an engorged *Ixodes holocyclus* tick on the dog, so you plan to treat the dog with tick anti-toxin serum (TAS).

Answer **all** parts of this question:

- a) Describe the **three (3)** reported methods of TAS dose calculation, and the evidence favouring a particular method. *(4 marks)*
- b) Describe the pathophysiology and clinical signs associated with the following four potential TAS adverse reactions, including whether or not prior exposure is required: *(14 marks)*
- i. Bezold-Jarish (B-J) reflex
 - ii. Type I hypersensitivity reaction
 - iii. Anaphylactoid reaction
 - iv. Type III hypersensitivity reaction.
- c) List the classic indications for commencement of mechanical ventilation. *(3 marks)*
- d) Assuming that your patient fulfils criteria for mechanical ventilation describe your complete anaesthetic protocol for mechanical ventilation and your initial ventilator mode and settings. *(12 marks)*.
- e) You elect to perform a temporary tracheostomy. Describe your step-by-step surgical technique. *(10 marks)*
- f) Outline the optimal nursing care required for management of a ventilator patient. *(5 marks)*

Continued over page

3. You are treating a 21-week-old, 10 kilogram, male entire Staffordshire bull terrier puppy for parvovirus gastroenteritis. The puppy has been vaccinated with a modified live vaccine for canine parvovirus at eight and twelve weeks of age.

Answer **all** parts of this question:

- a) Explain the most likely reason that this dog has tested positive for canine parvovirus despite having received two vaccinations. *(2 marks)*
- b) Discuss the pros and cons of antibiotic therapy in puppies with parvovirus, and how these are balanced when making clinical decisions for an individual patient. *(6 marks)*
- c) Discuss the pros and cons of administration of plasma transfusion in puppies with parvovirus. *(6 marks)*
- d) Discuss the potential benefits of placing a nasogastric feeding tube in a puppy with parvovirus gastroenteritis. *(3 marks)*
- e) Briefly explain **three (3)** techniques that you can use to assess correct placement of an NG tube. *(3 marks)*
- f) List **three (3)** prokinetic drugs, their mechanisms of action, and dosing schedules in dogs. *(9 marks)*
- g) Explain the potential advantages and disadvantages of metronidazole in treating dogs with diarrhoea. Answer generally (not specific to the described case). *(5 marks)*
- h) Your parvovirus patient is hypoglycaemic at hospital presentation. Describe the deleterious effects of hypoglycaemia, provide plausible differential diagnoses for hypoglycaemia in this case, and describe your treatment approach. *(8 marks)*
- i) Summarise the findings of recent studies that investigated outpatient protocols for management of dogs with parvovirus gastroenteritis. *(6 marks)*

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4. A 14-year-old, male neutered domestic shorthair cat is referred to your hospital for evaluation. He has a history of decreased appetite, lethargy, and weight loss over recent weeks. Physical examination reveals the following:

Mentation	obtunded
Body weight	4.14 kg
Body condition score	5/9
Rectal temperature	36.3°C
Heart rate / pulse rate	140 beats per minute
Femoral pulses	weak
Respiratory rate	28 breaths/min
Oral mucous membranes	pale pink, tacky, CRT 3 seconds
Skin turgor	moderately increased
Abdominal palpation	soft, non-painful, no palpable abnormalities

A venous blood gas and full biochemistry profile are provided. Concurrently the urine specific gravity was 1.015.

Parameter	Patient value	Reference interval	Units
pH	7.118	7.337–7.467	
pCO ₂	23.0	36.04–44.0	mmHg
pO ₂	78.4	80.0–100.0	mmHg
SO ₂ %	88.9	94.0–100.0	%
Hct	40	28–40	%
Hgb	133	93–133	g/L
Sodium	153.5	140.0–154.0	mmol/L
K	3.1	3.6–4.8	mmol/L
Cl	121	109–120	mmol/L
iCa	1.2	1.2–1.4	mmol/L
iMg	0.7	0.1–0.4	mmol/L
Glucose	27	4.4–6.67	mmol/L
Lactate	0.9	0.0–2.0	mmol/L
BUN	31.1	4.3–10.0	mmol/L
Creat	3.1	0.2–2.1	mmol/L
BE _{ecf}	-22.1		mmol/L
BE _b	-19.6		mmol/L
HCO ₃	7.5	18.0–24.0	mmol/L

Question 4 continued over page

Parameter	Patient value	Reference interval	Units
Glucose	30.3	3.89–6.67	mmol/L
Urea	27.5	5.36–11.78	mmol/L
Creatinine	212	80–186	µmol/L
Phosphorous	14.5	9.3–19.5	mmol/L
Calcium	2.4	2.2–2.9	mmol/L
Magnesium 2+	3.9	2.0–3.1	mEq/L
Total Protein	95	60–84	g/L
Albumin	36	22–40	g/L
Globulins	59	25–58	g/L
Sodium	151	146–158	mmol/L
Chloride	102	110–125	mmol/L
Potassium	2.3	3.4–5.2	mmol/L
TCO ₂ (Bicarb)	6	13–22	mmol/L
Anion Gap	43	9.0–21.0	
Na/K	66	28–43	
Total Bilirubin	82.1	1.71–5.13	µmol/L
Alkaline phosphatase	110	10–79	U/L
GGT	21	0–5	U/L
ALT	236	24–145	U/L
AST	67	5–42	U/L
Creatine kinase	203	14–528	U/L
Cholesterol	11.7	2–64.5	mmol/L
Triglycerides	1.23	0.28–2.1	mmol/L
Amylase	791	496–1940	U/L

Answer **all** parts of question 4:

- a) Describe the acid-base abnormality as completely as possible using a traditional acid-base approach. (5 marks)
- b) List **six (6)** differential diagnoses for the metabolic acid-base abnormality identified (generally, not specific to this patient). (3 marks)

Question 4 continued over page

- c) Calculate the **five (5)** key semi-quantitative acid-base parameters for this cat, drawing conclusions about which are contributing to his primary acid-base disorder(s). *(16 marks)*
- d) Given the information above derive a thorough fluid therapy plan for this cat for the first 24 hours of treatment. Explain the rationale for your choices. *(20 marks)*
- e) Formulate a plan for naso-oesophageal tube feeding of this patient over the first four days. Include calculations for kilocalories and protein requirements. *(4 marks)*

5. Answer **all** parts of this question regarding a young male cat with urethral obstruction:

- a) Describe the effects of hyperkalemia on action potential generation and the subsequent effects on the electrocardiogram. *(9 marks)*
- b) List the spectrum of treatment options for hyperkalaemia in this cat, and describe their mechanisms of action. *(10 marks)*
- c) List **two (2)** factors associated with fluid overload in cats in a recent case-control retrospective study published in the Journal of Veterinary Emergency and Critical Care. *(2 marks)*
- d) Describe the role of decompressive cystocentesis, and potential complications associated with its use. *(4 marks)*
- e) List **two (2)** drugs of different classes that could be administered parenterally for analgesia, describing dosing, their mechanisms of action, which components of the pain pathway they affect, and potential disadvantages in the context of this patient. *(5 marks)*
- f) Describe methods for providing local analgesia and anaesthesia for urethral catheterisation in this cat, including a detailed description of the technique(s) where appropriate. *(10 marks)*
- g) Provide mechanistic explanations for at least **four (4)** potential methods to prevent and/or treat urethral spasm in cats following urinary obstruction. *(8 marks)*

End of paper