



Australian and New Zealand College of
Veterinary Scientists

Fellowship Examination

June 2022

Veterinary Oncology

Paper 1

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

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

Answer **ALL EIGHT (8)** questions

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

Paper 1: Veterinary Oncology

Answer all eight (8) questions

1. Discuss the contributions and interactions of DNA replication, heritable factors, and environmental factors in cancer risk **and** carcinogenesis, using examples in companion animals to illustrate your answer. *(30 marks)*

2. Answer **all** parts of this question.
 - a) Describe the **two (2)** prominent theories proposed to account for tumour heterogeneity. *(14 marks)*

 - b) Provide an example that supports **each** of the theories. The example may be an observed aspect of tumour behaviour or research findings. *(2 marks)*

 - c) Provide **one (1)** example of a limitation of **each** theory. *(2 marks)*

 - d) List **three (3)** methods for identifying cancer stem cells. *(3 marks)*

 - e) Briefly discuss the implications of the presence of cancer stem cells (CSC) on current oncological treatment strategies. In your answer, describe mechanisms by which CSC are resistant to commonly used treatment modalities **and** list two treatment strategies for specifically targeting CSC. *(9 marks)*

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

- a) Define the pre-metastatic niche and describe the steps taken by the pre-metastatic niche to prepare for metastasis. *(15 marks)*
- b) Explain how extracellular vesicles can be used by cancer to develop a metastatic site. *(8 marks)*
- c) Describe the dominant type of macrophage present in tumours and its importance. List the main factors it produces and the combined effect on the environment. *(7 marks)*

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

- a) Discuss the differences between megavoltage and orthovoltage radiation. Include disease indications where megavoltage and/or orthovoltage delivery may be advantageous. *(8 marks)*
- b) Compare and contrast the planning and delivery for the following radiation techniques; 3D Computed Radiation Therapy, Intensity Modulated Radiation Therapy, and Brachytherapy. *(10 marks)*
- c) Contrast the causes of acute (or cyclic) and chronic hypoxia within a tumour. *(5 marks)*
- d) Briefly contrast the differences in pathophysiology between acute and late radiation adverse effects. *(7 marks)*

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

- a) Describe hypoxia-inducible factors (HIFs), their activation and promotion of tumour angiogenesis. There is no need to list proteins induced by HIF activation. *(12 marks)*
- b) Define metronomic chemotherapy and describe its proposed mechanisms of action. *(18 marks)*

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6. Describe the mechanism(s) of action, potential toxicities, metabolism/excretion and mechanism(s) of resistance for the following chemotherapy drugs.
- a) Vinblastine. *(10 marks)*
 - b) Mitoxantrone. *(10 marks)*
 - c) Chlorambucil. *(10 marks)*
7. Answer **all** parts of the question:
- a) Describe how cell cycle progression is mediated by the sequential activation and inactivation of cyclin dependant kinases (CDKs). Include in your answer their interaction with cyclins, CDK inhibitors, **and** the retinoblastoma protein. *(20 marks)*
 - b) List **two (2)** examples of cell cycle specific chemotherapy drug classes, including the phase in which they act. *(4 marks)*
 - c) List **two (2)** examples of cell cycle phase non-specific chemotherapy drug classes. *(2 marks)*
 - d) Describe the mechanism of action of the CDK inhibitor drug, Flavopiridol. *(4 marks)*
8. Answer **both** parts of the question:
- a) A research group asks your advice on whether to use a murine or canine model for mammary carcinoma. Discuss the advantages in using a canine model in general, and mammary carcinoma specifically. *(20 marks)*
 - b) A new biomarker has been found which has led to the development of a new monoclonal antibody. Briefly discuss the aim and structure of a phase III study **and** how an enrichment approach compares to the retrospective approach for targeted drugs. *(10 marks)*

End of paper



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Paper 2

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

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Answer **ALL EIGHT (8)** questions

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

Paper 2: Veterinary Oncology

Answer all eight (8) questions

1. An eight-year-old entire male Afghan hound was referred to you for evaluation of a 4 cm right-sided non-painful testicular mass. The patient presented to the referring veterinarian two weeks earlier for a complaint of lethargy and reduced appetite. There has been no further diagnostics performed or treatment to date. A neoplastic disease is considered most likely.

Answer **all** parts of this question:

- a) Discuss possible findings on physical examination that may support the diagnosis of testicular neoplasia. (6 marks)
- b) In addition to haematology, discuss the diagnostic tests that you would recommend in this case. (6 marks)
- c) The Afghan's scrotal mass was confirmed to be a testicular tumour on ultrasound. For the **three (3)** most common types of testicular tumours in dogs, list or tabulate the following: the tumour type, the tumour's prevalence relative to all dogs with testicular tumours, cellular origin of the tumour, potential for hormone production, associated paraneoplastic conditions and risk of metastasis. (12 marks)
- d) Haematology was performed (results below) prior to surgical removal of the testicular mass.. Other parameters were within normal limits. Briefly describe the pre-surgical considerations and therapies indicated in this dog. Include in your answer reference to prognosis. (6 marks)

HAEMATOLOGY

Parameter	Abbreviation	Units	Result	Reference range
Red Blood Cells		$\times 10^{12}/L$	2.9	4.9–8.2
Haemoglobin	Hb	g/L	66	100–206
Haematocrit	Ht	L/L	0.19	0.35–0.58
Reticulocyte percentage		%	0.9	0–1.5
Reticulocyte absolute count		$\times 10^9/L$	51	10–110
Platelet Count		$\times 10^9/L$	49	200–500
White Blood Cells	WBC	$\times 10^9/L$	3.9	4.5–17.0
Neutrophils		$\times 10^9/L$	1.1	3.5–12.0

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

- a) Define the sentinel lymph node. *(1 mark)*
- b) Briefly describe **two (2)** pre-operative sentinel lymph node mapping techniques, including their advantages and disadvantages or limitations based on your knowledge of the literature. *(7 marks)*
- c) Briefly describe **two (2)** intra-operative sentinel lymph node biopsy techniques, including their advantages and disadvantages or limitations. You must **not** describe the same technique used in the previous question. *(7 marks)*
- d) Discuss the rationale and justification of sentinel lymph node biopsy for canine mast cell tumours as a means of identifying metastatic disease. Include examples from the literature and indicate the potential impact on outcome. *(15 marks)*

3. A 10-year-old female spayed cocker spaniel presents with a 4 cm right-sided anal sac mass. Computed tomography of the thorax, abdomen and pelvis is performed and it reveals an enlarged right medial iliac lymph node measuring 3 cm diameter. Both the anal sac mass and lymph node are aspirated. Cytological analysis confirms metastatic anal sac carcinoma. No other metastatic disease found.

Answer **all** parts of this question:

- a) Define the clinical stage of this dog. *(1 mark)*
- b) With reference to the current literature, briefly discuss prognostic factors associated with apocrine gland anal sac adenocarcinomas. *(15 marks)*
- c) The dog has surgical excision of the primary mass (incomplete excision with solid pattern) as well as extirpation of the right medial iliac lymph node. Discuss whether toceranib phosphate therapy would be indicated in this dog. Justify your answer with reference to the literature. *(7 marks)*
- d) The dog has surgical excision of the primary mass (incomplete excision with solid pattern) as well as extirpation of the right medial iliac lymph node. Discuss whether radiation therapy would be indicated in this dog. Justify your answer with reference to the literature. *(7 marks)*

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4. Compare and contrast low- and high- grade forms of feline gastrointestinal lymphoma based on your understanding of the literature. Include your answer aspects of clinical presentation, diagnosis, treatment and prognosis. (30 marks)

5. Answer **both** parts of this question

a) Briefly describe the method of delivery of surgery, strontium 90 (Sr90), stereotactic radiotherapy (SRT), fractionated radiotherapy, phototherapy and bleomycin electrochemotherapy (ECT) when applied to feline nasal plane squamous cell carcinoma.(15 marks)

b) Compare and contrast the efficacy of the above treatment modalities with respect to treating cats with nasal planum squamous cell carcinoma of stage T1N0M0, T2M0M0 and T3N0M0, and justify your preferred treatment recommendation for each tumour stage. No other treatment options are to be considered in your answer.(15 marks)

6..Answer **both** part of this question:

a) A 12-year-old female spayed terrier presents with lower urinary tract signs, a mass in the apex of the bladder visible on ultrasound and a negative BRAF test result. Describe the impact of the BRAF test result on your diagnostic plan and justify your choice of next diagnostic step by comparing and contrasting options. Include in your answer, details on the sensitivity **and** specificity of the BRAF test. (15 marks)

b) A 13-year-old cross bred, female spayed dog presents with a histopathology-confirmed diagnosis of urethral carcinoma with marked stranguria for the last two weeks, and today she has a urethral obstruction. A urinary catheter has been placed. Discuss methods of maintaining urinary patency in this patient. . (15 marks)

7..A 10-year-old female Mastiff cross dog is presented following cytological and immunocytochemical diagnosis of stage IIIa ~~3A~~, multicentric large T-cell lymphoma. There are no cost constraints to consider when formulating a treatment plan for this patient.

Answer **both** parts for this question:

a) Briefly discuss commonly used chemotherapy protocols in the context of T cell lymphoma and indicate the most appropriate chemotherapy protocol for this patient. Justify your answer. (20 marks)

b) The above patient achieved complete remission; however, the disease has recurred one month after completion of therapy. Briefly discuss factors to

consider when selecting rescue therapy and indicate the most appropriate rescue protocol in this case. Justify your answer.

(10 marks)

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8. A nine-year-old female spayed mixed breed dog weighing 25 kg presents for a two-week history of abnormal mentation and acute onset seizure activity. Baseline haematology, biochemistry and urinalysis reveal no significant abnormalities and there is no history of potential neurotoxin exposure. Magnetic resonance imaging (MRI) of the neurocranium reveals an intra-axial mass in the left temporal lobe, presumed to be a glioma based on imaging characteristics, that measures 13 x 15 x 11mm. A moderate amount of peri-tumoural oedema is also noted on the MRI. Staging thoracic radiographs and abdominal ultrasound are both unremarkable. A cerebrospinal fluid tap revealed a mild pleocytosis with a total nucleated cell count of 10 cells/ μ L. The owner is keen to pursue treatment for this and asks you about the various options available with regards to radiotherapy. The Radiation Oncology service at your hospital has at its disposal a 300 kv orthovoltage unit and a 6 MV linear accelerator with intensity-modulated radiation therapy (IMRT) and volumetric modulated arc therapy (VMAT) planning and dose delivery capabilities.

Answer **all** parts of this question:

- a) Outline a protocol for this dog using **each** of the following forms of radiotherapy; definitive, palliative **and** stereotactic. For all three protocols, indicate the approximate number of Gray, the approximate number of fractions and the published median survival time. (9 marks)
- b) For this dog, list any prognostic factors identified within the information provided. (3 marks)
- c) For this dog, outline potential radiation side effects and their management. (8 marks)
- d) Briefly describe the concurrent medical management that is indicated at the time of initiating radiotherapy for this dog. You do not need to consider adjustments based on adverse effects that might occur. (3 marks)
- e) Describe the fundamental mechanism of action of ionising radiation that leads to cell death. Include in your answer a description of both direct and indirect actions of ionising radiation **and** explain why one form occurs more commonly in living tissue. (7 marks)

End of paper