Radiology

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Objectives

- Determine the appropriate machine settings for making a radiograph
- Describe essential radiograph accessories
- Describe the positions used to perform radiographs from different views
- Describe safety precautions and discuss their importance
Terminology

- X-ray tube of radiograph machine
  - Vacuum tube
    - Cathode emits electrons
    - Anode collects electrons
  - Metal target on anode
    - Electron beam (electrical current) perpendicularly directed
      - X-rays (photons, radiation) emitted
        - Patient’s tissues absorb
        - Strike patient and redirect (scatter radiation)
  - High voltage power source
    - 30-150 kilovolts (kV)
Milliamperage (mA)
- Unit of measure
- Controls amount of emitted x-rays
- \( \text{mA} \times \text{exposure time (S)} = \text{mAs} \)

Kilovoltage peak (kVp)
- Value of voltage
- Controls radiographic contrast of image
  - High mAs and low kVp = black and white image
  - Too high mAs = black image (over-exposed)
  - Too low kVp = white image (under-exposed)
  - Low mAs and high kVp = gray image
Source to image distance (SID)

Distance from anode to receptor (film, plate)

- Increase distance = decreases beam intensity
  - Lightens images
  - Requires increasing mAs settings
- Decrease distance = increases beam intensity
  - Darkens images
  - Requires reducing mAs settings
  - Reduces radiation exposure to patient
X-ray scatter control (reduces x-ray dose exposure to patient and x-ray scatter)

- Filtration device on x-ray tube
- Filtration device of lead strips (x-ray grid)
  - Between anode and receptor (film, plate)
    - Requires increasing mAs settings
    - Requires increasing kVp setting for large animal thorax
Determination of Machine Settings

- Measure thickness of patient’s part
  - Caliper instrument in centimeters
- Use technique chart for thickness measurement
- Position machine settings
  - kVp
  - mA
  - Exposure time
- Set distance
- Set needle of voltage line meter
  - 1/16 inch above center line
  - Insures constant voltage coming into machine
Radiographic Positions

- Head, neck, body, tail
  - Dorsal – top view
  - Ventral – bottom view
  - Lateral – side view
- Leg
  - Anterior – front view
  - Posterior – back view
  - Lateral – outer side view
  - Medial – inner side view
- Two views
  - One plane
  - $90^\circ$ angle to first view
Imaging Modalities

- Film/Screen Combinations
  - Cassette – holds film inside
  - Image produced on film – x-ray image (not visible)
  - Film development – image visible
    - Chemical, water, and drying times

- Computer Radiology (CR) or Digital Radiography (DR)
  - Cassette – holds phosphor plate
  - Image produced on plate – x-ray image (not visible)
  - Plate development – image visible
    - Plate in reader – laser reads and digitizes into digital image
    - Digital image – sent to computer for viewing and storing
  - Plate erased and refreshed for reuse – by exposure to light
- **Computerized Axial Tomography (CAT) or Computerized Tomography (CT) Scan**
  - Utilizes x-rays
  - Produces cross-sectional images of soft tissue and bone

- **Ultrasonography (Ultrasound)**
  - Utilizes sound waves
  - Produces images (sonograms) of soft tissues
    - Motion images
    - Still images

- **Magnetic Resonance Imaging (MRI) Scan**
  - Utilizes radio waves
  - Produces images in any plane of body
Images and Tissue Density

- Black image – air
- Gray image – soft tissue
- White image – bone, minerals, sand, metal, dental enamel
Patient Motion

- Voluntary motion (controlled motion) – restraint necessary
  - Looking around
  - Moving away
  - Moving extremeties
  - Paddling
  - Pushing away

- Involuntary motion (uncontrolled motion) – reduce exposure time, increase mA
  - Heart beating
  - Breathing
  - Panting
  - Discomfort moving
- Heart, lungs, and thorax images
  - Animal inhales – make exposure
- Abdomen, pelvis, and spine images
  - Animal exhales – make exposure
Safety Devices and Precautions

- Remove anyone from the x-ray room that is not needed.
- Every person should wear a lead apron and lead gloves when holding the x-rayed animal.
- Check the condition of gloves and aprons periodically by using radiography to determine if they allow x-rays to pass through.
- Limit the beam to the size of the film with a cone or lead diaphragm.
- Do not direct the x-ray beam into another room or work area.
- Install an aluminum filter (1 to 2 mm thick) at the tube housing opening to eliminate radiation from useless wave lengths.
- Cover the bottom side of the x-ray table with lead to protect the feet.
- The hands should not be placed in the path of the direct beam.
- Do not use fluoroscopy when radiography will do the job. Fluoroscopy is more hazardous and requires additional safety precautions.
Lead Gloves and Aprons

To help prevent deterioration of lead gloves and lead aprons:

- Roll or drape apron over curved surface rather than folding it.
- Store gloves by hanging or by placing cans with both ends open inside gloves to keep the gloves open and to allow moisture to evaporate.