

VT-1700: VETERINARY DIAGNOSTIC IMAGING

Cuyahoga Community College

Viewing: VT-1700 : Veterinary Diagnostic Imaging

Board of Trustees:

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Academic Term:

Fall 2024

Subject Code

VT - Veterinary Technology

Course Number:

1700

Title:

Veterinary Diagnostic Imaging

Catalog Description:

Introduction to radiography, ultrasonography, CT, MRI, and nuclear scintigraphy imaging modalities. Preparation, use and maintenance of radiography and ultrasonography equipment. Acquisition and processing of digital and analog diagnostic images.

Credit Hour(s):

3

Lecture Hour(s):

2

Lab Hour(s):

3

Requisites

Prerequisite and Corequisite

VT-1401 Veterinary Science I; and BIO-1420 Anatomy and Physiology of Domestic Animals II or concurrent enrollment.

Outcomes

Course Outcome(s):

Implement recommended radiation safety measures.

Objective(s):

1. Describe the hazards of ionizing radiation and articulate the dose limits for radiation exposure.
2. Explain principles of radiation safety including the concept of "As Low as Reasonably Achievable" (ALARA).
3. Demonstrate methods to reduce exposure of personal and patients to x-radiation.
4. Describe safety measures for alternative imaging technologies including MRI, CT, and nuclear scintigraphy.

Course Outcome(s):

Operate and maintain diagnostic imaging equipment.

Objective(s):

1. Explain how x-rays are produced.
2. Explain how the characteristics of the x-ray beam and appearance of a finished image are influenced by x-ray machine settings.
3. Describe the mechanics and function of x-ray generating equipment, image receptors, and processing equipment.
4. Operate and care for x-ray generating equipment, digital and analog x-ray receptors, and digital and analog x-ray processing equipment.
5. Demonstrate proper maintenance of radiographic equipment, including recognition of faulty equipment operation.
6. Implement radiographic quality control measures.
7. Describe the mechanics, operation, and care of ultrasonography equipment.
8. Describe principles of operation of alternative imaging equipment including MRI, CT, and nuclear scintigraphy.

Course Outcome(s):

Create diagnostic radiographic images of live animals using radiographic equipment.

Objective(s):

1. Choose, prepare, and position image receptors.
2. Develop and utilize radiographic technique charts to select machine settings that minimize the need for repeat exposures.
3. Prepare and operate stationary, portable, and dental x-ray generating equipment to create diagnostic radiographic images.
4. Process analog and digital radiographic images of dogs, cats, horses, and exotic animals using automatic, hand, and digital technologies.
5. Perform radiographic contrast studies.

Course Outcome(s):

Prepare and position patients of various species for radiographic and other imaging studies.

Objective(s):

1. Position dogs and cats for common soft tissue and orthopedic radiographic studies using topographical landmarks.
2. Position horses or equine models for common radiographic studies using topographical landmarks.
3. Perform radiographic screening techniques for canine hip dysplasia.
4. Demonstrate an understanding of the modifications of diagnostic imaging techniques as they apply to exotic mammals, birds, and other exotic animals.
5. Assist with an ultrasound examination of a veterinary patient.

Course Outcome(s):

Assess, store, and maintain radiographic images.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Assess radiographic image quality and articulate suggestions designed to maximize diagnostic usefulness.
2. Identify common analog and digital artifacts including causes and preventive measures.
3. Complete radiographic logs, reports, and records.
4. Label, file, and retrieve radiographic images.

Methods of Evaluation:

1. Lecture and laboratory quizzes
2. Unit and final lecture examinations
3. Laboratory practical examinations
4. Clinical performance evaluations
5. Homework assignments
6. Radiograph portfolio

Course Content Outline:

1. Radiation safety
 - a. Hazards of ionizing radiation including types of biologic damage
 - b. Sources of exposure
 - c. Measurement of radiation exposure
 - d. Devices used to measure radiation exposure
 - e. Agencies that regulate exposure limits (Maximum Principles Dose)
 - f. Minimizing exposure using the "As Low As Reasonably Achievable" (ALARA) principles
 - g. Care and use of personal protective equipment
2. X-ray production

- a. Definition of x-radiation
- b. Properties and characteristics of x-radiation
- c. Generation of x-radiation
3. Components of the x-ray machine
 - a. The x-ray tube
 - i. Cathode and anode
 - ii. Tube failure (types, recognition, causes, and prevention)
 - b. Electrical Components
 - i. Power supply and transformers
 - ii. Electrical circuits and timer switch
 - iii. Rectifier
 - iv. Generator
 - c. Collimator
 - d. Tube stand and control panel
4. Production of radiographic images
 - a. X-ray-tissue interaction
 - i. The five subject densities
 - ii. Subject density and contrast
 - iii. Radiographic density and contrast
 - b. Exposure factors
 - i. milliAmpseconds (mAs)
 - ii. kiloVoltage peak (kVp)
 - iii. Source-Image Distance (SID)
 - iv. How exposure factors affect the x-ray beam and finished image
5. Radiographic quality
 - a. Radiographic density
 - b. Radiographic contrast (short scale vs. long scale)
 - c. Scatter radiation
 - i. Origin and effects of scatter
 - ii. Control of scatter
 - d. Grids
 - i. Function of a grid
 - ii. Grid types and parts
 - iii. Use of a grid
 - iv. Causes of and prevention of grid artifacts
 - e. Geometric distortion and unsharpness
 - i. Magnification
 - ii. Foreshortening
 - iii. Elongation
 - iv. Unsharpness
 - v. Minimizing distortion and unsharpness
 - f. Recognition and prevention of artifacts and technical errors
 - i. Exposure errors
 - ii. Analog processing errors
 - iii. Digital processing errors
 - g. Maximizing image quality
 - h. Quality control/quality assurance
6. Film-based systems (analog systems)
 - a. How film-based systems work
 - b. Uses for film-based receptors
 - c. Film cassettes
 - i. Structure and function
 - ii. Types and sizes
 - iii. Care
 - d. Intensifying screens
 - i. Structure and function
 - ii. Types and sizes
 - iii. Screen speed

- iv. Relationship of screen speed, machine settings, and finished image
 - v. Screen care
 - e. X-ray film
 - i. Structure and function
 - ii. Types and sizes
 - iii. Latent image
 - iv. Film speed and latitude
 - v. Image resolution
 - vi. Film care
 - vii. Film identification and filing
 - f. Film processing
 - i. Dark room organization and light-proofing
 - ii. Processing chemicals
 - iii. 5 steps of processing
 - iv. Operation and maintenance of automatic processors
 - v. Silver recovery
 - g. Image identification
 - i. Required information
 - ii. Methods of film identification
 - iii. Directional and time indicators
 - iv. Limb indicators and Mitchell markers
 - h. Film filing, storage and retention
- 7. Digital Systems
 - a. How digital systems work
 - b. Comparison to film-screen systems
 - c. Hardware and software used in digital systems
 - i. Hospital Information System (HIS) and Radiology Information System (RIS)
 - ii. Picture Archiving and Communication System (PACS)
 - iii. Digital Imaging and Communications in Medicine (DICOM)
 - iv. Image backup
 - d. Digital Technology
 - i. Pixels
 - ii. Matrix and field of view
 - iii. Contrast resolution and spatial resolution
 - iv. Bit depth and dynamic range
 - v. LGM level (measure of average exposure level)
 - e. Cassette-based digital systems (Computed Radiography or CR systems)
 - i. CR Photostimulable phosphor plates
 - ii. CR Scanners
 - iii. CR Software
 - f. Cassette-less digital systems (Digital Radiography or DR systems)
 - i. How DR systems work
 - ii. Indirect vs. direct digital radiography (DDR) systems
 - g. Digital processing
 - i. Algorithms
 - ii. Windowing and leveling
 - iii. Cropping and masking
 - iv. Magnification and inversion
 - v. Annotation
 - h. Digital artifacts
- 8. Dental radiography
 - a. Dental machines and equipment
 - b. Intraoral analog dental image receptors
 - i. Film sizes, speeds, and types
 - ii. Identification of the area of interest (AOI) using the “bump”
 - c. Intraoral digital dental image receptors
 - i. Size and speed
 - ii. Identification of the AOI using the digital marker
 - iii. Protecting the receptor

- d. Acquiring the view
 - i. Patient restraint and position
 - ii. Tube position
 - iii. Receptor position
 - iv. Positioning aids
 - v. View used for each anatomical AOI
- e. Parallel technique
- f. Bisecting angle technique
- g. Manual processing using the chairside darkroom
- h. Digital processing
 - i. Use of software and managing images
9. Developing a technique chart
 - a. Purpose for a technique chart
 - b. Preparation
 - c. Trial exposures
 - d. Completing the chart
10. Assessing a finished radiograph
 - a. Routine orientation of an image
 - b. Assessing density and penetration
 - c. Assessing sharpness
 - d. Assessing positioning
 - e. Recognition of artifacts and technical errors
11. Radiographic positioning
 - a. Positioning terminology
 - b. For each AOI:
 - i. Routine views
 - ii. Special views
 - iii. Patient preparation
 - iv. Measurement
 - v. Centering
 - vi. Collimation
 - vii. Patient, limb, and head placement
 - viii. Special considerations
 - ix. Manual restraint/positioning aids
 - x. Selecting an image receptor
 - xi. Labeling the image
 - xii. Setting the machine
12. Small animal radiography
 - a. Thorax
 - b. Abdomen
 - c. Forelimb
 - d. Hindlimb
 - e. Skull
 - f. Spine
13. Equine radiography
 - a. Safety and restraint
 - b. Portable machine
 - c. Patient preparation
 - d. Radiation safety
 - e. Positioning devices and ancillary equipment
 - f. Anatomic AOI and view names
 - g. Studies of the distal limb
 - h. Additional studies
14. Radiography of exotic animals
 - a. Principles of exotic animal radiography
 - b. Routine views for birds, reptiles, and exotic mammals
 - c. Patient restraint and special equipment
15. Procedures

- a. Methods for diagnosis
 - i. Orthopedic Foundation for Animals (OFA)
 - ii. University of Pennsylvania Hip Improvement Program (PennHIP)
 - b. Fluoroscopy
16. Contrast studies
- a. Indications for contrast studies
 - b. Positive media
 - i. Barium sulfate
 - ii. Radiopaque markers
 - iii. Iodine preparations
 - iv. Characteristics, uses, and cautions
 - v. Negative contrast media
 - vi. Air and carbon dioxide
 - vii. Characteristics, uses, and cautions
 - c. Patient preparation
 - d. Contrast studies of the gastrointestinal (GI) system
 - i. Esophogram
 - ii. Upper GI series
 - e. Contrast studies of the urinary system
 - i. Excretory urogram
 - ii. Retrograde cystogram
 - iii. Urethrogram
 - iv. Other contrast studies
 - v. Myelogram
 - vi. Miscellaneous studies
17. Ultrasound
- a. Terminology of ultrasound
 - b. Ultrasound physics
 - i. The interaction of sound waves and tissues
 - ii. Creation of the image
 - c. Preparing and maintaining ultrasound equipment and transducers
 - i. Machine controls
 - ii. Selecting transducers
 - iii. Use and care of transducers
 - d. Display modes (B, M, and Doppler)
 - i. Uses for each mode
 - ii. Image appearance for each mode
 - e. Assisting with an ultrasound examination
 - i. Patient preparation and positioning
 - ii. Using the probe
 - f. Abdominal studies
 - g. Echocardiography
18. Alternative technologies
- a. Modalities
 - i. Computed tomography (CT)
 - ii. Nuclear scintigraphy
 - iii. Magnetic resonance imaging (MRI)
 - b. Indications for alternative technologies
 - i. Information provided by each modality
 - ii. Advantages and limitations of each modality
 - c. Patient preparation
 - d. Workplace safety for alternative imaging technologies

Resources

Brown, Marg and Lois Brown. *Lavin's Radiography for Veterinary Technicians*. 7th. St. Louis: Elsevier, 2021.

Dupont, Gregg and Linda DeBowes. *Atlas of Dental Radiography in Dogs and Cats*. 1st ed. St. Louis: Elsevier, 2009.

Easton, Suzanne. *Practical Veterinary Diagnostic Imaging*. 2nd ed. Ames, IO: Wiley-Blackwell, 2012.

Farrow, Charles. *Veterinary Diagnostic Imaging-The Horse*. 1st ed. St. Louis: Mosby, 2006.

Farrow, Charles. *Veterinary Diagnostic Imaging-Birds, Exotic Pets, and Wildlife*. 1st ed. St. Louis: Mosby, 2009.

Mattoon, John and Thomas Nyland. *Small Animal Diagnostic Ultrasound*. 3rd ed. St. Louis: Elsevier, 2015.

Silverman, Sam, and Lisa Tell. *Radiology of Birds*. 1st ed. St. Louis: Saunders Elsevier, 2010.

Sirois, Margi, Elaine Anthony and Danielle Mauragis. *Handbook of Radiographic Positioning for Veterinary Technicians*. 1st ed. Clifton Park, NY: Delmar, 2010.

Thrall, Donald. *Textbook of Veterinary Diagnostic Radiology*. 7th ed. St. Louis: Elsevier, 2018.

Wright, Matt, et al. *Radiation Safety and Positioning Animals with Rope and Tape in Veterinary Radiography*. 1st ed. Breedfreak Inc., 2013.

Resources Other

Clinician's Brief <http://www.cliniciansbrief.com/>

Veterinary Learning Systems <https://www.vetlearn.com/>

DVM360 <http://www.dvm360.com/>

<https://go.atdove.org/> Videos and articles

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