



Australian and New Zealand College of Veterinary Scientists

Membership Examination

June 2013

Veterinary Anaesthesia and Critical Care Paper 1

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL FOUR (4)** questions

Answer **FOUR** questions each worth 30 markstotal 120 marks

Paper 1: Veterinary Anaesthesia and Critical Care

Answer all four (4) questions

1. Fluid therapy is commonly used in veterinary science and represents an important part of anaesthetic management. Using your knowledge of the distribution of total body water, answer **all** of the following:
 - a) Describe or draw a diagram to illustrate the distribution of total body water into fluid compartments in mammalian species. Include in your answer **approximate** percentage distribution of water, the distribution of major electrolytes in each fluid compartment and a description of the barriers between each compartment. *(10 marks)*
 - b) Classify the following fluids (including the class and subclass of fluids in which they belong). *(5 marks)*
 - i. 7% sodium chloride
 - ii. fresh frozen plasma
 - iii. lactated Ringers solution
 - iv. pentastarch
 - v. dextrose 5% in water (D5W).
 - c) For **three (3)** of the fluids you have classified in Question 1b) above, describe the distribution of the water (contained in the fluid) and its components throughout body fluid compartments. For quantification purposes, assume that 100 mL of each fluid has been administered via the intravascular space. *(15 marks)*

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2. Anaesthetic breathing systems are an essential part of the anaesthetic machine, and selection of the correct circuit for your patient with an appropriate fresh gas flow rate is crucial. With respect to this statement and the two main classifications of breathing systems (rebreathing and non-rebreathing), answer **all** of the following:
- a) Name **two (2)** breathing circuits in **each** classification. (2 marks)
 - b) Using the four breathing systems you have identified in Question 2a) above, compare and contrast the two rebreathing systems with each other and also compare and contrast the two non-rebreathing systems with each other. Highlight **each** system's advantages and disadvantages. Do not specify the flow rate/s of oxygen used for each circuit as part of your comparison; focus on how the circuits function and what makes the circuits physically different from one another. (10 marks)
 - c) Choose **one (1)** breathing system from each classification, i.e. one rebreathing and one non-rebreathing system, and:
 - i. State the flow rate of oxygen you would choose at the start of an anaesthetic period (immediately after the intravenous agent induction of anaesthesia and intubation of the trachea); and for **each** circuit explain why you have chosen that flow rate. For the rebreathing circuit assume the vaporiser is positioned out of the breathing system (i.e. is a VOC). (6 marks)
 - ii. State whether you would change the flow rate at any stage during the anaesthetic period. If so, indicate what you would change it to. (4 marks)
 - d) When using a non-rebreathing system, state the main problem that occurs if you use lower flow rates than those you have identified, and explain why this happens. Provide **two (2)** examples of indicators that would allow you to identify that this problem is occurring. (4 marks)
 - e) For some rebreathing systems the vaporiser can be positioned inside (VIC) or outside (VOC) the breathing circuit. Briefly discuss the change in anaesthetic depth that will occur in a patient when the fresh gas flow rate is altered either up or down using either a VIC or VOC. (4 marks)

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3. Premedication is an important part of the anaesthetic management of veterinary species.
- a) Identify the advantages and disadvantages of premedication. (5 marks)
 - b) Identify the classes of drugs used for premedication of cats and dogs, and give at least **one (1)** example of **each** class. (3 marks)
 - c) Name **one (1)** specific agent or drug from **each** of four of the classes identified in Question 3 b) above. Compare (in a table form) the reason for using the agent in the premedication period; the general effect each agent has on the respiratory and cardiovascular systems (i.e. is the agent depressant, stimulatory or is there minimum effect); and the basic pharmacological properties of the agent. (12 marks)
 - d) Describe the more specific effects each agent has on the cardiopulmonary system and any contraindications or precautions for the use of the agent (ensure you provide justifications for the contraindications). (10 marks)
4. Halogenated anaesthetic agents are used for the maintenance of anaesthesia in domestic species. Over the last 20 years, three main inhalational agents (halothane, isoflurane and sevoflurane) have predominated.
- a) Identify the minimum alveolar concentration (MAC), blood: gas partition coefficient (solubility in blood), and saturated vapour pressure of **each** of the three main inhalant anaesthetic agents. (7.5 marks)
 - b) Using relevant pharmacokinetic, pharmacodynamic and physiological data compare and contrast the advantages and disadvantages isoflurane has over halothane. (10 marks)
 - c) Using the same criteria you have identified in Question 4b) above, critically evaluate for routine use, sevoflurane as a replacement for isoflurane in general veterinary practice. (7.5 marks)
 - d) Compare and contrast, for the maintenance of anaesthesia, inhalational anaesthetics versus the emulsion formulation of propofol (milky propofol) used as a constant rate infusion or by intermittent bolus administration. (5 marks)

End of paper



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Answer **ALL FOUR (4)** questions

Answer **FOUR** questions each worth 30 markstotal 120 marks

Paper 2: Veterinary Anaesthesia and Critical Care

Answer all four (4) questions

1. A two-year-old female spayed 18 kg cross-bred dog is presented to your clinic on Monday evening after a weekend of being looked after by the client's teenage children (who had several friends to stay). The dog was perfectly well when the client left on Friday but she has been anorexic and dull since Saturday evening and vomiting since Sunday. She has to be carried into the consult room and on examination has tacky mucous membranes, reduced skin turgor and her third eyelids are prolapsed. She has a heart rate of 100 bpm (which is regular and there are no murmurs present), regular pulse rate but somewhat weak pulse pressure, a rectal temperature of 37.6°C. Her mucous membranes appear pale and she has a capillary refill time of greater than two seconds. She is tachypnoeic (RR = 40 bpm) and moderately dyspnoeic and has an enlarged abdomen with a visible fluid wave. There is a well-circumscribed bruise at the caudoventral aspect of the abdomen. Immediately after the initial examination you place an intravenous catheter and take a sample of venous blood for complete blood count and biochemical analysis (results are given in the Table 1 below).
 - a) Based on the results on the clinical examination and blood results, identify the hydration and haemodynamic status of your patient and describe your fluid therapy plan for the next twelve hours. Include in your answer, quantification of the fluid deficits, the fluid or fluids you would use and rate/s of administration for that first twelve hours. (10 marks)
 - b) Describe the main fluid types that can cause distended abdomen in dogs and cats. Describe how you would differentiate between them. Indicate the most likely fluid in this case. (6 marks)

Question 1 continued over page

Table 1:

	Value	Reference Range	Unit
RBC	15.8	(6.0–15.0)	x 10¹²/L
HB	190	(120–180)	g/L
HCT	0.58	(0.37–0.55)	L/L
MCV	65	(60–77)	fL
MCH	22	(20–25)	pg
MCHC	315	(310–340)	g/L
Reticulocytes	10	< 60	x 10 ⁹ /L
Platelets	268	(200–600)	x 10 ⁹ /L
WBC	20.6	(6.0–15.0)	x 10⁹/L
Seg Neuts	15.5	(3.6–11.5)	x 10⁹/L
Lymph	3.2	(1.0–4.8)	x 10 ⁹ /L
Mono	1.5	(0.18–1.5)	x 10 ⁹ /L
Eosin	0.4	(0.12–1.5)	x 10 ⁹ /L
Red blood cell and leucocyte morphology appears normal			
ALP	65	(0–185)	IU/L
ALT	55	(0–58)	IU/L
AST	30	(0–80)	IU/L
Amylase	345	(170–174)	IU/L
Bilirubin	3	(0–6)	mmol/L
Ca	2.3	(2.05–2.66)	mmol/L
PO4	1.5	(0.8–1.6)	mmol/L
Cholesterol	4.5	(3.2–9.3)	mmol/L
CK	760	(0–800)	IU/L
Urea-N	35	(2.5–8.4)	mmol/L
Creatinine	288	(75–138)	mmol/L
Glucose	3.8	(3.2–6.5)	mmol/L
Albumin	44	(28–35)	g/L
Globulins	45	(17–39)	g/L
Total protein	89	(62–85)	g/L
Alb:Glob ratio	0.98	(0.7–2.1)	
K	7.9	(3.6–5.6)	mmol/L
Na	139 L	(141–155)	mmol/L
Na:K ratio	17.59 L	> 21	

Question 1 continued over page

- c) Based on the clinical presentation of this patient and the blood results provided, describe the medical management/stabilisation (do not detail any surgical intervention) of the patient during fluid resuscitation and during or after diagnosis of the fluid type present in the abdomen. Include in your answer any sedation and or anaesthetic protocols you would use should anaesthesia be indicated. *(14 marks)*
2. Arterial blood gas analysis is a monitoring technique used most commonly in anaesthesia and critical care as the 'gold standard' for assessment of acid/base balance and/or pulmonary function.
- a) Describe the technique you would use for arterial blood gas sampling. Include in your answer disadvantages of assessing acid/base balance and pulmonary function by this technique and provide alternative ways to obtain similar information. *(10 marks)*
- b) Indicate the **five (5)** main parameters reported by blood gas analysing equipment. *(2.5 marks)*
- c) For **each** of the **five (5)** parameters identified in Question 2 b) above, write a table giving the normal range (or single number) for a non-anaesthetised/non-sedated, 'healthy' dog, cat and horse, each breathing room air. *(7.5 marks)*
- d) Describe how the blood gas results would differ (direction of change) from the normal range in a dog with **each** of the following conditions. For **each** change you have identified please ensure you justify your answer.
- i. anaesthetic induced hypoventilation *(5 marks)*
 - ii. chronic pulmonary disease with severe hypoxia and subsequent lactic acid accumulation. *(5 marks)*

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3. Please answer the following questions relating to anaesthesia of large animal species. For both parts a) and b), assume you have access to full surgical facilities including hospital boxes/yards and appropriate anaesthetic equipment.
- a) A 12-year-old, 550 kg, 10-month pregnant Thoroughbred mare is presented for anaesthesia and surgical correction of a uterine torsion via midline laparotomy.
- i. Describe how you would respond in your anaesthetic management to the most common pathophysiological abnormalities you might encounter in this case. *(7.5 marks)*
 - ii. Explain the anaesthetic monitoring techniques and equipment you would ideally choose and the pathophysiological abnormalities that would likely be apparent from your monitoring in such a case. *(7.5 marks)*
- b) A four-year-old, 800 kg, prize winning Friesian bull presents with a penile hematoma requiring surgery. Apart from the hematoma the animal has no other health problems.
- i. Describe a suitable preanaesthetic management plan. Include in your answer drugs you would choose for the premedication and induction phases of anaesthesia and list specific advantages and disadvantages for all drugs you have chosen. *(10 marks)*
 - ii. Briefly discuss your recommendations for intraoperative and postoperative analgesic management of this case. Identify drugs you would use (stating advantages and disadvantages) and include any specific techniques in your answer. *(5 marks)*

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4. An 18-year-old, 3.5 kg, male, domestic shorthaired cat is presented to you for a dental procedure, which will include dental extractions. On presentation the cat is in relatively good health but is in thin body condition (body condition score of 3/9) and is notably tachycardic (heart rate of 220 bpm) with a regular rhythm. The clients are not keen to spend too much money on preanaesthetic workup, can only afford limited blood work and have declined further diagnostics. Using your knowledge of feline health issues answer **all** of the following:
- a) Identify all specific anaesthetic concerns and considerations you have for this patient. *(5 marks)*
 - b) Assign an anaesthetic risk using the ASA guidelines. *(1 mark)*
 - c) Design an anaesthetic protocol for this cat. Include in your answer specific drugs you would use in the premedication, induction and maintenance period as well as drugs you would specifically contraindicate or avoid and justify why. *(10 marks)*
 - d) Describe the anaesthetic management of this case, what complications you expect to encounter and how you would go about managing those. *(14 marks)*

End of paper