Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2018

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

Paper 1: Veterinary Emergency Medicine and Critical Care

Section A: Answer one (1) question

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

   a) Define acute kidney injury (AKI) **and** describe a systematic approach to the differential diagnoses for AKI in dogs and cats. Include detailed examples within **each** category. *(16 marks)*

   b) Describe the pathophysiology **and** time course of the **four (4)** phases of AKI. *(14 marks)*

   c) Explain the rationale for and objective basis of the scoring systems for AKI **and** provide **two (2)** specific examples of scoring systems used in veterinary medicine. Briefly outline the advantage(s) of such systems. *(6 marks)*

   d) Summarise the literature regarding the utility of serum symmetrical dimethylarginine (SDMA) and **two (2)** other novel biomarkers, as they relate to AKI in veterinary patients. *(13 marks)*

   e) Describe the **two (2)** main mechanisms of solute removal in continuous renal replacement therapies (CRRT). Provide **two (2)** examples of therapies that use **each** mechanism. *(5 marks)*

   f) Describe the technique **and** mechanisms of efficacy of **two (2)** novel extracorporeal therapies: single pass lipid dialysis and activated charcoal haemoperfusion. Provide an example of a toxicosis for which **each** therapy has been utilised in dogs. *(6 marks)*

Section B starts over page

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

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

   a) Describe the pathogenesis of patent ductus arteriosus (PDA), including the pathophysiology behind the **two (2)** main clinical presentations of dogs with symptomatic PDA. *(10 marks)*

   b) Describe pathognomonic physical examination findings associated with **each** of the **two (2)** main clinical presentations of dogs with PDA. *(6 marks)*

   c) Describe the most appropriate treatment for **each** of the **two (2)** main clinical presentations of dogs with PDA. *(8 marks)*

2. Explain the indications **or** contraindications of concurrent administration of the following drug combinations. Include discussion of the mechanism of action for **each** drug:

   a) Ampicillin and amikacin. *(4 marks)*

   b) Intravenous infusions of fentanyl and ketamine. *(4 marks)*

   c) Aminophylline and enrofloxacin. *(4 marks)*

   d) Butorphanol and morphine. *(4 marks)*

   e) Firocoxib and prednisolone. *(4 marks)*

   f) Cyclosporine and ketoconazole. *(4 marks)*

Continued over page

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

a) Provide a detailed description of the immunologic **and** haematologic mechanisms of the following laboratory abnormalities associated with canine immune- mediated haemolytic anaemia (IMHA).

i. hyperbilirubinaemia *(3 marks)*

ii. haemoglobinaemia *(3 marks)*

iii. in-saline auto-agglutination *(3 marks)*

iv. spherocytosis *(3 marks)*

v. rubricytosis *(3 marks)*

vi. platelet count $<15 \times 10^9$/L *(3 marks)*

b) Describe the proposed mechanism of action of intravenous immunoglobulin for the treatment of autoimmune disease. Provide the evidence for its use in dogs. *(6 marks)*

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

a) Synthetic colloids differ with regard to multiple characteristics. Explain **each** of the characteristics listed in the following sub-parts i. to iv., and describe how they affect the pharmacokinetics/dynamics of the product. For **each** characteristic, list **two (2)** products that differ with regard to that characteristic.

i. molecular weight *(3 marks)*

ii. molar substitution ratio *(3 marks)*

iii. C2:C6 substitution ratio *(3 marks)*

iv. diluent. *(3 marks)*

b) Compare and contrast literature regarding the use of crystalloids versus synthetic colloids for fluid resuscitation of septic and other critically ill dogs and humans. Provide examples of the findings in at least **two (2)** clinical papers in **each** species. *(12 marks)*

Continued over page

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

a) Describe the biological basis of early goal directed therapy (EGDT) for the treatment of septic shock, with reference to components of tissue oxygen delivery (DO_2) **and** the measured patient parameters used as markers of those DO_2 components. *(15 marks)*

b) Describe the changes in the '**Initial Resuscitation Section**' of the *Surviving Sepsis Campaign (SSC) Guidelines* between 2012 and 2016 **and** briefly relate these recommendations to the findings of the clinical trials on which they were based. *(7 marks)*

c) Identify the dynamic measures of fluid responsiveness that are included in the *2016 SSC Guidelines* that could be applied to veterinary medicine. *(2 marks)*

Section C starts over page

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

1. Based on the following table, list the sensitivity, specificity, positive predictive value and negative predictive value of ultrasound B-lines for the diagnosis of cardiogenic pulmonary oedema in dogs. *(6 marks)*

	No pulmonary oedema (n=43)	**Pulmonary oedema present (n=20)**
B-lines absent	40	2
B-lines present	3	18

2. Describe the pathophysiology, risk factors **and** the classic diagnostic findings of acute tumour lysis syndrome. *(6 marks)*

3. Describe the endocrine response to ionized hypocalcaemia. *(6 marks)*

4. Describe the primary toxic principle **and** clinical signs of cycad palm (also known as sago palm, *Cycas* species) toxicosis in dogs. *(6 marks)*

5. Define *serotonin syndrome*; summarise its clinical manifestations **and** potential causes in dogs **and** cats. *(6 marks)*

6. Regarding coagulation, list the components **and** function of **each** of the following complexes: *(6 marks)*

    i. extrinsic tenase complex

    ii. intrinsic tenase complex

    iii. prothrombinase complex.

Section C continues over page

7. Based on the definitions used in the *2016 Surviving Sepsis Campaign Guidelines*, differentiate broad spectrum antibiotic therapy from combination antibiotic therapy **and** give an appropriate example of **each**. *(6 marks)*

8. Explain, using an equation, why the single nephron glomerular filtration rate (SNGFR) is relatively high, compared to the movement of fluid across other capillaries in the body. *(6 marks)*

9. Differentiate the **two (2)** types of delayed neurological syndromes reported with anticholinesterase toxicity in humans and dogs. *(6 marks)*

10. Briefly describe the biological function and utility of the cardiac troponins C, I and T (i.e., cTnC, cTnI, cTNT), as biomarkers. *(6 marks)*

End of paper

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Paper 2

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Answer **ALL <u>FIVE (5)</u>** questions

All five (5) questions are of equal value.

Answer **<u>FIVE (5)</u>** questions, each worth 48 marks .....total 240 marks

Paper 2: Veterinary Emergency Medicine and Critical Care

Answer all five (5) questions

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

   a) Define status epilepticus. *(1 mark)*

   b) Define cluster seizures. *(1 mark)*

   c) Describe the classification of seizures according to their aetiology. Include examples of underlying aetiologies within **each** classification. *(10 marks)*

   d) Describe the pathophysiology of seizures. *(12 marks)*

   e) List **four (4)** possible complications of seizures. *(2 marks)*

   f) List the indications for starting anti-epileptic drug therapy in dogs according to the 2015 ACVIM Small Animal Consensus Statement on *Seizure Management in Dogs*. *(4 marks)*

   g) Describe the use of benzodiazepines in the treatment of seizures in dogs **and** cats. *(6 marks)*

Question 1 continues over page

h) Choose **three (3)** long-acting, anti-epileptic drugs used in veterinary practice. For **each** drug, provide the following information:

(4 marks per drug, 12 marks total)

i. Recommended use as a monotherapy or as an 'add-on' drug in dogs. *(0.5 marks)*

ii. **One (1)** benefit of this drug over other anti-epileptic drugs. *(0.5 marks)*

iii. Possible adverse effects in dogs **or** cats. *(1 mark)*

iv. Dosing information, including 'loading' **and** 'maintenance' doses, where applicable, maintenance dosing interval **and** route of administration. *(2 marks)*

Continued over page

2. A three-year-old, female, spayed French bulldog presents with lower motor neuron (LMN) signs including an inability to right herself, reduced to absent spinal reflexes in all four limbs, weak to absent withdrawal in all four limbs and an inability to maintain sternal recumbence. Her medical history is unremarkable.

Answer **all** parts of this question:

a) Provide a comprehensive, ranked list of differential diagnoses for this patient, differentiating likely or common differentials from less likely considerations and briefly providing a rationale for your ranking. *(6 marks)*

b) List the pertinent history questions to ask in this case **and** describe how **each** question would be useful to differentiate or rank your differential diagnoses. *(8 marks)*

The physical examination identifies an engorged *Ixodes holocyclus* tick on the dog.

c) Briefly describe the pathophysiology of tick paralysis, secondary to *Ixodes holocyclus*, **and** assign the patient an accurate neuromuscular score. *(3 marks)*

You plan to treat the dog with tick anti-toxin serum (TAS).

d) Describe the reported methods of TAS dose calculation **and** briefly discuss the evidence favouring a particular method. *(4 marks)*

e) Describe **four (4)** potential immunologic mechanisms of TAS adverse reactions using a standard classification scheme for hypersensitivity reactions. Include the clinical characteristics of those adverse reactions. *(17 marks)*

Based on inadequate oxygenation and ventilation, you intubate your patient and commence mechanical ventilation. Once the patient has stabilised, you elect to perform a temporary tracheostomy.

f) Describe in detail an appropriate surgical approach to temporary tracheostomy. *(10 marks)*

Continued over page

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

Note that this question includes different case scenarios.

a) Describe the most appropriate approach to managing a patient with suspected oligo-anuria, and its associated consequences, in a veterinary patient with acute kidney injury (AKI). Describe the mechanisms of, rationale for, and recommended doses of any drugs that you list. *(32 marks*)

b) Twenty-four hours following a small intestinal resection and anastomosis for management of septic peritonitis, your canine patient with oliguric AKI has visible abdominal distension. You are concerned that the dog could have abdominal compartment syndrome (ACS).

Briefly describe the pathophysiology and classification of ACS in this case; explain how the diagnosis should be confirmed **and** how the condition should be treated? *(9 marks)*

c) A dog is referred to you 48-hours after being hit by a car. He has become progressively lethargic and has not been observed to urinate, despite IV fluid resuscitation from shock and normal hydration. Uroabdomen is your primary differential diagnosis.

Contrast your initial management approach to this patient with the AKI approach in question 3 a). Your response should address diagnostic and treatment approaches, including a description of surgical decision making.

(7 marks)

Continued over page

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

Note that this question includes different case scenarios. The marks allocated for each sub-question are indicated.

a) Provide a systematic approach to the differential diagnoses for, **and** management of, patient-ventilator dyssynchrony (PVD). (*30 marks*)

b) An arterial blood sample is collected from a dyspnoeic dog prior to the commencement of oxygen supplementation, at sea level. The measured values are listed in the table below.

Calculate and interpret the dog's A-a gradient and PaO_2/FiO_2 ratio. *(9 marks)*

Parameter	**Units**	**Result**	**Reference range**
Na	mmol/L	149	136–154
K	mmol/L	3.3	3.4–5.3
Cl	mmol/L	118	100–117
iCa	mmol/L	1.22	1.12–1.42
Gluc	mmol/L	5.7	3.6–6.2
Lactate	mmol/L	0.7	0.5–2.0
pH		7.420	7.36–7.44
PaO_2	mmHg	34.5	90–100
$PaCO_2$	mmHg	46.8	36–44
HCO_3	mmol/L	21.8	24–26
BEecf	mmol/L	-1.9	-2.3 to -0.1
Anion gap	mmol/L	12.2	8–21
Hgb	g/L	9.2	11.6–18.3

c) Compare non-depolarising with depolarising neuromuscular blockers **and** provide relevant clinical example(s) of **each**. (*7 marks*)

d) Briefly describe **two (2)** methods for monitoring neuromuscular blockade in a ventilated patient. (*2 marks*)

Continued over page

5. You are treating a 21-week-old, 10 kg, male, entire Staffordshire bull terrier puppy as an in-patient for gastroenteritis. The puppy has been vaccinated with a modified live vaccine for parvovirus at approximately 8 and 12 weeks of age. The puppy tested negative on an in-house parvovirus test at the time of admission. A faecal multiplex polymerase chain reaction (PCR) was submitted at the time of presentation and the results (below) became available on day two of hospitalisation.

Canine faecal multiplex PCR

Bacteria	PCR result (N / D)
Salmonella species	N
Campylobacter species	N
Clostridium perfringens (A)	D

Parasite	
Giardia species	N
Cryptosporidium species	N

Viral	
Parvovirus	D
Canine coronavirus	N
Canine distemper virus	N

Note:
[N] Not detected
[D] Detected
[DL] Detected low levels

Answer **all** parts of this question:

a) Explain the pathogenesis of canine parvovirus infection in dogs and how this, in turn, affects clinical findings, diagnostic test results and treatment. *(10 marks)*

b) Explain, including consideration of test methodology, why the in-house test for parvovirus may be negative, while the faecal PCR is positive for parvovirus. *(2 marks)*

c) Discuss the role of antibiotic therapy in dogs with parvovirus. *(4 marks)*

d) Discuss the potential benefits of placing a nasogastric feeding tube in a puppy with parvovirus gastroenteritis. *(3 marks)*

Question 5 continued over page

e) Briefly explain **three (3)** techniques that you can use to assess the correct placement of a nasogastric tube. *(3 marks)*

f) List **three (3)** prokinetic drugs, their mechanisms of action **and** dosing schedules in dogs. (*9 marks)*

g) Discuss the potential advantages **and** disadvantages of the use of metronizadole in treating dogs with diarrhoea. *(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 a recent study that investigated an outpatient protocol for the care of dogs with parvovirus gastroenteritis. *(4 marks)*

End of paper