NEURO IMAGING 101

The neurologic examination should begin in the waiting area as you observe the gait and overall mentation of the patient as the client brings them to the exam room. The examination allows you to determine which area of the neurologic system is involved and helps you to decide which type of imaging will be best in helping to make the diagnosis. The imaging modalities that we consider are plain radiographs of the skull or spine, as well as CT-scan or MRI. Diagnostic results are best obtained through the use of general anesthesia. How to determine which modality to use is based on adequate knowledge of the modality, the specific circumstance of the patient, and the clinician in charge.

As a general rule when considering a CT scan or MRI, bone is best examined by CT scan and soft tissues are best seen with MRI. For example, a CT Scan would be chosen to examine: nasal sinuses, long bones, joints, lung, or inner/middle ear. (A CT with contrast is useful for nerve sheath tumors of the brachial plexus).

An MRI would be chosen for: brain, spinal cord, soft tissue masses, etc.

CONVENTIONAL RADIOGRAPHY
Along with bony structures, conventional radiography is also useful for soft tissue evaluation. The biggest advantage is that it is typically available in most veterinary hospitals. Digital radiography allows us to see the images almost immediately, with little to no anesthesia, and it is relatively inexpensive.

CT-SCAN
Computerized Tomography (CT) is the reconstruction of X-ray images by a computer to present tissue slices in a view similar to conventional radiography. Images are obtained by moving the patient through a ring shaped gantry which contains the X-ray tube. The tube moves in a circle around the patient with radiation exposure at multiple points around a central axis. Images are obtained for purposes of needs to be trained on positioning and radiographic technique. The interpreter of the films needs to then rely on the overall quality of the image and on their own experience. Finally, we must also consider radiation exposure of the employees and pets by using the proper radiation protection and monitoring equipment. There is a certain amount of record keeping involved as well, to comply with federal, state and local requirements.

The biggest disadvantage in the imaging of the central nervous system is that soft tissues such as brain and spinal cord cannot be seen, nor can a normal intervertebral disc. The skull is particularly difficult to image due to the many bones (three dimensions represented in only one) and structures within the skull. In order to make the final diagnosis, the technical staff taking the images...
MRI (MAGNETIC RESONANCE IMAGING)

Considering all of the current most readily available imaging modalities, magnetic resonance imaging (MRI) is the most complex. MRI offers the best soft tissue imaging available today for most uses. The process is complicated by a requirement for equipment that is very costly to install and maintain plus a very high level requirement for technician training. The time required for best images is longer than with either CT-scan or conventional radiography and general anesthesia is a necessity to insure patient cooperation. The strength of the magnet used for imaging lends certain dangers to personnel in the room as no ferrous metals may be nearby. Credit cards, jewelry, pens, and keys all represent danger if the magnet attracts the material and creates a flying object. The presence of identifying microchips produces an imaging artifact as will any metal implant or in the case of many hunting dogs buckshot which may be lodged in skin or muscle.

MRI works by aligning hydrogen atoms (protons) in a magnetic field. Think of a room filled with floating gyroscopes aligned in every direction, each producing a small magnetic field. The magnets are turned off except for a strong one. The moving protons are like tiny dipoles aligning with the strong field. This produces an induced electrical current (voltage) in all directions, creating some sort of signal. MRI works by detecting these signals.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.

Advantages of the procedure include increased sensitivity for X-ray imaging with lower overall exposure of the patient to radiation. There is also the ability to reconstruct alternate views with computer processing. Even 3-D images may be obtained by proper computer processing. Alternate colors beyond black and white may be assigned to allow easier examination of different tissues. Bone imaging is excellent.

The computer then reconstructs the image for presentation on a screen based on the data from all the points of exposure. Each imaging series is represented on screen by a slice which may vary in thickness depending on the requirements of the study. For many patients the initial series is made of thicker slices to allow for faster imaging. This is followed by thin slices to evaluate a smaller area of interest such as a bony lesion or a disc protrusion. The standard representation makes the images appear as if the viewer is seeing the patient from the nose or cranial end in axial sections and left to right with sagittal images.

The computer then reconstructs the image for presentation on a screen based on the data from all the points of exposure. Each imaging series is represented on screen by a slice which may vary in thickness depending on the requirements of the study. For many patients the initial series is made of thicker slices to allow for faster imaging. This is followed by thin slices to evaluate a smaller area of interest such as a bony lesion or a disc protrusion. The standard representation makes the images appear as if the viewer is seeing the patient from the nose or cranial end in axial sections and left to right with sagittal images.

Advantages of the procedure include increased sensitivity for X-ray imaging with lower overall exposure of the patient to radiation. There is also the ability to reconstruct alternate views with computer processing. Even 3-D images may be obtained by proper computer processing. Alternate colors beyond black and white may be assigned to allow easier examination of different tissues. Bone imaging is excellent.

The computer then reconstructs the image for presentation on a screen based on the data from all the points of exposure. Each imaging series is represented on screen by a slice which may vary in thickness depending on the requirements of the study. For many patients the initial series is made of thicker slices to allow for faster imaging. This is followed by thin slices to evaluate a smaller area of interest such as a bony lesion or a disc protrusion. The standard representation makes the images appear as if the viewer is seeing the patient from the nose or cranial end in axial sections and left to right with sagittal images.

Advantages of the procedure include increased sensitivity for X-ray imaging with lower overall exposure of the patient to radiation. There is also the ability to reconstruct alternate views with computer processing. Even 3-D images may be obtained by proper computer processing. Alternate colors beyond black and white may be assigned to allow easier examination of different tissues. Bone imaging is excellent.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.

MRI (MAGNETIC RESONANCE IMAGING)

Considering all of the current most readily available imaging modalities, magnetic resonance imaging (MRI) is the most complex. MRI offers the best soft tissue imaging available today for most uses. The process is complicated by a requirement for equipment that is very costly to install and maintain plus a very high level requirement for technician training. The time required for best images is longer than with either CT-scan or conventional radiography and general anesthesia is a necessity to insure patient cooperation. The strength of the magnet used for imaging lends certain dangers to personnel in the room as no ferrous metals may be nearby. Credit cards, jewelry, pens, and keys all represent danger if the magnet attracts the material and creates a flying object. The presence of identifying microchips produces an imaging artifact as will any metal implant or in the case of many hunting dogs buckshot which may be lodged in skin or muscle.

MRI works by aligning hydrogen atoms (protons) in a magnetic field. Think of a room filled with floating gyroscopes aligned in every direction, each producing a small magnetic field. The magnets are turned off except for a strong one. The moving protons are like tiny dipoles aligning with the strong field. This produces an induced electrical current (voltage) in all directions, creating some sort of signal. MRI works by detecting these signals.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.

MRI (MAGNETIC RESONANCE IMAGING)

Considering all of the current most readily available imaging modalities, magnetic resonance imaging (MRI) is the most complex. MRI offers the best soft tissue imaging available today for most uses. The process is complicated by a requirement for equipment that is very costly to install and maintain plus a very high level requirement for technician training. The time required for best images is longer than with either CT-scan or conventional radiography and general anesthesia is a necessity to insure patient cooperation. The strength of the magnet used for imaging lends certain dangers to personnel in the room as no ferrous metals may be nearby. Credit cards, jewelry, pens, and keys all represent danger if the magnet attracts the material and creates a flying object. The presence of identifying microchips produces an imaging artifact as will any metal implant or in the case of many hunting dogs buckshot which may be lodged in skin or muscle.

MRI works by aligning hydrogen atoms (protons) in a magnetic field. Think of a room filled with floating gyroscopes aligned in every direction, each producing a small magnetic field. The magnets are turned off except for a strong one. The moving protons are like tiny dipoles aligning with the strong field. This produces an induced electrical current (voltage) in all directions, creating some sort of signal. MRI works by detecting these signals.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.

MRI (MAGNETIC RESONANCE IMAGING)

Considering all of the current most readily available imaging modalities, magnetic resonance imaging (MRI) is the most complex. MRI offers the best soft tissue imaging available today for most uses. The process is complicated by a requirement for equipment that is very costly to install and maintain plus a very high level requirement for technician training. The time required for best images is longer than with either CT-scan or conventional radiography and general anesthesia is a necessity to insure patient cooperation. The strength of the magnet used for imaging lends certain dangers to personnel in the room as no ferrous metals may be nearby. Credit cards, jewelry, pens, and keys all represent danger if the magnet attracts the material and creates a flying object. The presence of identifying microchips produces an imaging artifact as will any metal implant or in the case of many hunting dogs buckshot which may be lodged in skin or muscle.

MRI works by aligning hydrogen atoms (protons) in a magnetic field. Think of a room filled with floating gyroscopes aligned in every direction, each producing a small magnetic field. The magnets are turned off except for a strong one. The moving protons are like tiny dipoles aligning with the strong field. This produces an induced electrical current (voltage) in all directions, creating some sort of signal. MRI works by detecting these signals.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.

MRI (MAGNETIC RESONANCE IMAGING)

Considering all of the current most readily available imaging modalities, magnetic resonance imaging (MRI) is the most complex. MRI offers the best soft tissue imaging available today for most uses. The process is complicated by a requirement for equipment that is very costly to install and maintain plus a very high level requirement for technician training. The time required for best images is longer than with either CT-scan or conventional radiography and general anesthesia is a necessity to insure patient cooperation. The strength of the magnet used for imaging lends certain dangers to personnel in the room as no ferrous metals may be nearby. Credit cards, jewelry, pens, and keys all represent danger if the magnet attracts the material and creates a flying object. The presence of identifying microchips produces an imaging artifact as will any metal implant or in the case of many hunting dogs buckshot which may be lodged in skin or muscle.

MRI works by aligning hydrogen atoms (protons) in a magnetic field. Think of a room filled with floating gyroscopes aligned in every direction, each producing a small magnetic field. The magnets are turned off except for a strong one. The moving protons are like tiny dipoles aligning with the strong field. This produces an induced electrical current (voltage) in all directions, creating some sort of signal. MRI works by detecting these signals.

Every procedure comes with certain disadvantages and CT imaging is no exception. The equipment is costly both to install and to maintain. Imaging requires more time than conventional radiography in most instances and for small animal patients requires general anesthesia. Technician and veterinarian training take time and investment in order to offer the best service. Given the complexity of the procedure the monetary costs to a client are significant.
opposite directions with a majority in one plane. A radiofrequency signal (RF) is applied for a time (T). The energy instilled in the atoms is then released by the protons measured and plotted by computer to produce the images we see.

**VARIOUS TERMS are utilized for everyday use in this technology.**

T1 – Time for atoms to recover to the initial longitudinal direction

T2 – Time for atoms to dephase to their original state from the synchronous state induced by the magnet

SAGITTAL – equivalent to a lateral radiograph

AXIAL – cross sections perpendicular to the sagittal plane (think of sliced bread)

CORONAL – longitudinal sections parallel to the ventral surface

MRI is an excellent imaging modality for brains and spinal cords. The application is somewhat limited in limbs but can be used successfully with the proper experience. Chests and abdomens may also be imaged but special techniques are necessary to eliminate motion artifacts for the best imaging outcome. As in a CT-scan, the images are presented as if the viewer is looking at the patient’s front end in axial views and puts the patient with a left to right orientation in sagittal images.

**MYELOGRAPHY**

Myelography is a specialized X-ray technique utilizing an X-ray blocking chemical (Iohexal®, an iodinated sugar solution). This technique is useful when conventional radiography fails to offer enough information. A spinal tap is performed (via the cisterna magna most often in our hospital and via lumbar injection in many other facilities) Iohexal® is injected into the subarachnoid space, and conventional radiographs are taken to follow the course of the contrast down the spine. By observing the flow of contrast and the overall appearance of any obstruction or deviation, a diagnosis of compression either by tumor, ruptured disc, or other etiology may often be made. As an additional benefit spinal fluid may be submitted for analysis and potentially culture. Some patients have more than one disease and may have meningitis in addition to a disc protrusion or other abnormality.

**INTERVENTIONAL RADIOLOGY**

Metropolitan Veterinary Associates offers a full range of cardiac as well as non-cardiac interventional radiology procedures. Interventional radiology involves the use of contemporary imaging methods (primarily **Video X-Ray, called Fluoroscopy**) to gain access to different structures of the pet’s body for diagnostic and therapeutic reasons without the need for traditional surgery.

**DIAGNOSTIC CAPABILITIES:**

- Diagnostic Fluoroscopy
- Diagnostic Angiography
- Patent Ductus Arteriosus Embolization
- Balloon Valvuloplasty
- Pacemaker Implantation
- Heartworm Retrieval
- Arterio-Venous Fistula Embolization
- Endomyocardial Biopsy
- Catheter Retrieval
- Tracheal Stent Placement
- Urethral & Ureteral Stent Placement
- Portosystemic Shunt Embolization
- Intra-Arterial Chemotherapy
- Chemoembolization

**AVAILABILITY FOR APPOINTMENTS**

Dr. Risa Roland:  
Tuesday – Friday,  
Hours: 9:00am – 4:00pm  
Call for an Appointment: 610.666.1050

---

**Risa Roland**  
DVM, DACVIM (Cardiology)
PET LOSS SUPPORT GROUP

Many of our employees understand the depth of loss experienced when a beloved four-legged family member passes. For that reason, Metropolitan provides a pet loss support group to help grieving owners in need. Our support group is designed to provide grieving pet parents with a safe, confidential environment to share their feelings with others who have experienced pet loss.

Meetings are held once a month onsite at Metropolitan and are free of charge for your clients (all family members are invited to attend). The group is led by Dr. Cari Thomson and co-led by psychiatrist Dr. Carol Tavani.

Please contact us at 610.666.1050 if you would like to have Pet Loss Support Group brochures mailed to your office. Clients are able to visit our website to find meeting dates and times, general information and recommendations on obtaining help outside of the group setting.

Pet Loss Support Group meetings held monthly for your clients (and are free of charge). Please contact us at 610.666.1050 for more information or for brochures.

MVA 5K & KIDS FUN RUN EVENTS

Join MVA in our 4th Annual 5K Run/Walk and Kids Fun Run Events benefitting Main Line Animal Rescue. Bring your dog along for these fun runs.

Enjoy music, give-a-ways, balloon animals by Matt Cadabra, food and beverages before and after the event. Main Line Animal Rescue will have some of their adoptable pets available for you to meet at the event as well. Proceeds from the event will benefit homeless animals rescued through Main Line Animal Rescue. Plus, MVA is pleased to welcome our very SPECIAL GUESTS, Steve Morrison from 93.3 WMRR’s “Preston & Steve Show” and author Lisa Loeb. Lisa Loeb is the author of the book Dog Ambassador.

MVA, partnering with Valley Forge Children Academy, are proudly organizing their 2nd Annual Kids Fun Run (Ages 4-12). The course will be just over ¾ mile and filled with obstacles, plenty of canine friends to meet, balloon animals, give aways and more! Each participant will walk away with an award just for being involved and the top 3 will receive a trophy for their placement. There is limited space, so please RSVP as soon as possible to hold a spot in the event.

DATE: Saturday, October 12th
LOCATION: MVA, 2626 Van Buren Ave., Norristown, PA
MVA 5K FEE: $20 in Advance, $25 after October 5
KIDS FUN RUN FEE: FREE to all Participants

MVA 5K Events: Starts at 9am
Kids Fun Run Events: Starts at 9:15am
Participants: FREE T-Shirt to all Pre-Registered Participants
To register for both events, contact Sarah Spurgeon at 610-666-1050

Registration: 7:30am, ends at 8:45am
MVA 5K Run/Walk Event Online Registration at:
http://www.active.com/event_detail.cfm?event_id=2103200

Rain or Shine Nothing will stop this run/walk! Please dress appropriately and remember to leash your dog.