Intervertebral Disk Herniation and Laser Disk Ablation

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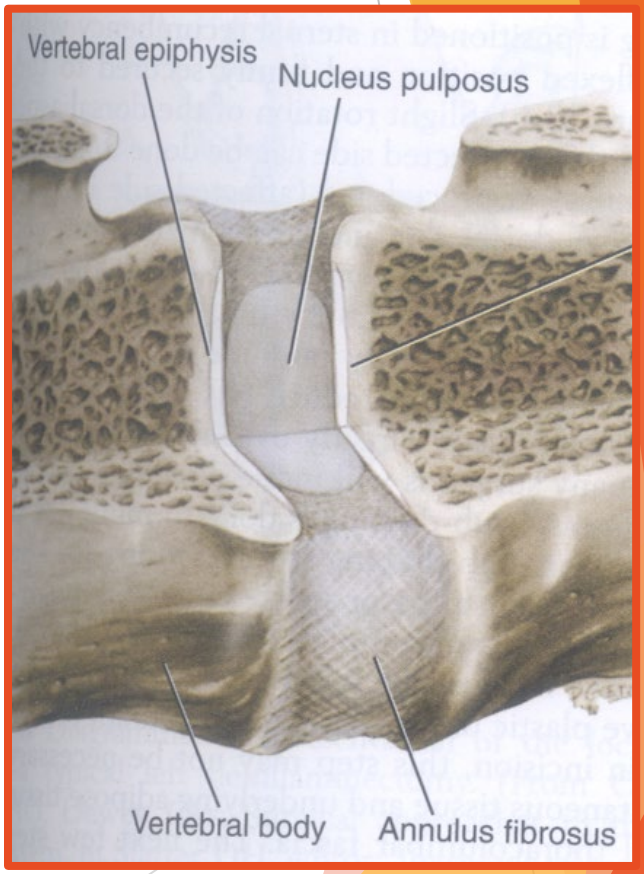
Anatomy of the Intervertebral Disk

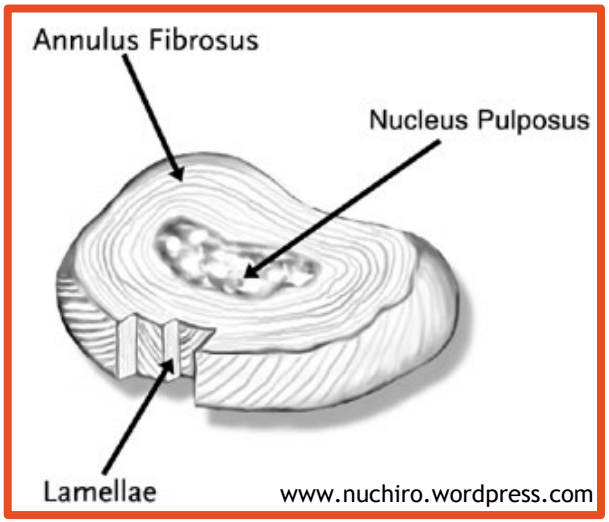
- 26 intervertebral disks in the canine spine
- 2 components
  - Annulus fibrosus
  - Nucleus pulposus
- Cartilagenous vertebral endplates
  - Source of nutrients via diffusion

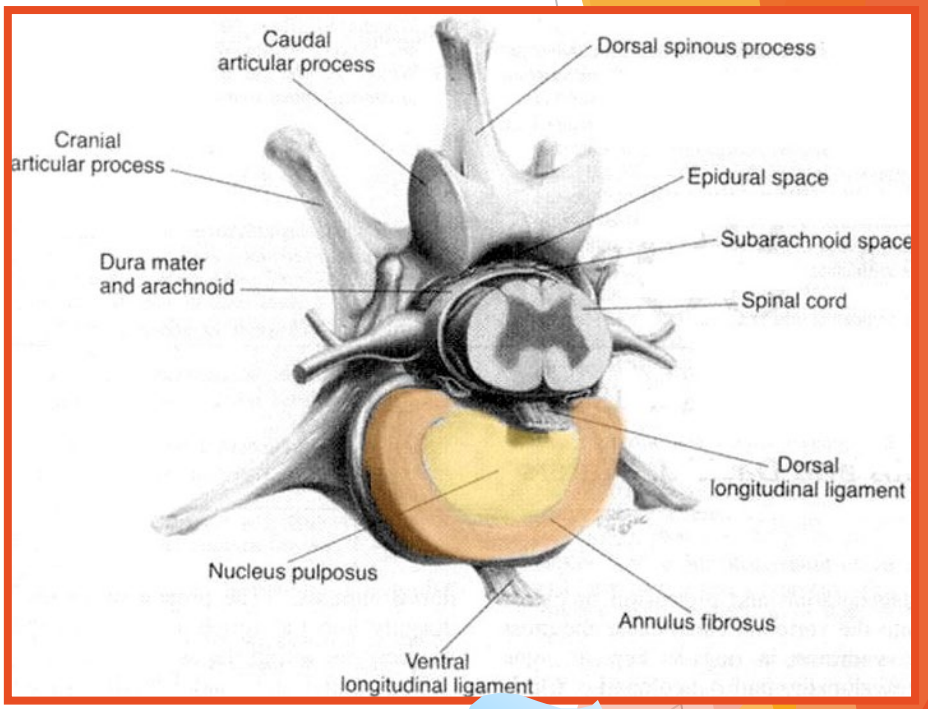


Tobias and Johnston, 1st edition

Disk: Annulus vs. Nucleus

- Annulus fibrosus
  - Parallel arrangement of lamellae
  - Twice as thick ventrally than dorsally
- Nucleus pulposus
  - Originates from embryonic notochord
  - Located eccentrically in the disc





Slatter 3rd edition

Function of the Intervertebral Disk

- Shock absorption and distribution
  - Determined by:
    - Proteoglycans in the nucleus
    - Elasticity of the annulus
- Flexible enough to allow: bending, shear, compression, tension, torsion
- Rigid enough to endure these physiologic forces

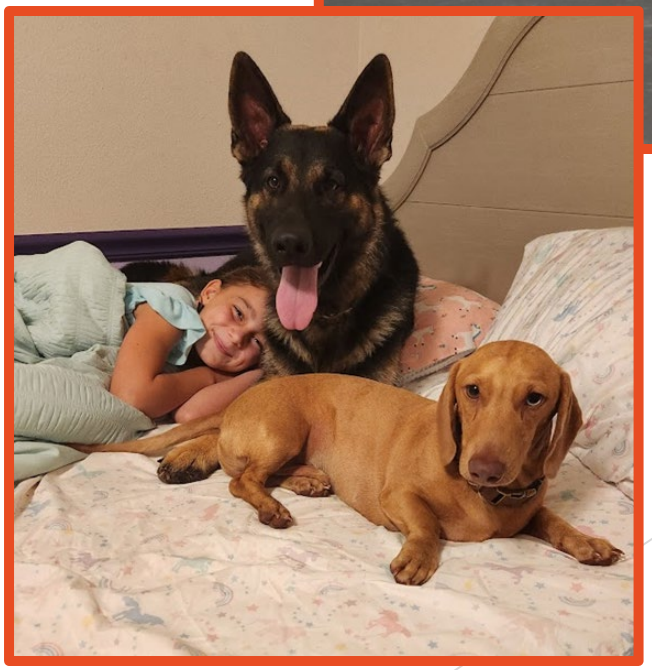
Pathophysiology of IVDH

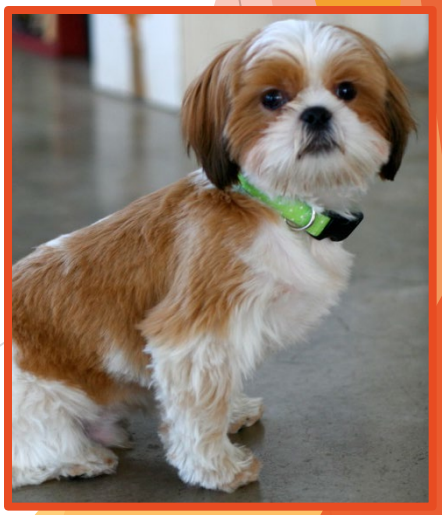
Slatter 3rd edition

- Molecular components of the disk:
  - Proteins – collagenous and noncollagenous
  - Proteoclycans
  - Glycoproteins
- IVDH
  - Molecular components change
    - Loss of water
    - Accumulation of mineral
    - Alteration of proteoglycans – chondroitin to keratin sulfate
  - Intradiskal pressure increases
  - Extrusion/herniation of the nucleus pulposus
  - Chondroid metaplasia

Signalment

- Chondrodystrophic breeds
  - Dachshund: 45-73% of IVDD cases
    - 40-50% less proteoglycans
    - 40% less glycoproteins
  - French Bulldog
  - Bassett Hound
  - Poodle
  - Pekingese
  - Shih Tzu
  - Cocker Spaniel
- Peak age: 3-7 years old





Clinical Presentation

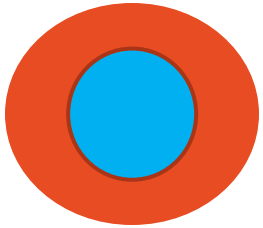
- Compressive myelopathy + contusion injury
- Factors:
  - Duration of compression
  - Velocity of disc herniation
  - Amount of disc herniation

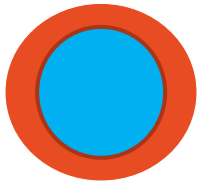
Clinical Presentation

- Paraspinal hyperesthesia
  - Abdominal discomfort?
  - Reluctance to ambulate
  - Hunched back/guarded neck
  - Vocalization
- Ataxia/paresis
- Plegia

IVDH
Cervical vs. Thoracolumbar

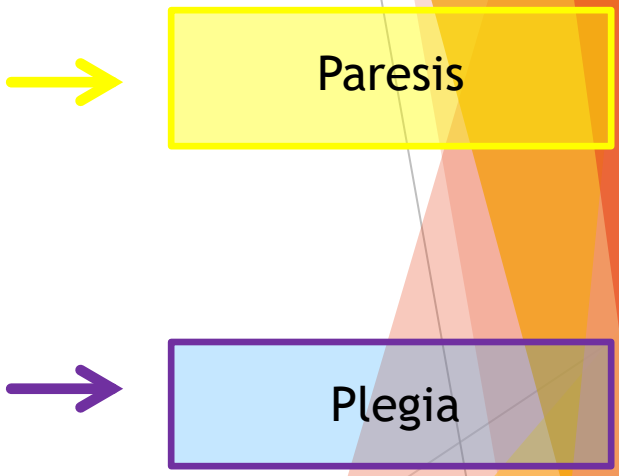
- Cervical
  - 25-33% of IVDH cases
  - C4-C5 most common
  - Pain more common
    - Up to 61%
    - Larger vertebral canal : spinal cord
- Thoracolumbar
  - 66-75% of IVDD cases
  - T10-11 → caudal
  - Nerve deficits + pain more common





Neurologic Progression

- Conscious proprioception
- Ambulation
- Motor (voluntary motor function)
- Urination
- Superficial pain
- Deep pain



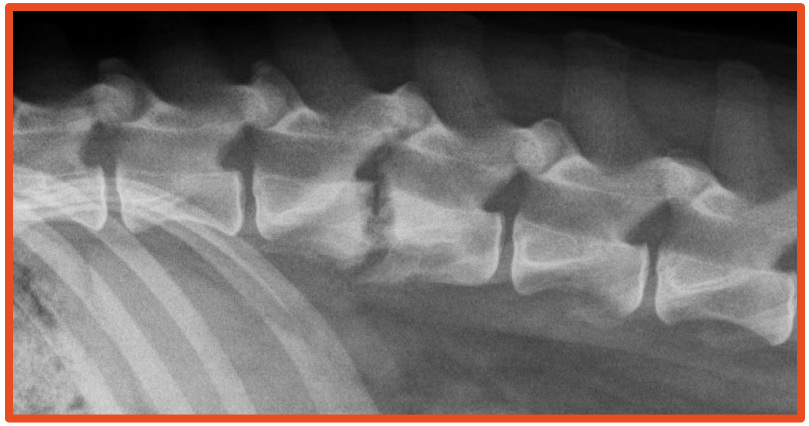
Neurologic Progression

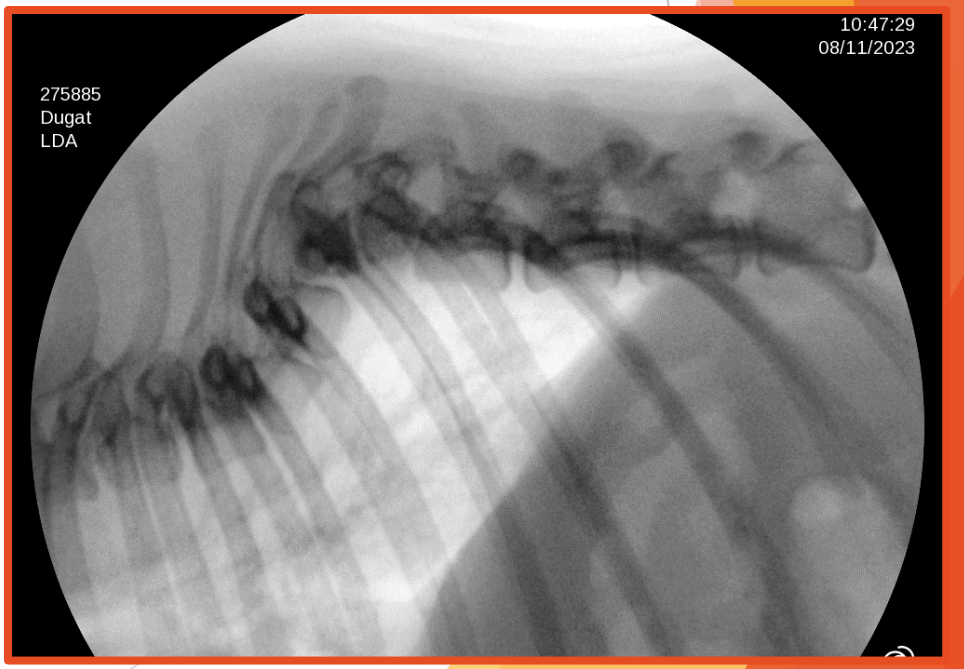
- Paresis
  - Weakness
  - Presence of voluntary motor function
  - *+/- ambulation*
- Plegia
  - Absence of voluntary motor function
  - *+/- deep pain sensation***

When to offer medical vs. surgical management

Differential Diagnosis

- Neoplasia
- Trauma
  - Fracture, luxation, subluxation
- Fibrocartilagenous embolism
- Infection – diskospondylitis
- Inflammation
- Orthopedic disease
- Congenital - hemivertebrae



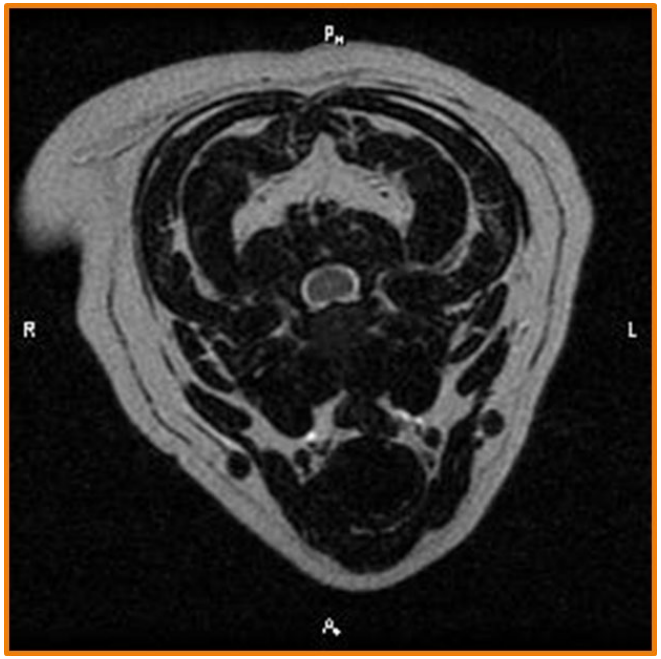


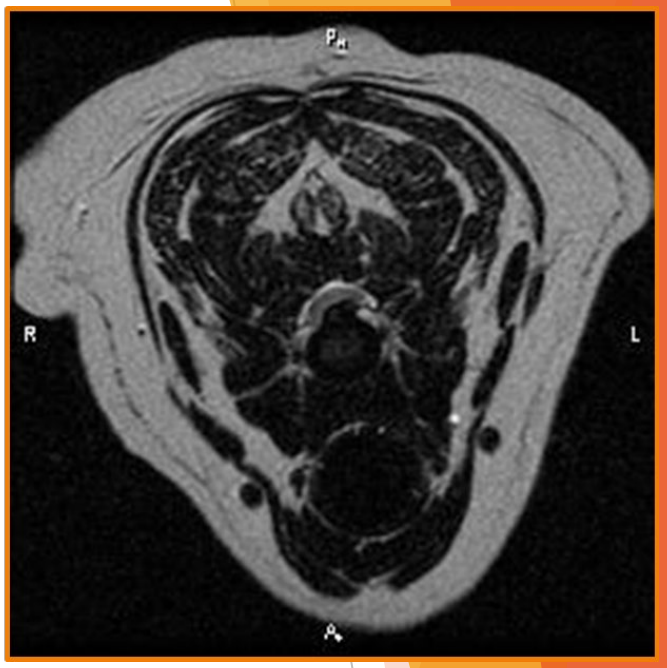
Diagnosis

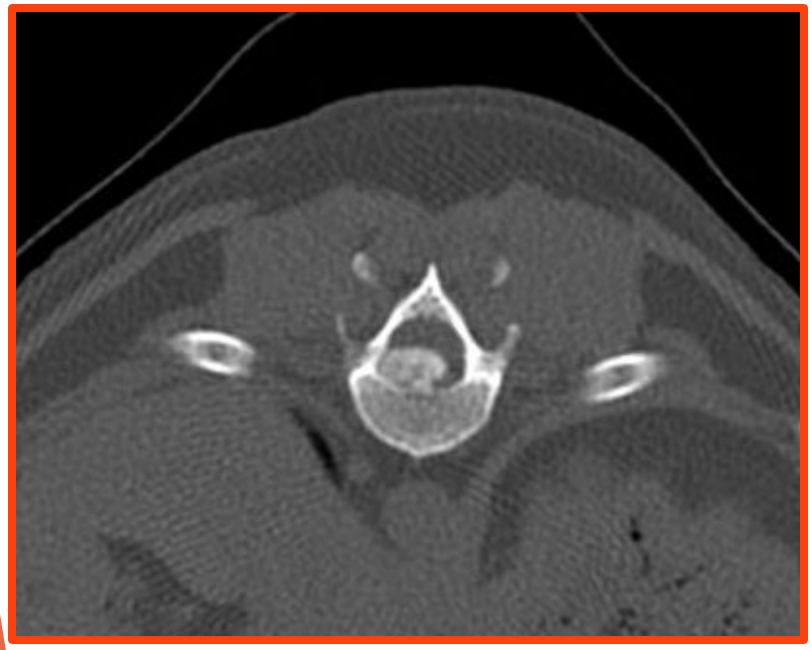
- Radiographs
  - Overall accuracy – 35%
    (Somerville, JAAHA 2001)
  - Rule out differentials
  - Mineralized disc in situ
    - Each disc = 1.4 X increased risk of IVDH
    - 5-6 mineralized discs = 50% IVDH risk

Diagnosis

- CT
- MRI







Management
Medical vs. Surgical

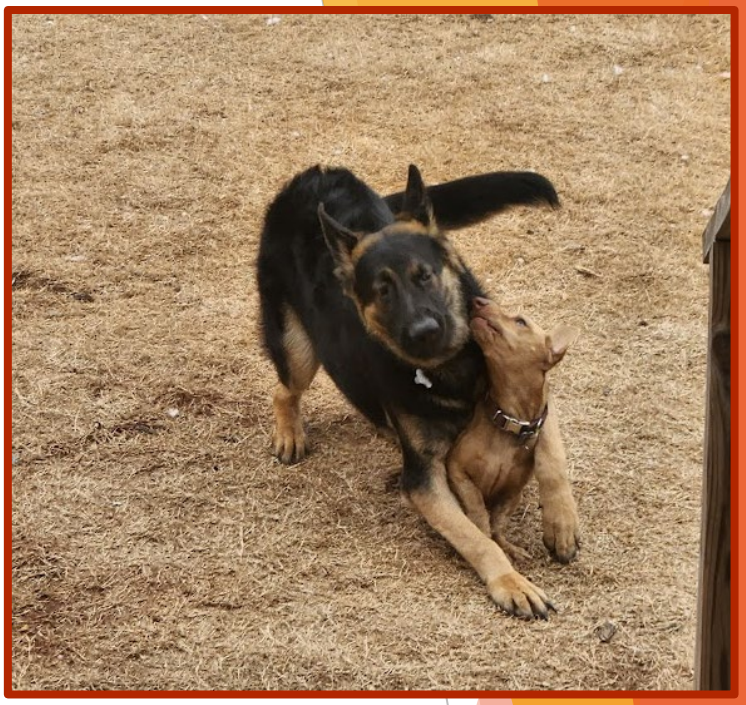
- Paresis
  - Weakness
  - Presence of voluntary motor function
  - Ambulation present
  - Ambulation absent
- Plegia
  - Absence of voluntary motor function
  - +/- deep pain sensation**

Medical vs. Surgical Management

Neurologic Status	Medical Management	Surgical Management
Pain only	Cervical 70-90% TL 90%	Not indicated
Unresolving Pain	Not indicated	90%
Ambulatory paresis	85-90%	90%
Non-ambulatory paresis	50-60%	80-90%
Plegia, + deep pain	50-60%	80-90%
Plegia, No deep pain <24 hours	Guarded	50-60% (Fair)
Plegia, No deep pain 48 hours	Grave	<5% (Guarded)

Medical Management

- 4-6 weeks of crate rest
- Pain medications as needed
  - NSAID
    - Carprofen 2.2mg/kg PO BID
    - Meloxicam 0.1mg/kg PO SID
  - Gabapentin 10-15 mg/kg PO TID
- Recheck evaluations
  - 1 or 2 weeks
  - 4 weeks



Medical Management Steroids

- Glucocorticoids were associated with negative outcome and quality of life *(Levine, Vet Surg 2007)*
  - Spinal cord injury was controlled
- Follow-up study in 161 dogs *(Levine, JAVMA 2008)*
  - Treatment groups:
    - Dexamethasone within 48 hours
    - Non-dexamethasone glucocorticoids within 48 hours
    - No glucocorticoids
  - Steroids did not affect short-term (4-6 week) outcome
  - Dexamethasone – higher risk of complications
    - Diarrhea (3.5 X)
    - Urinary tract infection (11.4 X)

Surgical Management

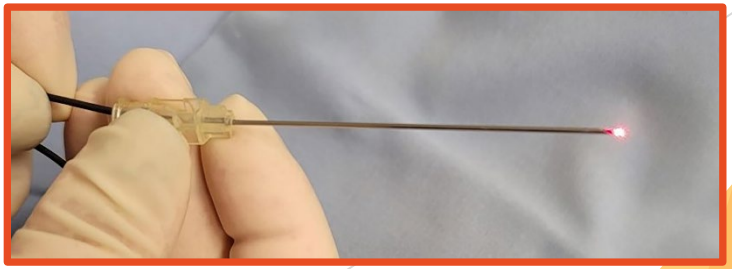
- When medical management fails
  - Continued pain
  - Worsening of neurologic signs
- Non-ambulatory paresis

Recovery and Prognosis

- 15-20% risk of recurrence, minimum
  - 2.6-41% (1-4)
- Recurrence risk greater with >5 mineralized discs in situ
- Recurrence risk greater with inappropriate confinement

Percutaneous Laser Disk Ablation

- Ablation of the nucleus pulposus
  - Alternative to fenestration
- Performed on T10-11 thru L5-6
- Goal
  - Reduce the risk of recurrence
  - Preventative for at-risk breeds
- Ho:YAG delivers laser energy + heat to nucleus → vaporization (5)
  - Reduced volume of nucleus pulposus
  - Reduced intradiskal pressure (6-10)
  - Nucleus fills in with cartilaginous fibrous tissue (11)
- Advantages over fenestration:
  - Lower complication rate/morbidity
  - Shorter time to recovery



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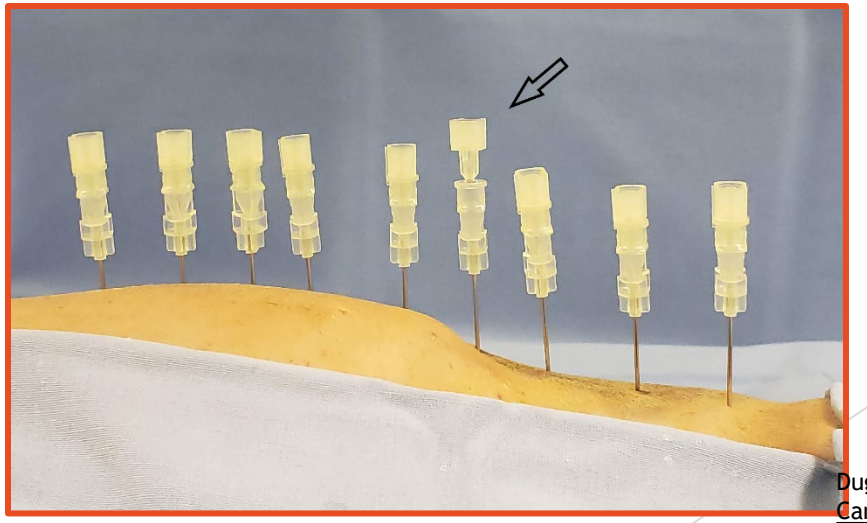
PLDA

- Outcome
  - Decreased intradiskal pressure
    - 76-94% success in humans (12-14)
    - 56% owners reported improved mobility (15)
- Complications:
  - Neuritis/pain, anesthesia, recurrence of IVDH episode



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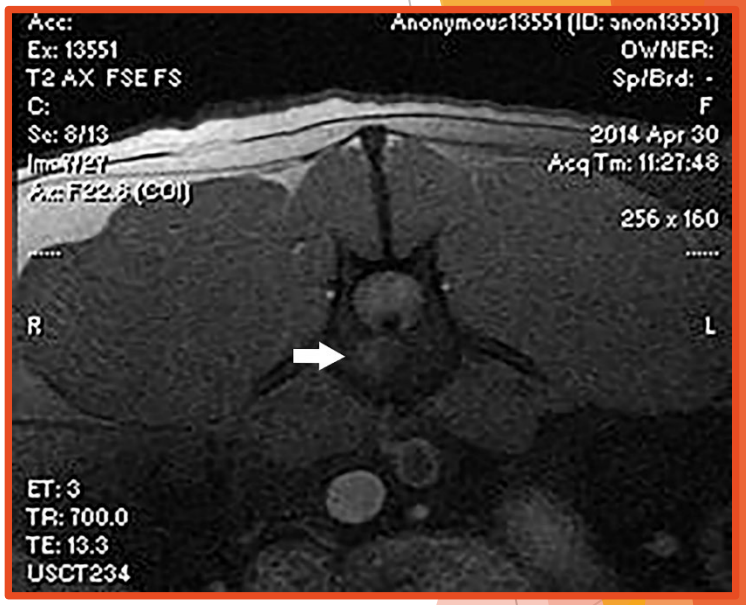
PLDA
Evaluating the Procedure (16)

- 30 dogs
  - Pre-PLDA MRI (baseline)
  - Post-PLDA MRI (immediate effects of PLDA)
  - 12-week post-PLDA MRI (later effects of PLDA)
- Intervertebral disk morphology
  - Disk morphology did not change
- Diskitis
  - Mild inflammation (0-15%) at 12 weeks
- Vertebral end plate changes
  - Correlated with subchondral bone marrow changes in adjacent vertebral bodies
    - T2 TRANS – edema (less than 2mm) at 12 wk MRI
    - Lack of correlation to clinical signs



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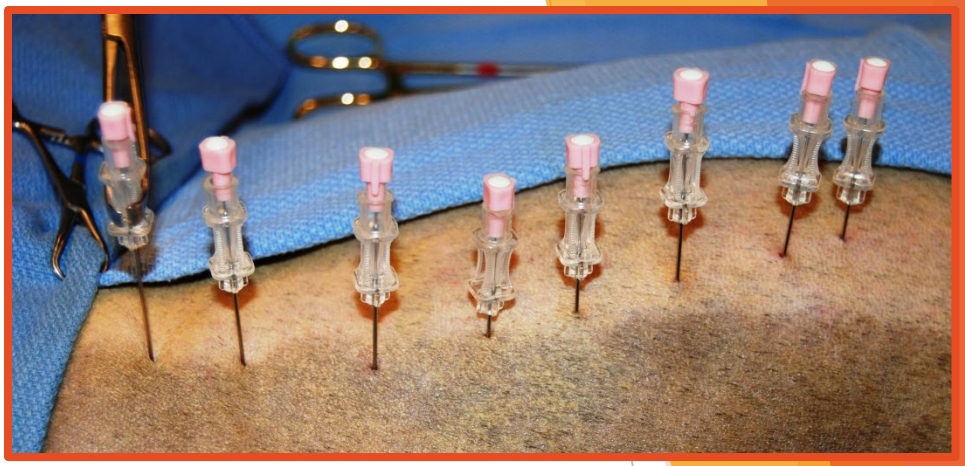
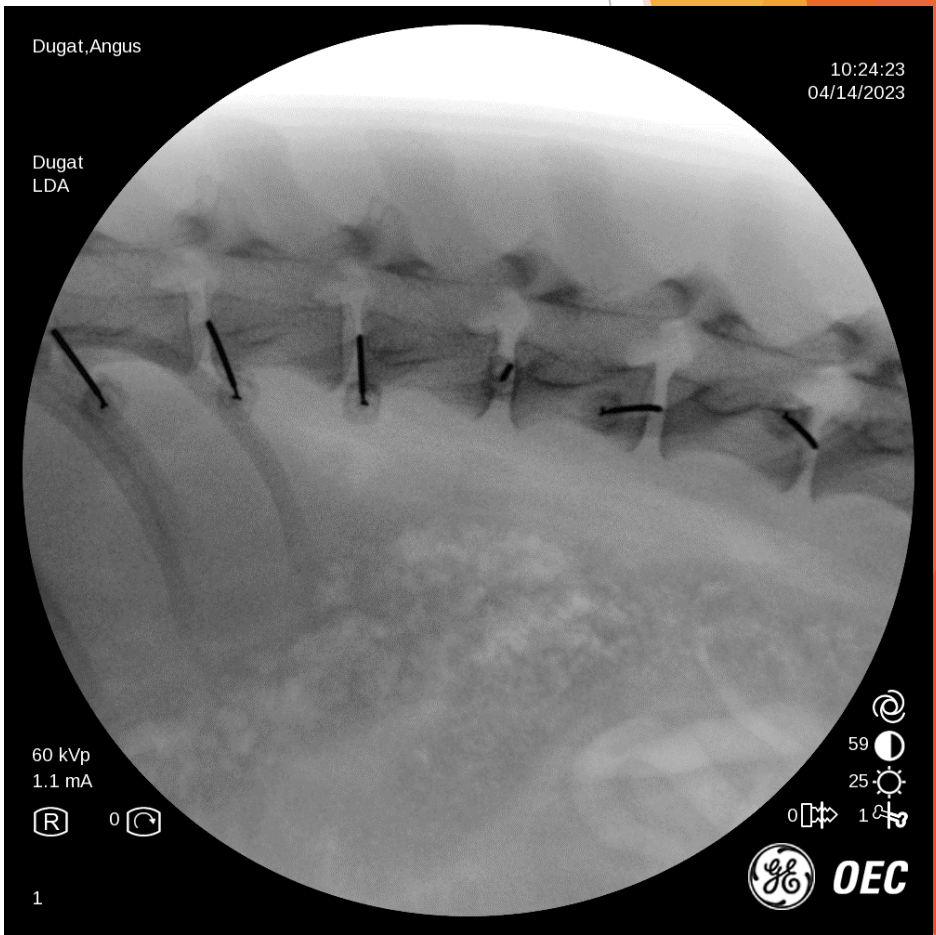
PLDA



- Criteria
  - Complete recovery from a previous episode
  - Pain free for 2 weeks prior to procedure
    - Time 0 exam
    - 2-week exam
  - No pain medications/anti-inflammatories for 2 weeks
  - Neurologically stable
  - Absence of skin infection/pyoderma
- Cost: $2,000-2,200



Things to Consider …

- Acute recurrence is often related to extrusion at same site as previous extrusion (<1 month)
  - 1-8% risk
- Urinary tract infection risk
  - 21% - 1 week (Stiffler, Vet Surg 2006)
  - 27% - 1 week; each day of management = 1.5X risk *(Bubenik, Vet Surg 2008)*
  - 38% developed UTI over 3 months (Olby, J Vet Intern Med 2010)
- Rehabilitation
- Electroacupuncture
  - Improved outcomes with medial management
    - Up to 85% improvement

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Questions?