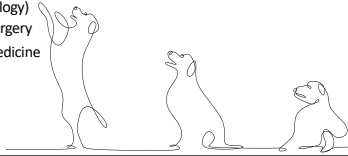


Walk This Way: understanding myelopathies and when to refer

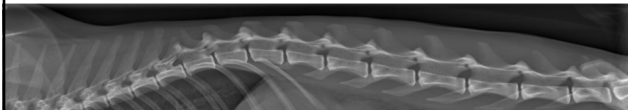
Amy B. Yanke, DVM, MS, DACVIM (Neurology)
Assistant Professor, Neurology & Neurosurgery
Auburn University College of Veterinary Medicine
Annual Fall Conference 2023



Outline

Review of common disease presentations...conservative management vs referral

- IVDD
- FCE(M)/ANNPE/HNPE
- Inflammatory/Infectious (including Discospondylitis)
- Trauma
- Neoplasia
- Degenerative Myelopathy



Intervertebral Disc Disease (IVDD)

Hansen's Type I

- Acute extrusion of nuclear material into canal
- Young, chondrodystrophic breeds
- Can be secondary to traumatic events or normal activity



Hansen's Type II

- Protrusion of annulus into canal
- Large breed dogs (GSD, Labs)
- Progressive over weeks, months, years; can be acute on chronic



Intervertebral Disc Disease (IVDD)

- Most common spinal disease of dogs

- Clinical signs

- Ambulatory is ≥ 10 unassisted steps

- Depends on region of spinal cord affected...

- Upper Motor Neuron (UMN) – normal to increased tone/reflexes; long strides
 - Lower Motor Neuron (LMN) – decreased to absent tone/reflexes; short/choppy gait

Modified Frankel Scale (MFS) Score	
5	Normal gait with spinal hyperesthesia
4	Ambulatory paresis
3	Non-ambulatory paresis
2	Paralysis with intact superficial pain
1	Paralysis with intact deep pain
0	Paralysis with absent deep pain ☹

	C1-C5	C6-T2	T3-L3	L4-S3
Thoracic Limbs	UMN	LMN	Normal	Normal
Pelvic Limbs	UMN	UMN	UMN	LMN

↳ "Two engine gait" (video to explain later)

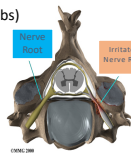
Nerve Root Signature (Radiculopathy)

- Clinical signs:

- Holding up the limb or scuffing/knuckling the limb
 - Pain – neck or with moving limb

- Lesion localization:

- C6-T2 myelopathy (Thoracic limbs)
 - L4-S3 myelopathy (Pelvic limbs)

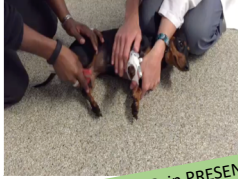


If a patient has voluntary motor, you DO NOT need to check for pain perception!



Can You See the Difference?

Normal Withdrawal Reflex



Deep Pain PRESENT

Normal Withdrawal Reflex



Deep Pain ABSENT

Intervertebral Disc Disease (IVDD)

- Conservative Management:
 - If only painful OR still ambulatory may do well
 - **CRATE REST x 2 weeks** → recheck → if improved continue x 4-6 weeks → then gradual return to activity over 8 weeks → **lifestyle changes indefinitely**
- Multimodal Pain Medications:
 - Gabapentin 10 mg/kg PO q8-12hrs
 - +/- Codeine 1-2 mg/kg PO q8-12hrs
 - If cervical muscle fasciculations: Methocarbamol 20 mg/kg PO q8hrs
 - If wound-up pain: Amantadine 2-5 mg/kg PO q24hrs
- Steroids vs NSAIDs?
- Plant the seed and expectation if referral...here \$5000-7000 pending no complications
 - if declining or not improving...need to move forward as soon as reasonably possible

REMEMBER!



THE CRATE IS YOUR MATE

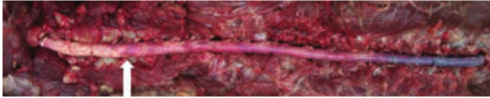
Intervertebral Disc Disease (IVDD)

- Surgery should be pursued if non-ambulatory tetra/paraparetic → OR fails medical management
- Client considerations may prevent this intervention :/
- Deep pain = Prognosis
- If +, 80-90% functional recovery (can walk on their own and urinate on own)
- If absent, at best 50%! – needs surgery as soon as reasonably possible

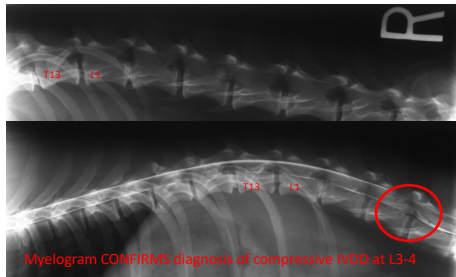


Myelomalacia (Ascending +/- Descending)

- In $\leq 10\%$ Deep Pain Negative Dogs – up to 30% in Frenchies :/
- Flaccid paralysis in pelvic limbs; absent abdominal tone
- Absent anal tone/flaccid bladder tone
- Ascending panniculus cut off $> T10$
- Respiratory distress
- Refractory pain!



IVDD on Myelogram



Myelogram CONFIRMS diagnosis of compressive IVDD at L3-4


IVDD on CT Scan



Normal thoracic spinal canal

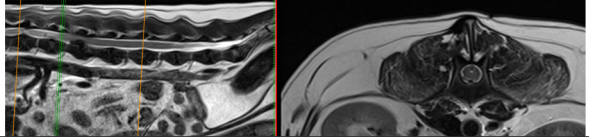
Thoracic spine Type I IVDD

Meet "Hank"...



The severity of clinical signs does NOT always correlate with the degree of compression...

Meet Hank's Disc...

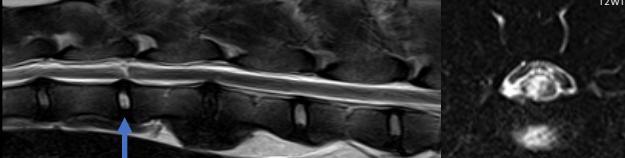


Another IVDD Success Story...



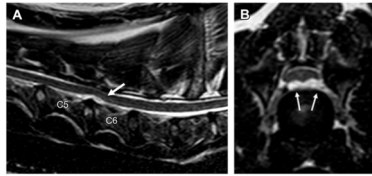
Acute Non-Compressive Nucleus Pulposus Extrusion (ANNPE)

- Normal, hydrated disc material is acutely extruded
- Can be secondary to traumatic event
- +/- hyperesthesia
- Concussive injury to spinal cord; not compressive
- T2 hyperintensity in cord from high velocity of material hitting cord, but not causing compression
- Crate rest and PT...if painful initially, put on pain meds



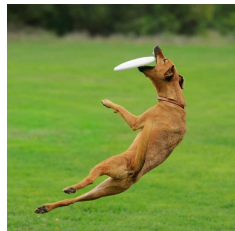
Hydrated Nucleus Pulposus Extrusion (HNPE)

- Extrusion of hydrated disc material **causing compression**
- Predilection for **cervical** spine
- Acute onset nonambulatory tetraparesis/plegia
- +/- hyperesthesia
- MRI – T2 hyperintense compressive material with "seagull" appearance and narrowed disc space
- Conservative vs surgical intervention controversial

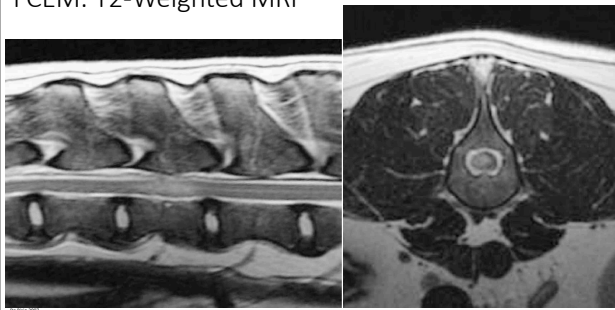


Fibrocartilaginous Embolic Myelopathy (FCE(M))

- "Stroke" – Embolization of artery/vein (gray > white matter affected)
- Material thought to originate from IVD
- Large/giant breeds; 20% less than 20 kgs
 - Mini schnauzer, Shelties
- Young to middle-aged dogs; cats median 10 years
- Asymmetric; non-progressive ≥ 24 hours
- NON-PAINFUL
- Dogs L4-S3 > T3-L3; Cats C6-T2
- Length expressed as ratio over C6 or L2 and cross-sectional area (%)
 - Length ratio < 2 or < 67% cross sectional area were significantly more likely to recover
- Median time to max recovery 3.75 months



FCEM: T2-Weighted MRI



Fibrocartilagenous embolic myelopathy (FCEM)



Courtesy: LA Medical

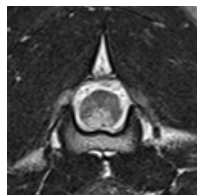
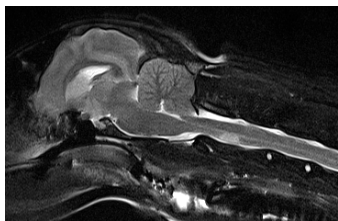
Meet "Zeni"



Courtesy: Dr. Stephanie Tomlinson

- 17 year old FS DSH
- 1 day history of non-ambulatory tetraparesis
- 1.5 month history of bilateral visual deficits due to systemic hypertension... on Amlodipine
- Grade III/VI systolic heart murmur
- Fundic exam = punctate hemorrhages OU
- Exam: non-ambulatory tetraparesis with increased extensor tone (TLs > PLs)
- Localized C1-C5 myelopathy

Cat with vascular lesion... Feline Ischemic Myelopathy



Well demarcated elliptical T2 hyperintensity common at C2-C3; vascular territory of ventral spinal artery

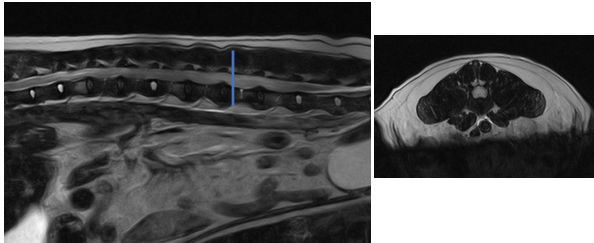
****Seen with concurrent systemic disease (hypertension, hyperthyroid, chronic kidney disease, hypertrophic cardiomyopathy) as opposed to an FCEM where there would be no other systemic disease (Relapse possible!)****

Inflammatory – Meningo(encephalo)myelitis of Unknown Etiology (MUE)

- Multifocal CNS inflammatory disease
- Acute onset, progressive
- Young to middle-aged toy/small breed dogs
- r/o infectious: toxoplasma, neospora, RMSF, Ehrlichia, cryptococcus; fungal organisms if appropriate!
- Treatment: mainstay = immunosuppressive Prednisone (2 mg/kg/day) tapering by 25% every 4-8 weeks to lowest effective dose over time
 - Depending response +/- additional immunosuppressive (Cytosar®, Cyclosporine, Mycophenolate, Leflunomide)



Inflammatory – Meningo(encephalo)myelitis of Unknown Etiology (MUE)



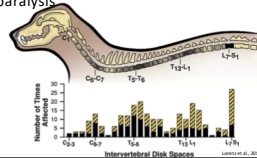
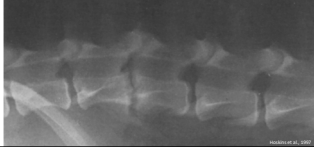
Inflammatory – Steroid Responsive Meningitis Arteritis (SRMA)

- aka "Beagle Pain Syndrome"
- Immune vasculitis of meningeal a. and meningitis
- Sometimes infiltrates CNS parenchyma
- 6 months to 2 year old large breed dogs and Beagles
- CS: severe neck pain, +/- cervical myelopathy, +/- febrile; rarely can cause seizures
- Diagnosed with MRI and CSF tap (neutrophilic pleocytosis)
- Can present with concurrent polyarthropathy
- Treatment: Once infectious titers confirm negative → increase to immunosuppressive steroids (Prednisone 2 mg/kg/day tapering by 25% every 4-8 weeks pending clinical response weaning to lowest effective dose)



Infectious Spinal Cord Disease - Discospondylitis

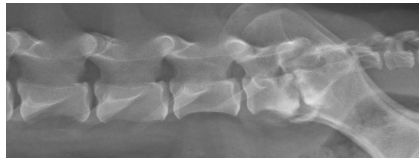
- Infection of disc and adjacent vertebral bodies
- Hematogenous spread or direct infection (surgery, penetrating wound, migrating awn)
- *Staphylococcus intermedius/aureus*, *Streptococcus*, *Escherichia coli*, ***Brucella canis***; fungal testing (*Aspergillus* – German Shepherds)
 - **Test all for *Brucella* as Zoonotic!**
- CS: most commonly pain only; stiff gait, paresis/paralysis



Discospondylitis - Diagnostics

- Urine culture: positive in about 25-50%
- Blood cultures: 3 samples 1 hour apart vs 3 sites all at once; positive in about 45-75%
- Tube agglutination for *B. Canis*
- +/- echocardiogram – if new murmur or febrile r/o endocarditis
- Radiographic abnormalities lag behind onset of clinical signs for average of 2-3 weeks (Shamir et al., 2001)

When to refer...
if worsening or NOT
improving after 2 weeks



Antibiotics for Discospondylitis

Organism	Antibiotic	Dosage
Staphylococcus spp	Cephalexin	20-30 mg/kg PO TID
	Cefazolin	20 mg/kg IV, IM, SQ QID
	Cloxacillin	10 mg/kg IV, IM, PO QID
	Oxacillin	15-25 mg/kg PO T-QID
	Amoxicillin-clavulanate	12.5-25 mg/kg PO B-TID
Streptococcus spp	Amoxicillin	20 mg/kg PO BID
Brucella canis	Enrofloxacin	10-20 mg/kg PO SID
	Doxycycline	25 mg/kg PO BID
Actinomyces spp	Penicillin G	100,000 U/kg IV, IM, SC, QID
Aspergillus spp	Ketoconazole	10 mg/kg PO BID (dog); 50 mg/kg PO BID (cat)
	Fluconazole	5 mg/kg PO BID (dog); 50 mg/kg PO BID (cat)
Escherichia coli	Enrofloxacin	10-20 mg/kg PO SID
	Cefazolin	20 mg/kg IV, IM, SQ QID
	Cephalexin	20-30 mg/kg PO TID
	Amoxicillin-clavulanate	12.5-25 mg/kg PO B-TID
	Chloramphenicol	22 mg/kg PO, IV, SQ TID

Antibiotics for a min of 2-3 months; may need to for 6 months - 1 year

Trauma – spinal luxations/fractures

- Be cautious of patient manipulation – may need spinal board
- First steps...
 - Airway
 - Breathing
 - Circulation
- Assess patient
 - TPR
 - Physical exam – though may be limited
- Identify and treat life-threatening conditions first



Trauma – spinal luxations/fractures

- Orthopedic Examination
- Neurological Examination
 - Be as complete as possible but be careful with manipulation!
 - Mentation
 - Cranial nerve exam
 - Posture assessment
 - Motor function
 - Reflexes
 - If paralyzed...
 - Withdrawal reflex DOES NOT MEAN PATIENT FEELS STIMULUS
 - Deep pain perception assessment
 - If deep pain intact, prognosis is fair to good (medical vs surgery)
 - If deep pain negative = poor prognosis (for functional recovery)



Trauma – spinal luxations/fractures

- Once patient is stable...
- Diagnostics
 - Survey radiographs (orthogonal views!)
 - Minimize spinal movement – horizontal beam?
 - Radiograph the entire spine – they can have multiple lesions (20%)!
 - Radiographs may miss the lesion in 25% of cases!
 - CT scan +/- MRI



Trauma – spinal luxations/fractures

Conservative Management

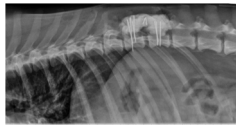
- STRICT cage rest for 8-12 weeks
- +/- external splinting
 - Cotton padding
 - Gauze cling wrap
 - Vet wrap
- Pain control
- Bladder management*
- Recumbent care*



Trauma – spinal luxations/fractures

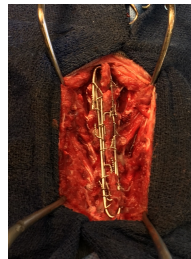
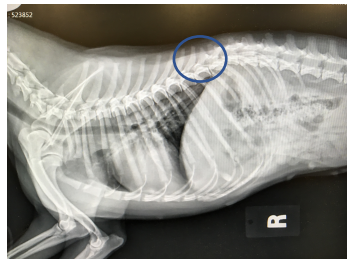
Surgical stabilization performed when...

- Patient has significant neuro signs
- Moderate to severe displacement of spine
- Worsening of neurological status

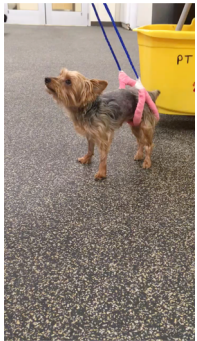
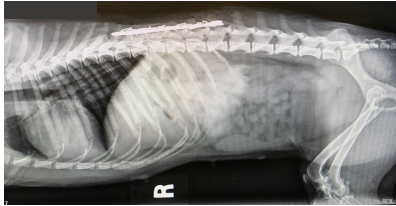


Plant the seed and expectation for referral...surgery here \$7000-10,000 pending no complications. Additionally, will have post-operative recheck radiographs and may need revisional surgery over time if implant failure.

Trauma – spinal luxations/fractures

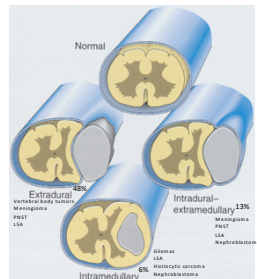


Trauma – spinal luxations/fractures



Neoplasia

- Variety of primary vs secondary tumors
- Lymphoma most common in cats
 - Prevalence 28-40%
 - Bimodal
 - Extra-CNS disease in 85%
- Meningiomas – cranial cervical region (dogs)
- Peripheral Nerve Sheath Tumor (PNST) –
 - Nerve root signature; muscle atrophy; axillary mass/pain; can invade spinal cord
- Nephroblastoma – young dogs :/



Degenerative Myelopathy (DM)

- Progressive, non-painful T3-L3 myelopathy
- Medium to large breed dogs > 5 years (mean 9 years)
- German shepherds, Boxers, Corgis
- MRI/CT scan unremarkable
- Axon and myelin degeneration in dorsal aspect of lateral funiculi and dorsal funiculi
- Superoxide dismutase 1 (SOD1) gene mutation → genetic testing



Canine Genetic Diseases Network
University of Missouri






Degenerative Myelopathy (DM) – Treatments?



- Physical therapy – intensive daily therapy = walking, passive range of motion, massage of the limbs and **hydrotherapy** significantly improved mean survival time (255 days) > moderate physiotherapy (130 days) or no physiotherapy (55 days) - Kathmann et al., 2006


Degenerative Myelopathy (DM) – Treatments?



- Medications?
 - Lack of confirmed efficacy
 - Aminocaproic acid
 - N-acetylcysteine
 - Vitamin E
 - Vitamin C
 - Riluzole
 - Steroid trial
- Most are euthanized within 6-12 months of diagnosis :/

Not to forget cats...

- Cats rarely have IVDD!!!
- Consider Inflammatory/infectious (toxoplasma, FIP, cryptococcus)
- Neoplasia (LSA vs other)
- Vascular (FCEM/Ischemic myelopathy)





References

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