



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2021

Equine Medicine

Paper 1

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

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

Answer **ALL EIGHT (8)** questions

All eight (8) questions are of equal value

Answer **EIGHT (8)** questions, each worth 30 marks.....total 240 marks

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Paper 1: Equine Medicine

Answer all eight (8) questions

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

- a) Describe the gastric mucosal barrier function in the stomach of adult horses as it pertains to protection of the mucosa from acid-induced injury. (10 marks)
- b) Contrast and compare gastric ulcer disease in adult horses (equine gastric ulcer syndrome; 'EGUS') and foals/weanlings (gastroduodenal ulcer disease; 'GDUD') in terms of risk factors, mechanisms of gastrointestinal mucosal injury, location of lesions, clinical signs and prognosis. (20 marks)

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

- a) Outline the mechanisms by which administration/ingestion of the following substances may result in acute kidney injury in horses or foals. (6 marks)
 - i. Gentamicin
 - ii. Vitamin K3
 - iii. Oak (*Quercus* spp.) leaves or acorns.
- b) Describe **four (4)** mechanisms by which acute kidney injury may occur in an adult horse presenting to a referral hospital for treatment of acute colitis and systemic inflammatory response syndrome. (8 marks)
- c) Describe the diagnostic approach to a horse presenting to a clinic for further investigation of suspected acute kidney injury. You can assume there is access to a well-equipped hospital and laboratory with no financial limitations associated with the case. (8 marks)
- d) Discuss the treatment of acute kidney injury in horses. (8 marks)

Continued over page

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

- a) List the classifications of shock and include a brief outline of their pathogenesis. (5 marks)
- b) List the determinants of oxygen delivery to tissues. How does the body respond to depletion of effective circulating blood volume? (10 marks)
- c) List the options for volume expansion in the horse. For each option, outline the mechanism of action. (5 marks)
- d) Compare and contrast the mechanisms used to monitor effective volume expansion. (10 marks)

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

- a) Compare and contrast normal triglyceride metabolism and the derangements in lipid metabolism that results in hyperlipaemia. A diagram may be used. (15 marks)
- b) Outline the physiological basis for the treatment of a pony with hyperlipaemia. (15 marks)

Continued over page

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

- a) List the clinical signs of Horner's syndrome. (5 marks)
- b) Define the underlying neurological deficit in Horner's syndrome and list the common aetiologies in the horse. (5 marks)
- c) Describe and/or illustrate the neuroanatomic pathway that is involved in Horner's syndrome. (10 marks)
- d) Describe how neurological assessment can help to localise the site of the lesion. (10 marks)

6. Purpura haemorrhagica is an acute, immune-mediated, potentially fatal disease of horses.

Answer **all** parts of this question:

- a) List the characteristic microscopic lesion identified on histopathology in horses with purpura haemorrhagica. (2 marks)
- b) Define the type of hypersensitivity reaction (I, II, III or IV) that occurs in purpura haemorrhagica, outline the immunologic processes that occurs in this type of hypersensitivity reaction, and list one other disease that is caused by the same type of hypersensitivity reaction in horses. (4 marks)
- c) List **five (5)** primary infectious diseases that have been implicated as an inciting cause of purpura haemorrhagica in horses. (5 marks)
- d) Identify the antibiotic agent of choice for treatment of purpura haemorrhagica and justify your choice. (3 marks)

Question 6 continued over page

- e) For both:
- dexamethasone and
 - azathioprine,

describe: *(16 marks total; 8 marks per drug)*

- i. the mechanism of action
- ii. the route(s) of administration
- iii. potential adverse effects associated with their administration
- iv. steps than can be taken to reduce the risk of adverse effects eventuating.

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

- a) Describe the pathophysiological mechanisms in the development of uveitis in the horse. *(20 marks)*
- b) The treatment of uveitis includes the administration of atropine topically onto the affected eye. In the horse, how does knowledge of atropine ophthalmic pharmacology and ocular response to atropine administration assist in monitoring the progression of a therapeutic plan? *(10 marks)*

Continued over page

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

- a) Define the following terms and provide an example of each: *(6 marks)*
- i. intrinsic antimicrobial resistance
 - ii. extrinsic (acquired) antimicrobial resistance.
- b) Describe the **four (4)** mechanisms by which microbes are resistant to antimicrobials. *(8 marks)*
- c) Describe how genes conferring resistance can be acquired or transferred. *(6 marks)*
- d) Discuss in detail risk factors, manifestations and diagnosis of methicillin resistant *Staphylococcus aureus* infections (MRSA) in the horse. Include risk factors for colonisation in horses and humans. *(10 marks)*

End of paper



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Paper 2

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Answer **ALL EIGHT (8)** questions

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Paper 2: Equine Medicine

Answer all eight (8) questions

1. For each disease listed below in a)-c), answer each of the following questions:

- List **two (2)** medications that may be used in treatment of each disease and describe their mechanism of action. *(4 marks per disease)*
- Design a diet for a 12-year-old gelding used for low level eventing who has been diagnosed with each disease, justifying your choice of feedstuffs in relation to the pathophysiology of the disease. *(6 marks per disease)*

- a) Equine asthma.
- b) Right dorsal colitis (RDC).
- c) Hyperkalaemic periodic paralysis (HYPP).

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

- a) List **two (2)** enzymes which may be elevated in the serum of horses with rhabdomyolysis and list the half-life of each enzyme. *(2 marks)*
- b) List **three (3)** plants which can cause toxic myopathies and **three (3)** infectious agents which can cause acute myopathies in horses. *(6 marks)*
- c) Compare and contrast atypical myopathy and marshmallow weed (*Malva parviflora*) toxicity in terms of proposed mechanisms of toxicity, risk factors, clinical presentation (clinical signs, physical examination findings, diagnostic test findings etc) and prognosis. *(22 marks)*

Continued over page

3. A six-year-old Thoroughbred mare presents to your hospital for evaluation of acute colic and inappetence. You are the first veterinarian to examine her for this problem. She does not receive any medications prior to presentation and travels two hours via truck to get to your clinic.

On presentation the mare is not showing active signs of colic. She is quiet, alert and responsive. Her heart rate is 56 beats per minute, her respiratory rate is 12 breaths per minute and her temperature is 39.1°C. Her mucous membranes and sclera are icteric. Her capillary refill time is less than two seconds and she has slightly prolonged skin tent and jugular refill times. Auscultation of her thorax reveals the presence of normal heart and lung sounds. Auscultation of her abdomen reveals moderately decreased frequency of the borborygmi in all four quadrants. A normal ileocaecal flush is heard. Her digital pulses are within normal limits in all four limbs. She does not have any nasal or ocular discharge. She passes a small pile of soft formed faeces and a short stream of dark orange urine during physical examination. Her blood lactate is 3.7 mmol/L.

Answer **all** parts of this question:

- a) List **four (4)** differential diagnoses for this mare based on her history and physical examination findings. *(4 marks)*

You submit a blood sample for a complete blood count and serum biochemistry panel on admission and the results are on the following pages:

Question 3 continued over page

Haematology

Parameter	Units	Result	Reference range
Red blood cell count	x 10 ¹² /L	10	6.0–12.0
Haemoglobin	g/L	157	130–174
Haematocrit	L/L	0.46	0.35–0.47
MCV	fL	46	38–49
MCH	Pg	16	13–16
MCHC	g/L	339	300–390
White blood cell count	x 10 ⁹ /L	10.8	6.0–12.0
Neutrophils	x 10 ⁹ /L	8.21	2.47–7.0
Lymphocytes	x 10 ⁹ /L	2.16	1.63–4.4
Monocytes	x 10 ⁹ /L	0.43	0.0–0.72
Eosinophils	x 10 ⁹ /L	0.0	0.0–0.96
Basophils	x 10 ⁹ /L	0.0	0.0–0.36
Platelets	x 10 ⁹ /L	148	100–350
Fibrinogen	g/L	3	2–4

Question 3 continued over page

Serum biochemistry

Parameter	Units	Result	Reference range
Sodium	mmol/L	138	136–142
Potassium	mmol/L	3.3	3.0–4.4
Chloride	mmol/L	93	95–106
Calcium	mmol/L	3.11	2.78–3.32
Phosphate	mmol/L	1.14	0.92–1.38
Magnesium	mmol/L	0.84	0.73–0.91
Glucose	mmol/L	4.6	4.5–6.3
Urea	mmol/L	3.8	3.7–7.0
Creatinine	µmol/L	77	70–160
Total bilirubin	µmol/L	301	17–48
Alkaline phosphatase	U/L	639	<200
Aspartate aminotransferase	U/L	2089	<350
Gamma glutamyltransferase	U/L	120	<22
Creatine kinase	U/L	260	<350
Total protein	g/L	73	55–65
Albumin	g/L	36	29–37
Globulin	g/L	37	13–37

- b) Interpret the above laboratory results and provide a revised differential diagnosis list. (10 marks)
- c) Describe four additional diagnostic tests you would like to perform in this horse and provide justification for the selection of each test. (12 marks)
- d) Describe the technique of percutaneous liver biopsy in the adult horse. (4 marks)

Continued over page

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

- a) You own a referral equine hospital that offers a broad spectrum of inpatient and outpatient care for medical, surgical and reproductive conditions in horses of all ages, breeds and disciplines. You employ 40 staff including veterinarians, veterinary nurses, administrative staff and stable staff. You note a subjective increase in inpatients with soft manure and fevers over the period of a fortnight and have six horses return positive *Salmonella* faecal culture results during this time.

Describe in detail and justify the immediate biosecurity measures you would put in place to reduce the risk of transmission of *Salmonella* throughout your hospital and the steps you would take to investigate whether or not nosocomial transmission of *Salmonella* had already occurred. (15 marks)

- b) You are asked to design a testing protocol for a racing stable housing 40 thoroughbreds in training which has had two horses diagnosed with *Streptococcus equi* *ss equi* (strangles) in the past week. The local racing authority has stated that no horse from the stable will be allowed on to their racetracks to train or race until they are declared 'free from strangles' by their regulatory veterinarian, to whom you will provide clinical records and test results for review.

Describe and justify your proposed protocol in detail, including a discussion of the sensitivity and specificity of at least **three (3)** currently available laboratory tests used for diagnosis of strangles in Australia. (15 marks)

Continued over page

5. An 11-month-old Australian stock horse colt in poor body condition (BCS 3/9) presents for investigation of lethargy, inappetence, pyrexia, weight loss and panhypoproteinaemia. The colt was first examined by the referring veterinarian 10 days ago when the owner noticed the colt to be dull and intermittently lying in lateral recumbency. Haematological and blood biochemical examination by the referring veterinarian revealed a marked left shift and marked hypoproteinaemia. Treatment with systemic antimicrobials (procaine penicillin and gentamicin) and flunixin (0.5mg/kg IV SID) was commenced. There was minimal response to treatment and ventral oedema developed in all four distal limbs and the serum total protein concentration decreased further. No diarrhea has been noted by the owner.

The colt has been dewormed three times since birth with Ivermectin. Faecal egg counts are not routinely performed on the farm and an interval drenching regimen is used for all horses on the farm. The colt is housed in a paddock with other yearlings and they are fed together. The farm has previously had foals diagnosed with *Rhodococcus equi* pneumonia with one foal severely affected two years ago and subjected to euthanasia.

Clinical examination at the time of presentation reveals obtunded mentation, marked peripheral oedema and mild tachycardia (heart rate 52 beats per minute). Other cardinal signs recorded are within normal limits.

Haematological and blood biochemical examination yield the following results:

Haematology

Parameter	Units	Result	Reference range
Red blood cell count	x 10 ¹² /L	7.10	6.5–12.5
Haemoglobin	g/L	106	110–190
Haematocrit	L/L	0.33	0.32–0.52
MCV	fL	43.0	34.0–58.0
MCH	Pg	15.0	12.3–19.7
MCHC	g/L	353	310–370
White blood cell count	x 10 ⁹ /L	34.0	5.5–12.5
Neutrophils	x 10 ⁹ /L	31.0	2.5–8.0
Lymphocytes	x 10 ⁹ /L	1.7	1.5–5.5
Monocytes	x 10 ⁹ /L	1.3	0.0–0.90
Eosinophils	x 10 ⁹ /L	0.3	0.0–0.80
Basophils	x 10 ⁹ /L	0.0	0.0–0.30
Platelets	x 10 ⁹ /L	250	100–500
Fibrinogen	g/L	4.0	1.0–4.0

Question 5 continued over page

Biochemistry

Parameter	Units	Result	Reference range
Total protein	g/L	28.0	58–76
Albumin	g/L	9.0	28–38
Globulin	g/L	19.0	26–40
A:G ratio		0.5	0.8–1.9
Urea	mmol/L	6.4	3.6–8.9
Creatinine	µmol/L	99.0	81–164
Bilirubin	µmol/L	13.4	4–100
AST	U/L	135.0	150–400
CK	U/L	792	50–400
GGT	U/L	<1	20.0–38.0
GLDH	U/L	0	0.0–48
Triglycerides	mmol/L	0.28	0.2–20.0
Glucose	mmol/L	6.0	3.5–6.5
Sodium	mmol/L	124	132–152
Potassium	mmol/L	3.5	2.8–5.0
Na:K ratio		35.0	>29.0
Anion gap	mmol/L	9.5	8–20
Chloride	mmol/L	88.0	98–110
Bicarbonate	mmol/L	30.0	23.0–32.0
Calcium	mmol/L	2.28	2.5–3.6
Phosphorus	mmol/L	0.62	0.8–1.7
Ca:Phos ratio		4.0	1.8–3.8

Faecal egg count results

Stronglyes	Oxyuris	Parascaris	Tapeworm	Coccidia
20	0	60	0	0

Counts performed to 20 e.p.g. detection method

Flotation fluid: saturated MgSO₄, S.G.–1.28

Numbers denote eggs per gram of faeces

Question 5 continued over page

Answer **all** parts of question 5:

a) Answer **both** sub questions:

i. Interpret the clinical examination findings and haematology and blood biochemistry results. *(10 marks)*

ii. List the major differential diagnoses in this case. *(5 marks)*

b) Interpret the FEC results and discuss their significance in light of the clinical history and presenting clinical signs in this case. *(5 marks)*

c) List the further diagnostic tests you would perform in this case. Include in your answer justification for performing each test. *(10 marks)*

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

a) Describe the approach to resuscitate a foal born following a prolonged dystocia; Include equipment required and medications utilised (including dosages). Assume this occurred in a well-equipped hospital. *(10 marks)*

b) Discuss using room air versus 100% oxygen in the resuscitation of a newborn foal. *(5 marks)*

c) Examine the following haematology and biochemistry results from a two-day-old septic foal which is being treated in hospital with intravenous fluids (Hartmanns), partial parenteral nutrition, antimicrobials and intra-nasal oxygen. Comment on the possible aetiology, clinical significance and treatment modification indicated for these abnormalities. *(15 marks)*

Question 6 continued over page

Haematology

Parameter	Units	Result	Reference range	
			Hot blood	Hot blood
Haemoglobin	g/dL	8.2	11.7–16.5	11.8–17.6
PCV	L/L	0.26	0.34–0.46	0.31–0.44
Red cell count	$\times 10^{12}/L$	5.5	8.8–11.0	7.8–9.6
MCV	fL	48	37–49	35–42
MCH (Hb/RCC)	Pg	15		
MCHC	g/dL	31	31–38	35–40
White cell count	$\times 10^9/L$	19.4	4.5–11.5	7.2–13.5
Atypical cells	$\times 10^9/L$		0	0
Metamyelocytes	$\times 10^9/L$		0	0
Bands	$\times 10^9/L$		0	0
Neutrophils	$\times 10^9/L$	18.4	3.0–9.6	5.0–10.7
Lymphocytes	$\times 10^9/L$	1.0	0.6–2.1	1.0–3.8
Monocytes	$\times 10^9/L$		0.05–0.4	0.02–0.4
Eosinophils	$\times 10^9/L$		0.0–0.1	0.0–0.1
Basophils	$\times 10^9/L$		0.0–0.04	0.0–0.2
Platelets	$\times 10^9/L$	361	125–390	98–385
NRBC	/100		0	0
Total solids	g/L	34	51–77	51–75
Fibrinogen	g/L	4.4	1.1–4.5	1.6–4.2
Foal IgG	mg/dL	<400		
Comments: none				

Question 6 continued over page

Biochemistry

Parameter	Units	Result	Reference range
Sodium	mmol/L	128	133–150
Potassium	mmol/L	2.7	3.0–5.3
Chloride	mmol/L	97	97–109
Calcium	mmol/L	2.31	2.50–3.15
Phosphate	mmol/L	1.0	0.8–1.8
Urea	mmol/L	3.9	3.6–8.9
Creatinine	mmol/L	0.10	0.11–0.17
Glucose	mmol/L	13.8	3.4–6.7
Total bilirubin	μmol/L	26	0–40
Conjugated	μmol/L		0–10
GLDH	U/L	3	
AP	U/L	473	40–400
GGT	U/L	16	
AST	U/L	115	150–400
CK	U/L	183	50–400
Total protein	g/L	29	58–76
Albumin	g/L	16	28–38
Iron	μmol/L	26	13–25
Triglycerides	mmol/L	0.2	0.1–0.9

Comments: *adult reference values

Red cell morphology: anisocytosis ++, macrocytosis +

White cell morphology: normal

Continued over page

7. A three-day-old Thoroughbred foal presents to your well-equipped veterinary hospital for further evaluation and treatment of acute onset respiratory distress. The foal was able to stand but tired quickly. The foal's heart rate was 120 beats per minute and respiratory rate was 92 breathes per minute. Thoracic auscultation revealed harsh bronchovesicular lung sounds.

Answer **all** parts of this question:

- a) Interpret these admission arterial blood gas results. (5 marks)

Parameter	Result	Reference range
pH	7.07	7.3–7.45
PaCO ₂	68.9	35–49 mmHg
PaO ₂	60.6	70–90 mmHg
HCO ₃	26.6	26–32 mmol/L
Glucose	2.1	6.7–12 mmol/L
Lactate	8.2	<2.5 mmol/L

- b) Compare and contrast acute lung injury and acute respiratory distress, including the underlying pathophysiology. (10 marks)
- c) List possible differential diagnoses for this foal and discuss diagnostics utilised to differentiate the differential diagnoses. (15 marks)

Continued over page

8. A two-day-old Thoroughbred foal presents to your intensive care unit for treatment and management of sepsis. The foal weighs 52 kilograms and is unable to stand and nurse.

Answer **all** parts of this question:

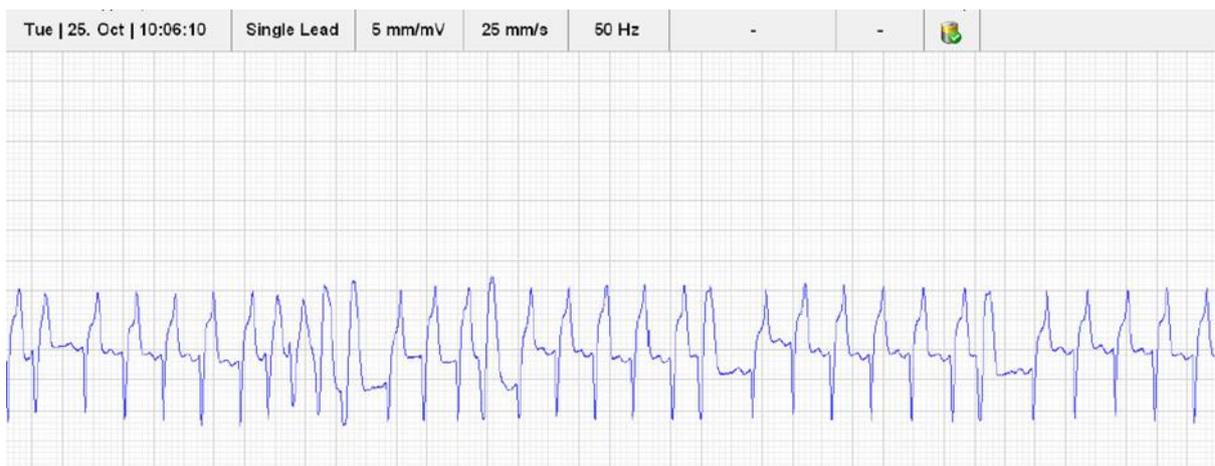
- a) Describe and justify the/your plan for fluid and electrolyte supplementation over the first 24 hours. Assume there are no cost constraints. *(6 marks)*

Following 12 hours of fluid therapy the foal is tolerating 200ml of mare's milk via NGT. Blood gas analysis demonstrates a fall in potassium concentration from 4.2 to 2.4 mmol/L, and an increase in glucose from 3.0 to 5.2 mmol/L. Lactate has dropped from 9.0 to 5.0 mmol/L.

- b) Outline how movement of potassium between the intracellular and extracellular space is affected by pH. *(2 marks)*
- c) Outline how movement of potassium between the intracellular and extracellular space is affected by glucose administration. *(2 marks)*
- d) Outline an ongoing plan for potassium supplementation in this foal over the next 12 hours. *(3 marks)*

Question 8 continued over page

Following another 24 hours of hospitalisation the foal has a potassium of 8.0 mmol/L, a glucose of 6.0mmol/L and a lactate of 4 mmol/L. The heart rate is 120 beats per minute and there is an irregular heart rhythm. The following ECG recordings (Lead II) are obtained:



- e) Describe the rhythm irregularities in the above ECG recordings and the potential clinical outcome. (5 marks)
- f) Describe the ECG features that can be associated with hypokalaemia and hyperkalaemia. (4 marks)
- g) Outline your plan for emergency treatment of the rhythm abnormality in the previous images. Give reasons for your choices. (8 marks)

End of paper