2005 Radiation Oncology Exam Cases

GENERAL, BASIC AND CLINICAL KNOWLEDGE QUESTION FROM THE 2005 RADIATION ONCOLOGY CERTIFING EXAMINATION

Question

Aside from supportive measures such as antiemetics and antidiarrheals targeting the acute side effects of chemotherapy and/or radiotherapy, there are three compounds specifically approved to prevent the development of long term debilitating side effects which greatly decrease the quality of life for patients and/or are potentially life-threatening. Name the three (3) approved chemotherapy and/or radiotherapy protectors and their indicated label uses: (1.5 points)

Answer

- Amifostine –xerostomia prevention in head and neck tumors, cisplatin induced nephrotoxicity
- Dexraxozane (Zinecard) – doxorubicin cardiotoxicity
- Mesna – ifosfamide associated hemorrhagic cystitis

Knowledge of radio- and chemo-protective agents of normal tissue is important in veterinary radiation oncology. Candidates should be familiar with approved compounds used for normal tissue protection in cancer therapy.

Objective

Pathophysiology, prevention and treatment of toxicities and complications resulting from radiation therapy.

References

- DeVita VT, et al. Cancer Principles and Practice of Oncology. Sixth edition. Chapter 55
- Andreassen CN, Grau C and Lindegaard JC. Chemical radioprotection: A critical review of amifostine as a cytoprotector in radiotherapy. Seminars in Radiation Oncology, 2003, 13(1):62-72.
- Withrow and MacEwen, 3rd ed. Chapter 9, Cancer Chemotherapy

PHYSICS AND DOSE CALCULATION QUESTION FROM THE 2005 RADIATION ONCOLOGY CERTIFING EXAMINATION

Question

Particular care must be taken when prescribing electron beam therapy to a surface that is uneven or not oriented perpendicular to the central axis of the beam. Why?

Answer

- Electron beams are scattered preferentially outward by steep projections and inward by steep depressions, (toward a direction parallel to the slanted surface). This can create high and low dose zones as well as increased dose deposition at or outside the margin of the beam.
- Inverse square effects could become evident at extreme angles and oblique incidence concentrates the isodose lines near the surface.

- Candidates should have knowledge of how the patient's surface topography effects dose distribution.

Objective

The characteristics and principles of operation of orthovoltage x-ray machines, of cobalt teletherapy machines, and of linear accelerators; also be able to compare benefits.

References

- The Physics of Radiation Therapy, Faiz M. K

RADIATION BIOLOGY AND RELATED TOPICS QUESTION FROM THE 2005 RADIATION ONCOLOGY CERTIFING EXAMINATION

Question (1.5 points)

- Define Tpot
- Provide the equation for Tpot
- Briefly define each of the parameters of the equation.

A) Definition of Tpot:

B) Equation:

C) Define the parameters:

Answer

A) Tpot refers to potential doubling time and it is a measure of the rate of increase of cells capable of continued proliferation and therefore may determine the outcome of a radiotherapy treatment protocol delivered in fractions over an extended period of time.

B) calculated using the following equation: $Tpot = \lambda Ts/LI$.

C)

- Ts : the length of the DNA synthetic period
- LI : the labeling index; the fraction of cells synthesizing DNA at any time
- λ : a correction factor to allow for the nonlinear distribution in time of the cells as they pass through the cell cycle; (has a value of 0.67 – 1.0)

Candidates should be familiar with tumor parameters that may influence the outcome of radiation therapy.

Objective

The clinical aspects of fractionation in radiotherapy. The interrelationship between number of fractions, treatment time, and dose per fraction.

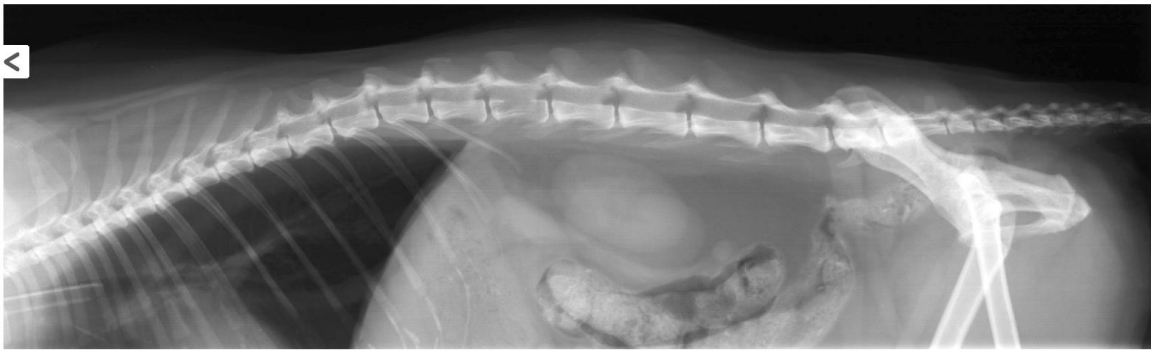
References

- Eric Hall. Radiobiology for the Radiologist. 5th Edition Chapter 21 Cell, Tissue and Tumor Kinetics, pages 385-387.

CLINICAL ASPECTS OF RADIATION ONCOLOGY, INCLUDING IMAGE INTERPRETATION QUESTION FROM THE 2005 RADIATION ONCOLOGY CERTIFING EXAMINATION

Question

An 11-year-old neutered male domestic shorthair cat was presented for acute, progressive paraparesis. Physical examination revealed inability to support weight on the rear limbs and mildly exaggerated patellar reflexes. Radiographs were obtained (see below). Please describe the significant abnormalities (if any) and list two (2) differential diagnoses. (3 points) {2 films}.



Lateral Spine 1
Image 1 of 3

VD Spine
Image 2 of 3

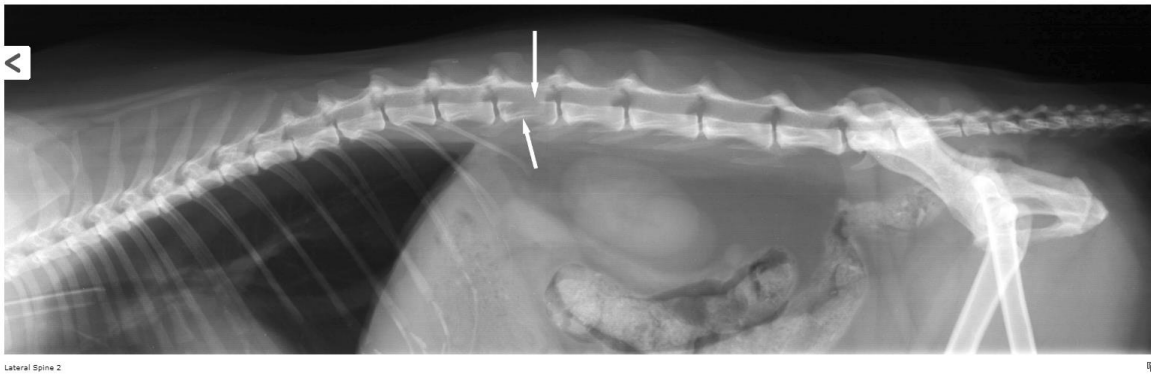
Answer

Abnormalities

- Lytic lesion in the body of L2. (1 point)

Differential Diagnoses

- Primary bone tumor (Osteosarcoma, Chondrosarcoma, Fibrosarcoma). (1 point)
- Lymphoma. (1 point)
- Other accepted differentials: Plasma cell tumor, meningioma, metastasis.



Candidates are expected to evaluate radiographs and other imaging modalities in the evaluation of a cancer patient. Diffuse lysis in a vertebral body is most consistent with neoplasia. The lysis can be best seen in Figure 1. Note the arrows outlining the lysis of the L2 vertebral body on the lateral radiograph (Fig. 3). The lysis cannot be seen well on the VD view (Fig. 2) due to overlying abdominal structures.

Objective

The radiographic signs of cancer in domestic animals, and other abnormalities likely to be found in diagnostic images of cancer patients. Examples include: radiography of lung metastasis; osseous and spinal neoplasia; sonography of the liver, spleen and lymph nodes; neuroimaging related to cancer. Be able to read and interpret radiographs, nuclear scans, sonograms, CT images, MR images, and port films from cancer patients.

References

- Textbook of Veterinary Diagnostic Radiology, 4th edition, D. E. Thrall, pp. 57-70, 98-109. * Withrow and McEwen, 3rd edition, pp. 378-417, 516-520, 600, 607.