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4th Year Lecture
Radiology

Diagnostic Imaging Techniques

Procedures of diagnostic imaging techniques can include:

1. X-ray
2. Ultrasound
3. CT
4. MRI

The aim of the diagnostic imaging techniques is to rule out, rule in of the disease or find out new information

X-ray technique:

Definition: A composite shadow of structures and objects in the path of an x-ray beam recorded on film

__**Density:** the weight per given volume of a body tissue or object in general

__**Opacity:** the measure of tissue or object to block the x-ray

__ Note that the denser the object is, the more the radiation will be inhibit; and the greater the object dense is, the less radiation reaches the film.

The radiographic opacities can be recognized are (Figure 1):

- Metal
- Bone
- soft tissue & fluid
- fat
- Air

Figure 1: This figure shows the different materials that the x-ray film can be recognized

Factors affecting on x-ray quality:

1. **Motion:** the less motion the animal has during the x-ray capturing time, the better quality the image will be.
2. **Film properties**
3. **Film/screen**
4. **Object/ film distance:** the distance between the object/ the animal and the film is correlated to other factors like the kilovoltage, the amperage and the time of capturing. Generally, the distance usually ranged between 60-90 cm
5. **Grids:** reduce the scattered radiation
6. **Processing**
7. **Artifact**
8. **Distortion:**

Ultrasound

Definition:

It is a non-ionized radiation through which the soft tissue can be visualizes in real time (Figure 2). The sonogrphaic image is specially used for soft tissues

No ionizing radiation is involved, but the quality of the images obtained using ultrasound is highly dependent on the skill of the person (sonographer) performing the exam and the patient's body size.

Figure 2: The ultrasonogrphaical image showing almost completed fetus

CT scan (Computed tomography)

CT imaging uses X-rays in conjunction with computing algorithms to image the body. In CT, an X-ray tube opposite an X-ray detector (or detectors) in a ring-shaped apparatus rotate around a patient, producing a computer-generated cross-sectional image (tomogram). CT is acquired in the axial plane, with coronal and

sagittal images produced by computer reconstruction. CT exposes the patient to more ionizing radiation than a radiograph (Figure 3). The CT scan image is three

dimension one. The technique is typically for hard tissue however, it can be used for soft tissue too.

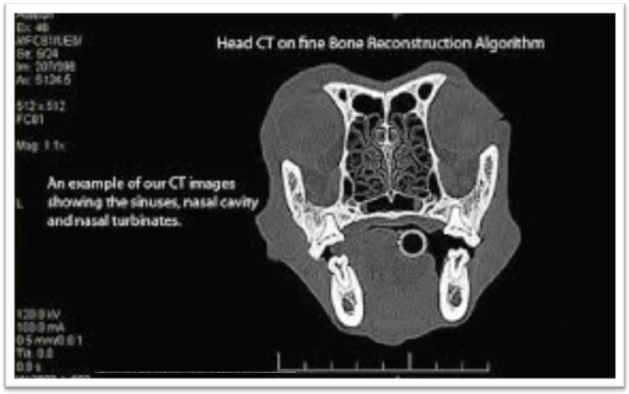

Figure 3: Transverse section of the CT scan image showing the perfect view for the bony structures

MRI (magnetic resonance imaging technique)

Strong magnetic fields to align spinning atomic nuclei (usually hydrogen protons) within body tissues, then disturbs the axis of rotation of these nuclei and observes the radio frequency signal generated as the nuclei return to their baseline status. MRI scans give the best soft tissue contrast of all the imaging modalities. One disadvantage is that the patient has to hold still for long periods of time in a noisy, cramped space while the imaging is performed. The MRI is typical for soft tissue more than hard tissues.

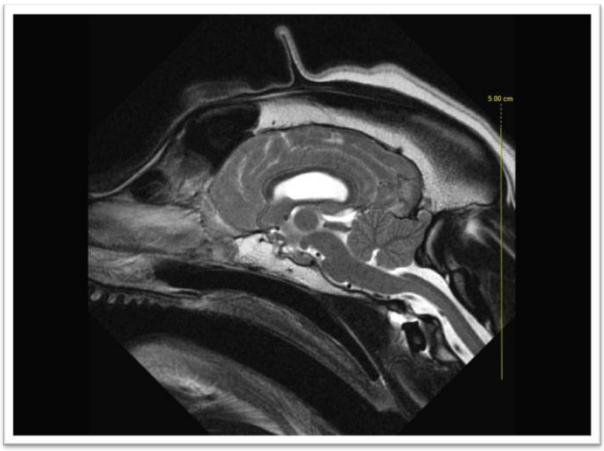

Figure 4: This image shows that brain which is imaged using MRI technique

Contrast agents:

Contrast medium (contrast agent): is a substance used to enhance the contrast of structures or fluids within the body in medical imaging

Types of contrast medium:

1. Positive contrast medium [Barium sulphate, iodine compounds-ionic (Figure 5) & nonionic, Gadolinium].
2. Negative contrast medium_air (Figure 5).

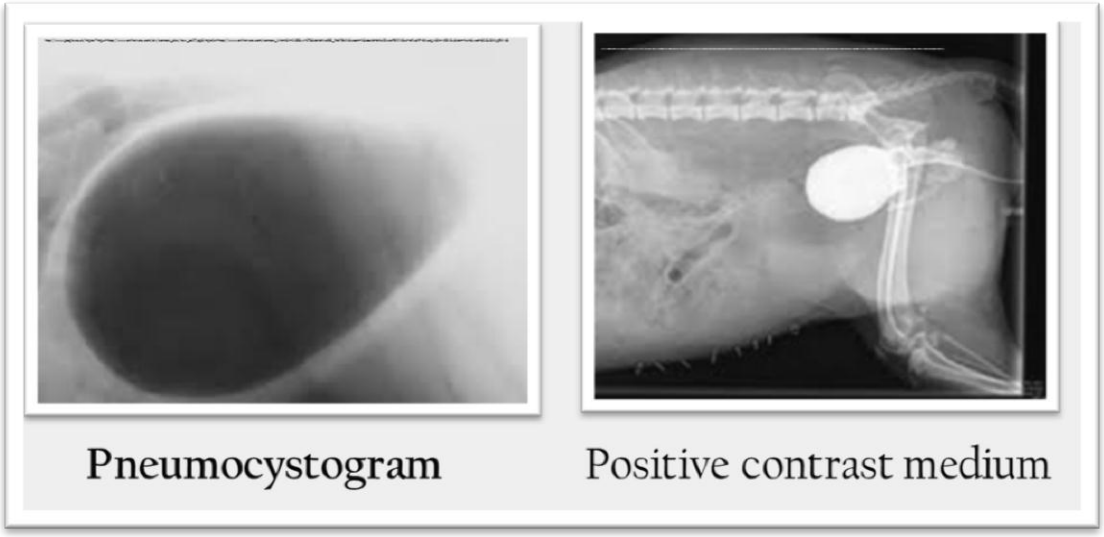

Figure 5: two images shows the using of negative contrast media (pneumocystogram) and the positive contras media (iodine compounds)

The radiological report

The radiological report has to have four points:

- **A good description:** Working from the outside of the radiograph to the inside in. Evaluate technique and positioning, and how it could affect your interpretation. Radiological findings include size, shape, opacity, number and position of organs. Ex., if you are evaluating the liver, you might say that the liver margin extends beyond the costal arch, and the margins are rounded. Describe your findings first, then move on to the next step
- A radiologic diagnosis: Ex., hepatomegaly could be caused by hyperadrenocorticism, diabetes, inflammation, toxicity etc…
- A ranked differential diagnosis
- Further recommendations