Small Animal MRI

Advanced Animal Imaging
Ryan Harrell BS, BS, CNMT
Advanced Animal Imaging (AAI)

- Regionally Owned
- Advanced Technology
- Affordable Imaging
- Expert Analysis
- Rapid Report Turn Around Time
Location

- Located at the corner of Liberty Mills Rd. and Homestead Rd.

- In the lower level of Indian Creek Veterinary Hospital.

Phone: (260) 434-1555
5902 Homestead Road
Fort Wayne, IN 46814
AAI Services

- Small Animal MRI
- Small Animal Ultrasound
- Feline I-131 radioiodine therapy. **Coming July 2010**
- Canine and Feline Thyroid hyperthyroid and hypothyroid diagnostic testing. **Coming July 2010**
Floor Plan for MRI and U/S
Small Animal MRI

Esaote VET-MR
Objectives

- Understand what small animal MRI is and how it works.
- Determine neurological MRI uses.
- Define non-neurological MRI uses.
- Understand when to order a MRI exam.
- Decide when to use MRI contrast (gadolinium).
- MRI versus CT.
- MRI case review.
- Define AAI’s MRI preparation.
- Answers to common questions.
What is MRI

- MRI = Magnetic Resonance Imaging
- Is a noninvasive imaging test used to diagnose a variety of medical conditions in the brain, head, orbits, neck, hocks, stifle, hips, and spine.
What is MRI

- MRI is one of the most advanced tools available for the investigation of **soft tissue injury** and pathology.

- It usually is expensive and not widely available in veterinary medicine.
How does MRI work?

- MRI creates a high quality detailed image of the organs, tissues and bones.
- MRI uses a strong magnet filed and radio waves.
How does MRI work?

- The animals body is made up of billions of atoms.
- The nucleus of these atoms spins on an axis. (Like a top off of its vertical axis)
How does MRI work?

- Imagine millions of nuclei all randomly spinning in different directions at the same time.

- MRI is focused on hydrogen atoms (water molecules).
How does MRI work?

- When the animal is placed in the MRI scanner’s magnetic field, the water molecules within their body line up north and south with the magnetic field.
How does MRI work?

- Radio frequency waves are then turned on and off rapidly throughout the exam.

- When this occurs the hydrogen molecules flip back to their original alignment giving off a small signal.
How does MRI work?

- These small signals are picked up by a coil and sent to a computer.
- The computer is able to reconstruct detailed images of the animal from these signals.
How does MRI work?

- Different tissues in the body give off unique signals.

- **Bone**
- **Soft Tissue**
  - Fat
  - Muscle
  - Blood Vessels
  - Ligaments
  - Synovial Tissue
  - Tendons
  - Nerves
Animal Cranial Nerves

- CNI = Olfactory
- CNII = Optic
- CNIII, CNIV, CNVI = Eye position, Pupil Response, Sympathetics,
- CNV = Corneal Reflex
- CNVII = Facial
- CNVIII = Auditory
- CNIX, CNX, CNXI = Swallowing, Gag Reflux, Eye Pressure, Heart Rate, Laryngeal and Trapezius Muscles.
- CNXII = Tongue Movement
Animal Cranial Nerves

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Neurological MRI

- **Neurological**
  - Problems dealing with the nervous system.

- **Peripheral Nervous System**
  - Sensory Fibers
  - Motor Neurons

- **Central Nervous System**
  - Brain
  - Brain Stem
  - Spine
Neurological MRI

- Autonomic Nervous System
  - Nerves involved in organ movement.
  - The animal has no voluntary control over the autonomic system.
Reasons to order a Neurological MRI

- Seizures / Convulsions
- Head Tilt
- Loss of Balance
- Abnormal Behaviors (Stuck in corners, staring into space)
- Inability to Walk
- Weakness in the legs/limbs
- Walking in circles
- Deafness
- Blindness
- Abnormal Nasal Drainage or Swelling
- Neurological Pain
- Other Neurological Signs
Reasons to order a Neurological MRI

- Blindness can be neurological or ophthalmological.
- Lameness can be neurological or orthopedic.
- Seizures can be due to brain disorders, toxins, or liver disease.
Seizures / Convulsions

- Seizures (Epilepsy) are common and there are many causes.
- Most commonly occur between age 1-5 years old.
- Seizure is composed of 3 parts:
  - Preictal
  - Ictus
  - Postictal
- Seizure recurring without recovery between episodes is called status epilepticus and is a serious medical emergency.
Seizures / Convulsions Signs

- Sudden / Violent Shaking
- Paddling
- Dilation of Pupils
- Unresponsive Staring
- Loss of Consciousness
- Salivation / Drooling
- Stiffness
- Twitching
- Involuntary Urination / Defecation.
Common Causes of Seizures

- **Congenital**
  - Hydrocephalus
  - Lissencephaly

- **Inflammatory**
  - Infectious
    - Bacterial
    - Rickettsial
      - Rocky Mountain Spotted Fever
      - Ehrlichiosis
    - Viral
      - Distemper
      - Feline Infectious Peritonitis (FIP)
      - Feline Immunodeficiency virus (FIV)
      - Feline Leukemia Virus (FeLV)
  - Fungal
    - Cryptococcosis
  - Protozoal
    - Neoseporosis
    - Toxoplasmosis

- **Parasitic**
Common Causes of Seizures

- **Inflammatory**
  - Immune-Mediated
    - Meningoencephalitis
  - Breed-Specific Encephalitis
    - Small Dog Encephalitis
    - Pug Dog Encephalitis (PDE)

- **Neoplastic**
  - Glioma
  - Meningioma
  - Metastatic Neoplasias

- **Toxic**
  - Strychnine
  - Metaldehyde
  - Organophosphate
  - Heavy Metals

- **Traumatic**
  - Head Injury
Common Causes of Seizures

- **Inflammatory**
- **Metabolic**
  - Storage Diseases
  - Thiamine Deficiency
  - Hypocalcemia
  - Hypoglycemia
  - Hepatoencephalopathy
    - Portosystemic Shunt
    - Hepatic Microvascular Dysplasia
    - Liver Failure / Hepatitis
Types of Seizures

- Partial / Focal Seizures
  - Simple
  - Complex / Psychomotor

- Generalized Seizures
  - Absence
  - Tonic-clonic / Grand Mal

- Secondary Tonic-clonic Seizures
  - Both Partial and Generalized Seizures
When to Order the MRI Exam

Common Practice
- Blood work to screen for metabolic or infectious causes.
- Wait.
- Medicate if seizures occur more frequently.

Recommended Practice
- Blood work to screen for metabolic or infectious causes.
- Wait and if happens more often order a MRI.
- MRI to search for brain structural abnormalities.
- Analysis of cerebrospinal fluid (CFS) for signs of infection.
- Medicate depending on the MRI results.
Balance Disorders

- Four main functions in the animal vestibular system need to function for proper balance.
  - Sensors in the **inner ear** monitor head position and time.
  - Converting the information about the position of the head into electrical signals in the inner ear via **vestibulocochlear nerve** to the lower brain.
  - The balance control center is the **brainstem** working signals with the cerebellum to keep an animal upright.
  - The vestibular nuclei relay signals from the brain steam to the **cerebellum** which uses constant feed back on body position to coordinate movement.
Balance Disorders Signs

- Lack of Balance
- Head Tilt
- Circling
- Nausea
- Falling / Rolling
- Nystagmus
- Tremors
- Ataxial
- Horner’s Syndrome
- Hypermetria
Common Causes of Balance Disorders

- Peripheral Vestibular Disease (Inner Ear & Vestibulocochlear Nerve)
  - Inflammatory
    - Infection (otitis media / interna)
    - Immune-mediated (polyps)
  - Neoplastic (inner / middle ear)
    - Melanoma
    - Squamous cell carcinoma
    - Adenocarcinoma
  - Traumatic
    - Head Injury
    - Eardrum Rupture
  - Toxic
    - Medications
  - Idiopathic
    - Geriatric Vestibular Syndrome
Common Causes of Balance Disorders

- **Central Vestibular Disease** *(Brainstem & Cerebellum)*
  - Degenerative / Metabolic
    - Cerebellar Abiotrophy (Breed Specific)
  - Congenital
    - Cerebellar Hypoplasia
    - Hydrocephalus
  - Inflammatory
    - Immune-Mediated
      - Cerebellitis
      - White Dog Syndrome
  - Neoplastic
    - Medulloblastoma
  - Traumatic
    - Head Injury
  - Toxic
    - Metronidazole
  - Vascular

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Central Nervous System
When to Order the MRI Exam

Common Practice
- Physical Exam
- CBC / Labs / CSF Fluid.
- Medicate and Observe

Recommended Practice
- Physical Exam
- Neurological Exam
- CBC / Labs / CSF Fluid
- Order MRI
- Medicate and Observe
Abnormal Behavior

- Abnormal behavior can be caused by several different factors.
- Using a neurological physical examination can help identify if it is a neurological disorder or a defiant animal behavior.
Abnormal Behavior Signs

- Getting stuck in the corner
- Hyperactive
- Tired and Fatigued
- Staring off into space
- Barking at nothing, for no reason
- Becoming violent
- Walking in circles
Common Causes of Abnormal Behavior

- Brain
  - Seizures
  - Tumor
  - Hydrocephalus
  - Breed-Specific Encephalitis
    - Small Dog Encephalitis
    - Pug Dog Encephalitis (PDE)
- Thyroid
  - Feline Hyperthyroidism
  - Canine Hypothyroidism
  - Thyroid Carcinoma
- Toxic
  - Strychnine
  - Metaldehyde
  - Organophosphate
  - Heavy Metals
- Traumatic
  - Head Injury
  - Heavy Metals
- Viral
  - Canine Distemper Encephalomyelitis
  - Rabies
When to Order the MRI Exam

**Common Practice**
- Evaluate the mental status.
- Run labs for Thyroid / Toxins.
- Evaluate for Distemper / Rabies.
- Behavior Modification.

**Recommended Practice**
- Evaluate the mental status.
- Run labs for Thyroid / Toxins.
- Evaluate for Distemper / Rabies.
- Order the MRI exam.
- Behavior Modification.
The brain, spinal column, and limbs must communicate to produce proper movement.

If any one of the main 3 structures is not functioning properly then communication will not produce motion or create partial movement.

Paresis is reduced ability.

Paralysis is the inability to active motor neurons.
Weakness and Limb Paralysis/Paresis

- **Weakness** is the decrease in strength of one or more muscles.

- **Paralysis/Paresis** are signs of myelopathy or encephalopathy of the central nervous system.

- While **Weakness** is a sign of neuropathy and/or myopathy in the peripheral nervous system.
Weakness and Limb Paralysis/Paresis Signs

- Knuckling
- Dragging Leg(s)
- Abnormal Gait
- Monoparesis / Monoplegia
- Paraparesis / Paraplegia
- Tetraparesis / Tetraplegia

Knuckling / Weakness

Dragging Legs

Distal Myopathy
Common Causes of Weakness and Limb Paralysis/Paresis

- **Spinal Cord Disease (Myelopathies)**
  - **Degenerative**
    - Lumbarsacral Stenosis
    - Intervertebral Disc Disease
    - Cervical Spondylomyelopathy / Wobber Syndrome
    - Arachnoid Cyst / Diverticulum
    - Spondylosis Deformans
  - **Congenital**
    - Vertebral Malformations
    - Atlantoaxis Subluxation
    - Caudal Occipital Malformation Syndrome
    - Syringomyelia or Hydromyelia
    - Spine Bifida
Common Causes of Weakness and Limb Paralysis/Paresis

- **Spinal Cord Disease** *(Myelopathies)*
  - **Inflammatory**
    - Bacterial
      - Discospondylitis
      - Tetanus
    - Rickettsial
      - Rocky Mountain Spotted Fever
      - Ehrlichiosis
  - Viral
    - Canine Distemper Encephalomyelitis
    - Feline Infectious Peritonitis (FIP)
    - Feline Leukemia (FeLV) Associated Myelopathy
    - Rabies
  - Fungal
    - Aspergillosis
    - Blastomycosis
    - Cryptococcosis
    - Coccidiomycosis / Valley Fever
    - Histoplasmosis
  - Protozoal
    - Neosporosis
    - Toxoplasmosis
- **Parasitic**
Common Causes of Weakness and Limb Paralysis/Paresis

- **Spinal Cord Disease (Myelopathies)**
  - Immune-Mediated
    - Steroid Responsive Meningitis / Arteritis
    - Granulomatous Meningoencephalomyelitis (GME)
  - Neoplastic
    - Osteosarcoma
    - Fibrosarcoma
    - Meningioma
    - Nerve Sheath Tumor
    - Metastatic Neoplasia
    - Multiple Myeloma
    - Lymphoma
  - Traumatic
    - Fracture, Subluxation / Luxations
  - Vascular
    - Fibrocartilaginous Embolism (FCE)
    - Ischemic Myelopathy
  - Metabolic
    - Degenerative Myelopathy
    - Degeneration of Motor Neurons
Common Causes of Weakness and Limb Paralysis/Paresis

- Neuromuscular Disease (Neuromyopathies)
  - Degenerative
    - Fibrotic Myopathy
  - Congenital
    - Congenital Myasthenia Gravis
  - Inflammatory
    - Infectious
      - Myositis
      - Neuritis
      - Acute Idiopathic Polyradiculoneuritis / Coonhound Paralysis
    - Bacterial
      - Tetanus
    - Protozoal
      - Neosporosis
      - Toxoplasmosis
  - Immune-mediated
    - Acquired Myasthenia Gravis
    - Paraneoplastic Neuropathy
    - Myositis
    - Neuritis
Common Causes of Weakness and Limb Paralysis/Paresis

- Neuromuscular Disease *(Neuromyopathies)*
  - Neoplastic
    - Nerve Sheath Tumor
  - Traumatic
    - Brachial Plexus Tumor
    - Peripheral Nerve Injuries
  - Toxic
    - Botulism
    - Organophosphate Poisoning
    - Tick Paralysis
  - Vascular
    - Ischemic Neuropathy
      - Aortic Thromboembolism
  - Metabolic
    - Diabetic Neuropathy
    - Muscular Dystrophy
    - Hypothyroidism
When to Order the MRI Exam

Common Practice
- Physical Exam.
- CSF Fluid / CBC / Labs
- Take an X-Ray.
- Treat with pain killers and anti inflammatory medications.
- Myelogram

Recommended Practice
- Physical and Neurological Exam.
- CSF Fluid / CBC / Labs
- Take an X-Ray.
- Treat with pain killers and anti inflammatory medications.
- If persistent or getting worse order an MRI exam.
Deafness

- Deafness can be caused by a degeneration of the nerves.
- Animals can be unilaterally or bilaterally deaf.
- Unilateral deaf animals experience difficulties in localizing the source of the sound but usually learn quickly to compensate.
- Bilateral deaf animals are unable to hear, locate the source of the sound or anticipate danger.
Deafness

- When completing a hearing loss exam the examiner should be out of the field of vision.
- Unilateral hearing loss can be difficult to discover.
- Deafness can be classified by 3 categories:
  - Inherited Deafness (At Birth)
  - Acquired Deafness (Aged Hearing Loss)
  - Conductive Deafness (External Abnormalities)
  - Neurological Deafness (Internal Abnormalities)
Neurological Deafness

- Conduction deafness is caused by abnormalities of the pinna (external ear), ear canal, tympanic membrane (eardrum), auditory ossicles or middle ear. Waxy debris occluding the ear canal, tympanic membrane, and severe ear infections are all examples of diseases causing conduction deafness.

- Neurologic or sensorineural deafness is caused by abnormalities of the inner ear, auditory nerve or in the brain itself.
Deafness Signs

- Unresponsive to calling.
- Turns to see when hearing a noise.
- Unaware of dangerous situations.
- Hearing gradually gets worse with age.
- Shakes their head more.
- Paws at their ears.
- Sleeps more.
- Not waking unless touched.
Common Causes of Neurological Deafness

- **Nerve Deafness**
  - Degenerative changes in the cochlea of an old dog
  - Anatomic
    - Hypoplasia
    - Aplasia of the spiral organ
    - Hydrocephalus caused by damage to the auditory cortex
- **Neoplastic**
  - Acoustic Neuroma
  - Neurofibroma
  - Neurofibrosarcoma
- **Inflammatory and Infectious**
  - Otitis Interna
  - Canine Distemper virus can cause alterations in hearing (not complete deafness)
  - Naso-pharyngeal polyps invading inner ear
- **Trauma**
Common Causes of Neurological Deafness

- **Toxins and Drugs**
  - **Antibiotics**
    - Aminoglycosides
    - Polymixin B
    - Erythromycin
    - Vancomycin
    - Chloramphenicol
  - **Antiseptics**
    - Ethanol
    - Chlorhexidine
    - Cetrimide
  - **Antineoplastics**
    - Cisplatin
  - **Diuretics**
    - Furosemide
  - **Heavy Metals**
    - Arsenic
    - Lead
    - Mercury
  - **Miscellaneous**
    - Ceruminolytic Agents
    - Propylene Glycol
    - Salicylates
When to Order the MRI Exam

Common Practice
- Evaluate the internal and external ear.
- Rule out an ear infection or age related.
- Perform a hearing test.
- Perform the cotton ball test.
- Offer treatment (medical or surgical).

Recommended Practice
- Evaluate the internal and external ear.
- Rule out an ear infection or age related.
- Perform a hearing test.
- Perform the cotton ball test.
- Offer treatment (medical or surgical).
- If unresponsive to treatment order the MRI.
Blindness

- Vision comes from the proper function of:
  - Eye and Retina
  - Optic Nerve
  - Brain

- Patient’s with problems in the eye, retina or nerves will have abnormal pupillary light response (PLR).

- Patient’s with problems in the brain (i.e. Cortical blindness) will have a normal PLR.
Blindness Signs

- Sudden Blindness
- Normal or Abnormal Pupillary Light Response.
- Walking into objects.
Common Causes of Blindness

- Common diseases associated with vision disorders.
  - Eye and Retina
  - Optic Nerve
    - Inflammatory
    - Optic Neuritis
  - Brain
    - Congenital
    - Hydrocephalus
    - Inflammatory
    - Encephalitis
  - Neoplastic
    - Brain Tumor
    - Retrobulbar Mass
  - Traumatic
    - Head Injury
  - Metabolic
    - Anoxia
    - Storage Diseases
    - Hepatoencephalopathy
  - Vascular
When to Order the MRI Exam

Common Practice
- Testing for:
  - Vision
  - Eye Movement
  - Pupil Size
  - Menace Reaction
  - Palpebral Reflex
  - Corneal Reflex
  - Pupillary Light Reflexes
- Ocular Ultrasound to review retinal detachment.

Recommended Practice
- Testing for:
  - Vision
  - Eye Movement
  - Pupil Size
  - Menace Reaction
  - Palpebral Reflex
  - Corneal Reflex
  - Pupillary Light Reflexes
- If determined Neurological order an MRI.
Abnormal Nasal Drainage

- Nasal discharge comes from several sources, including mucous cells and glands in the nose.

- Secretions usually move caudally (away from the nostril) by the mucociliary apparatus (small hair-like projections) and when they reach the nasopharynx (where the nasal cavity meets the throat) they are swallowed.

- When secretions accumulate to the exterior, it suggests that there is an increased production of secretions or an obstruction to drainage.

- MRI is helpful for determining the amount and extent of bony involvement of a nasal mass.
Abnormal Nasal Drainage

- Sneezing
- Nasal Drainage
- Swelling over the bridge of the nose
- Tearful Eyes
- Matted Eyes
- Breathing through the mouth
- Wheezing
Common Causes of Abnormal Nasal Drainage

- Common causes of abnormal nasal drainage
  - Inflammation / Infection
    - Rhinitis
    - Sinusitis / Sinus Infection
    - Narrow Nasal Opening
  - Neoplasia
    - Nasal Neoplasia
  - Reverse Sneezing
  - Other
    - Foreign Body
    - Nasal Mites
  - Fungal
    - Nasal Fungal Disease
  - Brachycephalic Syndrome
    - Stenotic Nares
  - Viral
    - Respiratory Viral Infection
    - Canine Distemper Encephalomyelitis
    - Feline Infectious Peritonitis (FIP)
    - Feline Leukemia (FeLV) Associated Myelopathy
    - Rabies

Nasal Passage
When to Order the MRI Exam

Common Practice
- Physical Exam
- Evaluate for Viral Infection / Distemper / FIP / FeLV / Rabies.
- Clean Nasal Passage
- Treat with Antibiotics.
- X-Ray of the Skull

Recommended Practice
- Physical Exam
- Evaluate for Viral Infection / Distemper / FIP / FeLV / Rabies.
- Clean Nasal Passage
- Treat with Antibiotics.
- If persistent order an MRI to evaluate nasal tumor, fungal rhinitis, or bony changes.
Neurological Pain

- Pain can arise from an actual tissue injury, inflammation or from damage to a portion of the nervous system.
- Swelling maybe the cause of pain.
- Neck pain may be due to an increase in intracranial pressure.
- Back pain may initially cause abdominal pain.
- Polyarthritis could appear to be cervical spinal pain.
- Panosteitis may resemble lumbar spinal pain.
- Certain abscesses of the jaw or bone could be mistaken for head pain.
- Pain from the cruciate ligament ruptures often show similar signs as limb pain.
Neurological Pain Signs

- Crying Out
- Holding Limb Up
- Low Head Carriage

Crying Out

Holding Up Paw
Common Causes of Neurological Pain

- **Head**
  - Brain Swelling
  - Inflammation
  - Tumor

- **Spine**
  - Herniated Disc
  - Vertebral Infections or Tumors
  - Meningitis
  - Vertebral Fracture or Subluxations / Luxations
  - Neuritis

- **Limb**
  - Nerve Root or Peripheral Nerve Tumor
  - Inflammation (Neuritis)
  - Myalgia (Myositis)
When to Order the MRI Exam

**Common Practice**
- Physical Exam.
- Labs
- Take an X-Ray.
- Treat with pain killers and anti-inflammatory medications.
- Myelogram

**Recommended Practice**
- Physical and Neurological Exam.
- Labs
- Take an X-Ray.
- Treat with pain killers and anti-inflammatory medications.
- If persistent or getting worse order an MRI exam.
Other Neurological Signs

- Many neurological problems have specific signs that are not associated with any of the previously mentioned problems.
Other Neurological Signs

- Difficulty Swallowing or Chewing
- Decreased Facial Movement
- Voice Change
- Muscle Atrophy of the Head
- Facial Paralysis
- Dropped Jaw
- Trismus
Common Causes of Other Neurological Signs

- Common Neurological Diseases whose primary signs have not been covered.
  - Facial Paralysis
    - Idiopathic Facial Paralysis
    - Facial Nerve Trauma
  - Jaw Paralysis
    - Trigeminal Neuritis
    - Tetanus
  - Laryngeal Paralysis
  - Dysphagia
    - Megaesophagus
    - Myasthenia
  - Bulbar Neuritis
    - Hypoglossal Paralysis
  - Trigeminal Neuritis
  - Masticatory Myositis
  - Dysautonomia
  - Narcolepsy
  - Syncope
When to Order the MRI Exam

**Common Practice**
- Physical Exam
- Neurological Exam
- CBC / Labs
- X-Ray
- Myelogram

**Recommended Practice**
- Physical Exam
- Neurological Exam
- CBC / Labs
- X-Ray
- Order a MRI
Reasons to order a Non-Neurological MRI

- Tumors
- Masses
- Abscess
- Edema
- Unknown Swelling
- Sarcoma
- Organ Imaging
Common Non-Neurological Disorders

- Enlarged Lymph Nodes Unknown Cause
- Thyroid Tumor
- Mammary Tumor
- Large Lipoma Unknown Orientation for Surgery
- Cushing’s Disease or Hyperadrenocorticism
  - (Pituitary / Adrenal Gland Evaluation)

Mammary Tumor

Large Lipoma

Thyroid Tumor

Cushing’s Disease
Common Malignant Tumors

- Malignant Tumors
  - Tubular Adenocarcinoma
  - Papillary Adenocarcinoma
  - Papillary Cystic Adenocarcinoma
  - Solid Carcinoma
  - Anaplastic Carcinoma
  - Osteosarcoma
  - Fibrosarcoma
  - Malignant Mixed Tumor
  - Mast Cell Tumors
  - Skin Cancer
When to Order the MRI Exam

Common Practice
- Physical Exam
- Needle Aspiration / Biopsy.
- Labs
- X-Ray
- Surgery

Recommended Practice
- Physical Exam
- Needle Aspiration / Biopsy.
- Labs
- X-Ray / MRI
- Surgery
MRI Contrast (Gadolinium)

- MRI uses Gadolinium as its contrast agent.
- Gadolinium is silvery-white, malleable, ductile rare-earth metal, and is very paramagnetic.
- Gadolinium is used to enhance possible tumors or scar tissue.
- Gadolinium allows you to see blood flow for tumor enhancement.
MRI versus CT

**MRI**
- Uses a strong magnet and non-ionizing radio frequency signals to acquire images.
- Better for imaging non-calcified tissue such as muscle, tendons, soft herniated disc and edema.

**CT**
- Uses X-rays, a type of Ionizing Radiation, to acquire images.
- Better for imaging bone and the tissue surrounding them.
MRI versus CT

MRI

- Viewed in **multiple planes** without moving the patient.
  (Transverse, Saggital, Dorsal, and Oblique)

- **Gadolinium contrast** has a paramagnetic property.

CT

- Primarily viewed in **one plane** (Transverse)

- **Iodine or Barium contrast** agents with higher atomic numbers compared to surrounding tissues.
MRI versus CT

MRI
- MRI can detect the subtle difference in tissues contrast without the use of myelography.

CT
- Necessary to perform a myelogram prior to a CT of the spine in order to see a compression to the spinal cord.
MRI versus CT

- 15 year old feline with a balance disorder.
- **MRI** clearly showed an infection in the right ear canal and did not appear to have any destruction of the bone.
- If there was destruction of the bone, then the lesion could be invading the brain and causing a poor prognosis.
- **CT** was performed and revealed the bone was intact.
Case Study #1

- A 8 year old female German Shepherd Dog.
- Presented with Seizures.
- MRI was ordered.
Case Study #1

Meningioma

- A tumor is found in the Olfactory Bulb and frontal cortex.
- Diagnosis is typical of a meningioma and was confirmed with a tumor removal surgery.

Meningioma is the most common primary brain tumor in dogs and cats. More common in long nosed breeds: Golden Retrievers, German Shepherds, etc...
Case Study #2

- 6 year old female Boxer.
- Developed an increased thirst, change in personality and seizures.
- MRI was ordered.
Case Study #2

- A large cystic tumor is present in the thalamus.
- The location of the tumor, within the substance of the brain, rather than on the surface makes a glioma the likely diagnosis.

Glioma

Glioma is common in short nosed breeds: Boxers, Boston Terriers, French and English Bulldogs.
Case Study #3

- A six year old female Dalmatian.
- Born with three legs.
- Presented with a 2 week history of progressive weakness in all legs and increased neck pain.
- MRI was ordered.
Case Study #3

Prolapsed Disc

- A prolapsed disc was diagnosed. In addition revealing diseased and healthy vertebra.
- Spinal Surgery was performed with physiotherapy and hydrotherapy post surgery.
- **Follow Up 4 weeks later:** no longer having pain, able to stand, increased in range of motion, reverting back to normal.
Case Study #4

- 5 year old female Cat.
- Presented with low back pain.
- Unsure of possible injury.
Slipped disc between L6 and L7.

Surgery was performed and the MRI was used to find the location of L6 and L7. The ruptured disc was removed and the cat recovered back to normal.

A Myelogram may not diagnose a slipped disc in the low back on cats and dogs.
Case Study # 5

- 6 year old male Australian Shepherd.
- Sudden onset of tenderness, lameness, and some knuckling over.
- Noticed the lameness, when playing fetch.
- X-ray was ordered and nothing abnormal was found.
- MRI was ordered.
Case Study #: 5

Fibrocartilaginous Embolism (FCE)

- The Axial T2 shows an area of hypointensity, normal CSF column and minimal cord enlargement.
- Post contrast axial T1 images shows an area of hyperintense inflammation in origin. The contrast shows a loss of blood flow to this area. This is consistent with fibrocartilaginous embolus.
- Sag. T2 imaging shows the hyperintense area within the cord representing an area of infarction. The nerve cells are inured due to the lack of oxygen and have more unbound intracellular and extracellular water resulting in increased T2 signal.
Case Study #6

- 7 year old male Poodle.
- Presented with a sudden onset of blindness.
- Pupillary Light Response (PLR) was abnormal.
- MRI was ordered.
Case Study #6

Optic Neuritis

MRI shows swelling and edema of the optic nerve (arrows)
AAI MRI Preparation

- A full CBC / Chem panel should be performed within 7 days prior to the exam.
- AAI can provide the needed lab work for a thorough sedation evaluation.
- If desired the client can bring the lab results or the facility can fax the result ahead of time to AAI.
- NPO for 12 hours before the MRI examination.
- Bring any pertinent lab work and x-rays with the client to the appointment.
- Please notify us if your pet may have metal objects in their body or a pacemaker.
Common Questions

- Will my pet be radioactive?
  No because MRI uses strong magnets and no ionizing radiation.

- Is MRI contrast harmful to my pet?
  Gadolinium dye reactions are rare. Reactions to gadolinium dye can include skin rash, itching, hives, sweating and swelling.

- Is there any at home precautions to follow?
  No

- How do I know if I need an MRI or not?
  Feel free to give AAI a call and a veterinarian can help assist your questions.
Common Questions

- **How long will it take for the MRI exam?**
  MRI exams can take 45 minutes to 2 hours depending on the exam. Most animals are dropped off in the morning and picked up in the afternoon.

- **What should the client expect when their pet has a MRI exam?**
  Your pet will be given routine sedation. This is needed to keep your pet still during the exam. Your pet will be positioned on a padded table. During the MRI exam your pet will be thoroughly monitored.

- **Who will be performing the exam?**
  An experienced board-certified MRI technologist, veterinarian and anesthesia trained veterinarian technician.

- **How do we order the exam?**
  By calling for an appointment to AAI.
Common Questions

- **When will the results be ready?**
  You can expect to have the results of your MRI exam in 24-48 hours.

- **How does the referring veterinarian get the results?**
  The referring veterinarian can view the report and images online at:
  www.advancedanimalimaging.com
Understanding MRI

- Understanding the proper time to order a MRI exam will aid in early diagnosis and treatment options.

- MRI is a great diagnostic tool once fully understood.
References

- [www.vetneuro.com](http://www.vetneuro.com)
- Veterinary Neuro Services
- [www.vetinfo.com](http://www.vetinfo.com)
- Rocky Mountain Veterinary Neurology