Unacceptable

GOOD
Radiation Detection

- Radiation cannot be detected by the human body
- Two main types of detection instruments:
  - Survey instruments
  - Dosimeters

Dosimeters

- Measure cumulative radiation dose
- Cannot distinguish type of radiation exposure
- Cannot determine when exposure occurred

Be Smart

- Know the rules
  - Appoint a practice “radiation safety” officer
  - Never permit <18 yr old involvement
  - Rotate personnel
  - Use personal protection equipment
  - Monitor radiation exposure
  - Stay out of the primary beam!
- Optimize radiographic technique
  - Machine
    - Never hold x-ray machine
  - Cassettes
    - Never hold cassette
  - Processing
    - Use chemical restraint
    - Use artificial restraint
    - Tape, Sand bags

Image quality
Image quality

- Things to remember and focus on to maximize the image quality and usefulness of the exam:
  - Good radiographic technique → proper exposure is important even with digital!
  - Good patient positioning
  - Standard views of the region of interest → perform a complete study
  - Remember to use physical radiographic markers – not just digital markers

Quality is hugely important

- Improves confidence that you are really seeing what you think you are seeing.
- Know your radiographic system
  - Technique chart
  - Pre-programmed settings
- Saves time on both ends of the spectrum:
  - Once settings are standardized, fewer retakes
  - If sending top quality images, very few if any delays for requests for more images – over or underexposed, oblique images, etc.

Importance of markers...

Image Quality

- Common problems:
  - Overexposure, underexposure, poor positioning and too few views
- All are easily correctable
- May take some additional training of staff to perform their own quality control, but the importance of good image quality cannot be understated.
  - “Garbage in, garbage out.”
Overexposed

- Lungs?
- Heart?
- Margins of vertebrae?

Have control of the airway? Use positive pressure ventilation to get good inspiration.

What do you think of L7-S1?
Also important to “hang” images the right way

- Standardized hanging protocols
  - Another small step that can help speed up the interpretation – no need to flip and rotate images
  - Radiographic interpretation is very much pattern recognition → radiographs which are not displayed correctly stand out as looking “wrong”
  - Negatively impacts speed and likely accuracy of reporting

To a radiologist,

Ouch!

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Image Quality

- Better images will help you receive more reports that have fewer words that sound like the radiologist’s favorite plant...

Some common exams

- We’ll just focus on a few…
  - Abdomen, thorax, spine
Abdominal Radiographic Technique

- Three views is standard: Left and right laterals + VD
- Moves gas around and helps when assessing the intestinal tract
- Most people leave out the left lateral projection → this view is very important for viewing the pylorus and proximal duodenum.
  - Can miss proximal foreign bodies without this view.
  - One of the first requests from a teleradiologist in a case with a suspected foreign body that is questionable will likely be to add a left lateral projection.

- Low inherent contrast between the abdominal structures
  - A lot of soft tissue, a little fat, a little bone

- Hind limbs stretched caudally
- Make exposure on EXPIRATION
- Why?
  - Spreads out organs to decrease superimposition

Radiographic Technique

For the abdomen, you want to use low kVp and high mAs.

- Low kVp = lower penetrating power so more easily absorbed
- High mAs = Lots of individual X-rays

- The lower energy X-rays are absorbed more by the different organs, and because there are lots of them you end up with “shadows” of the organs with fairly crisp margins.

High kVP, Low mAs
Low kVP, High mAs

Thorax vs. Abdomen

Thorax vs. Abdomen
Therefore, we don’t want to see this...

Excellent

Normal Dog Abdomen Positioning

Normal Dog Abdomen Positioning
Three views – easiest to see lesions when surrounded by aerated lung
- Right and left lateral
- Ventrodorsal or Dorsoventral

Sometimes four views to met check – small nodules in the caudodorsal lung fields may be missed in a VD, but can be seen in a DV where the caudal lungs are more aerated

Take on INSPIRATION – want lungs fully inflated

Good positioning is important for evaluating lungs and heart

From cranial to the thoracic inlet to the caudal tips of the lungs
Normal Thorax

Rotated: Ribs malaligned, trachea looks deviated

Straight: rib heads level, trachea normal
Covering the whole body region

- In some large breeds you may have to take a cranial and a caudal image in order to include the whole thorax or abdomen...

- A full thorax and abdomen on a Great Dane could take 12 images.

Spinal rads
Starting to be replaced by tomographic imaging such as CT and MRI

Spinal trauma
Radiographic sensitivity and negative predictive value for acute canine spinal trauma
- 2006 paper in Veterinary Radiology & Ultrasound
- Radiographs have a low negative predictive value (48%) and moderate sensitivity (72%) for detection of vertebral fractures

What not to do...
Sedation or general anesthesia is indicated
The goal is to have the sternum and spine in the same plane
  - Generally have to elevate the sternum with pads
  - May have to place pads under sagging portions of the spine to decrease distortion
Collimate!
Remember that the X-ray beam diverges ➔ creates a problem for viewing intervertebral disc spaces towards the periphery of the image…

Spinal rads: what to do
Spinal rads

- Should always be planned in concert with the results of a neurologic exam
  - Need to localize the lesion
  - Then you can focus your radiographic study to one region
- Remember that the beam diverges, and you need multiple centering points along the spine to have the X-ray beam pass fairly perpendicularly through the intervertebral disc space → allows for good assessment of the width of the intervertebral disc space.

Multiple centering points along the spine

- Center your views at:
  - Cervical
    - C3 and C6
  - Thoracic
    - T5, T9, T13
  - Lumbar
    - L3, L7
The Goldilocks Effect. These are real histories. The character names have been changed to protect the innocent.

### Too much...
- Started with ulcerative, crusty, alopecic skin lesions on ear tips and feet June 2014. She was given an injection of Convenia and started on Prednisolone 2.5 mg po q 12 h. She has a history of allergic skin disease and has responded well to this therapy. Her weight at that time was 12 lbs. On August 19th she presented because her skin had not improved at all and was actually getting worse. She was not weighed during this appointment. The prednisolone was discontinued, she was started on the 12 lbs dose of Atopica for cats and Clavamox drops at the same time. The owners called a few days later stating that she had started to tremor a little on the 23rd of August and the owner stopped the meds. They started them again on the 26th of August. Her skin has not improved at all on Atopica. Complete blood work from 9/9/2014 showed hypoalbuminemia, hypoproteinemia, Elevated biliruben 0.7 (0-0.3), BUN 42 Creatinine 1.2 (normal) no urine to compare concentration, low ALT (AST, GGT, ALKP all normal). T4 normal. She is also anemic RBC 6.7, HCT 24.9 but normal WBC parameters. She has been anorexic at home but ate well after her abdominal ultrasound today.

### Too little...
- Not himself
- ADR
- Limping
- Lame for 1.5 weeks. Worse with exercise, better with rest. Pain on palpation of point of shoulder.
  - Which shoulder???
- Heresay history: “Dull and depressed per the owner.”
  - What were the exam findings? Any other useful information?
Too little follow-up history...

- REPEAT RADIOGRAPHS FROM YESTERDAY. PATIENT VOMITED ONCE THIS MORNING
- Okay, but what else?? Doing better? Worse? BAR, QAR? Painful? Eating?
- Basic information can help guide the ranking of differentials and improve ability to provide recommendations.

Goldilocks history...

- Chief complaint
- Main clinical signs, duration of signs
- Physical exam findings
- Pertinent labwork
- Presumptive diagnosis or differentials you are considering

Important information to help the radiologist better rank differentials or exclude some altogether.

Let’s talk!

- Communicate – give feedback.
- Got biopsy results?
- Surgical findings?
- Send a quick email to your radiologist – we love getting follow up on cases. Helps us to learn from the cases. Helps us help you and others more in the future.

Teleradiology Services
Many to choose from, mostly in the US

- PetRays
- Idexx
- Antech
- Vet-Rad

- Some veterinary schools offer a teleradiology service, but these are dwindling as there are fewer academic radiologists...
  - WCVM used to have this service but has not in a number of years.

Few loan warriors in Canada...

- Only about 20 veterinary radiologists in Canada
- Most in the big cities or at academic institutions

- Few that do teleradiology:
  - Me in Saskatoon
  - Tim Spotswood in Calgary
  - Paul Rist in the Maritimes
  - Maybe more, but not many

Services

- All offer about the same services
  - Radiographic interpretation
  - Ultrasound, CT, MRI interpretation

- Some in your local area may offer mobile ultrasound
  - If you are looking into using a mobile sonographer, check to see if they are board certified
  - Some non-vet and non-boarded sonographers are out there and based on personal experience through teleradiology some (not all!) do not do a good ultrasound exam → buyer beware.
  - At least with an ACVR Diplomate you know the level of training they have received, and they have passed a rigorous examination process.

Why use veterinary teleradiology?

- Frees up your time to see more patients
- Adds the benefits of specialist training to your practice without having to have a radiologist on staff
- Provide a specialist’s opinion to support your recommendations
- Limit your liability
- Increase overall client satisfaction
Big company vs. small company?

- Larger companies may have a faster turnaround time
  - 24/7 service
  - Better ability to turn around STAT cases

- Smaller companies may allow for a more personal relationship with the radiologist
  - More consistency in reports
  - Learn their reporting style better → don’t have to translate what they mean
  - May be easier to communicate with the radiologist about cases on a regular basis

The End!

- Thank you for listening.

- Questions?

- Feel free to email me:
  james.montgomery@prairietimaging.com