Intervertebral Disc Disease in the Dachshund

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Intervertebral Disc Disease in the Dachshund

- Overview of IVDD
- Clinical Signs
- Diagnosis
- Treatment
- Prevention

From the Dansk Gravhundeklub website
Overview of IVDD
Overview of IVDD

- **Normal anatomy**
- The intervertebral discs sit between the vertebrae and act as shock absorbers
Overview of IVDD

- Normal anatomy
- Discs have a soft centre (the nucleus pulposus) inside a fibrous ring (the annulus fibrosus)
- The normal nucleus pulposus is a viscous gel
- When surrounded by the tough annulus fibrosus the gel will compress and absorb energy like a shock absorber
Overview of IVDD

• Disc disease
  • First categorised by Hansen in 1952
  • Degeneration of either component of the disc can occur
    • Nucleus pulposus degeneration
    • Annulus fibrosus degeneration
Overview of IVDD

• Disc disease
  • First categorised by Hansen in 1952
  • Degeneration of either component of the disc can occur
    • Nucleus pulposus degeneration
    • Hansen Type 1 disease
    • Common in Daschunds
    • Can lead to sudden onset of problems
  • Annulus fibrosus degeneration
Overview of IVDD

- Disc disease
  - First categorised by Hansen in 1952
  - Degeneration of either component of the disc can occur
    - Nucleus pulposus degeneration
    - Annulus fibrosus degeneration
      - Hansen Type 2 disease
      - Unusual in Dachshund
      - Can lead to gradual, progressive onset of problems
Overview of IVDD

• **Type 1 Disease**
  • Increased incidence in chondrodystrophic (or more correctly hypochondroplastic) breeds including -
    • Dachshund
    • Pekingese
    • Beagle
    • Spaniel breeds
  • **Hypochondroplasia** -
    • Gene mutation causes abnormal cartilage production
    • Results in characteristic body shape
    • But..... also contributes towards chondroid metaplasia – the cause of nucleus pulposus degeneration
Overview of IVDD

• Chondroid Metaplasia
  • Results in changes to the nucleus pulposus -
    • Loss of fluid
    • Replacement with cartilage
    • Severely affected discs may become calcified, although this does not always occur
  • The nucleus becomes less compressible
  • This places increased forces on the annulus which begins to degenerate
Overview of IVDD

- **Chondroid Metaplasia**
- Eventually the annulus ruptures and degenerate nucleus pulposus is extruded into the vertebral canal.
- This causes compression of the spinal cord, often resulting in clinical signs.
- Lifetime incidence of 18% in Dachshunds (probably more without obvious signs).
Overview of IVDD

- Chondroid Metaplasia
- Microscopic changes begin before birth
- Macroscopic changes are present in around 90% of Dachshunds by one year of age
- As discs degenerate they may become mineralised
Clinical Signs
Clinical Signs

• What to look out for
  • Pain
  • Incoordination (ataxia)
  • Paralysis
Clinical Signs

• What to look out for
  • Pain
    • Yelping (unprovoked or when handled)
    • Reluctance to jump or climb
    • Arching of the back
    • Low head carriage
    • Reluctance to lower head to eat
    • Reluctance to look upwards
  • Incoordination (ataxia)
  • Paralysis
Clinical Signs

• What to look out for
  • Pain
  • Incoordination (ataxia)
    • Most commonly hindlimbs
    • May affect all four limbs
    • When severe see obvious stumbling, swaying and wobbliness
    • When subtle -
      • Paws may occasionally be placed upsidedown
      • May hear claws scraping on hard ground
      • Incoordination may only be seen on difficult terrain
  • Paralysis
Clinical Signs

• What to look out for
  • Pain
  • Incoordination (ataxia)
  • Paralysis
    • Usually hindlimbs although occasionally all four limbs
    • Commonly preceded by incoordination
    • May be associated with urinary incontinence
Clinical Signs

• Neurological Grading
  • Grade 1 - Pain Only
  • Grade 2 - Ataxia / muscle weakness - walking
  • Grade 3 - Muscle weakness - not walking
  • Grade 4 - Paralysis with pain sensation
  • Grade 5 - Paralysis without pain sensation
Clinical Signs

- What to do!
  - Seek advice from your vet
    - Paralysis or rapid progression of signs should be considered emergencies
    - Pain or mild non-progressive ataxia warrant urgent (same or next day) veterinary examination
Diagnosis
Diagnosis

• Initial Assessment
  • Clinical examination
    • Establish the problem as neurological
    • Assess any concurrent problems
      • General health
      • Orthopaedic examination
  • Disc extrusion cannot be diagnosed on the basis of clinical examination alone -
    • There are many causes of back pain and neurological signs other than disc extrusion
Diagnosis

• Initial Assessment
  • X-Rays
    • Of limited value -
    • The spinal cord does not show up on X-Rays
    • Disc calcification indicates the presence of disc degeneration, not extrusion
    • A narrowed intervertebral disc space indicates that extrusion has occurred.... but not necessarily recently
  
  • Cord compression by disc extrusion cannot be diagnosed by X-Rays
    • Consider immediate referral before X-Rays
Diagnosis

• Diagnosis
  • Assessment of spinal cord compression can be made by-
    • Myelography
    • MRI examination
    • CT examination
Diagnosis

- **Myelography**
  - A dye that shows up on an X-ray is injected into the fluid that surrounds the spinal cord
  - Deviation of the outline of the fluid space indicates compression
  - Some risk
Diagnosis

- MRI (Magnetic Resonance Imaging)
  - A very strong magnet causes the atoms within tissues to emit radio waves
  - These are measured and are used to make a 3-D image of the body
  - Provides cross-sectional images of spinal cord and discs
  - Safe
Diagnosis

- MRI
Diagnosis
Diagnosis

- CT (Computed Tomography)
  - A 3-D X-Ray
  - Rapid and accurate imaging of the bones of the spine
  - Computer processing allows soft tissues to be seen
  - Safe
Diagnosis

- CT
Diagnosis

- CT
Treatment
Treatment

• Treatment Options
  • Non-Surgical
  • Surgical
Treatment

• Treatment Options
  • Non-Surgical
    • Can be considered if -
      • Mild pain
      • No ataxia
      • First episode of problems
    • Cage rest 4 weeks, then limited exercise further 2 months
    • Nearly all dogs improve.......  
    • BUT..... Up to 34% will have further extrusion of disc material
Treatment

- Treatment Options
  - Non-Surgical

- Steroids???

  - Ruddle (VCOT 2006) reviewed outcomes in 250 dogs (including 141 Dachshunds) paralysed as a result of disc extrusion and treated surgically
  - Outcomes were no different in dogs that were or were not given steroids
Treatment

• Treatment Options
  - Non-Surgical

  - Levine (JAVMA 2008) reviewed outcomes in 161 dogs (including 87 Dachshunds) treated surgically
  - Outcomes were no different in dogs that were or were not given steroids
  - Dogs given Dexamethasone were 3.4 times as likely to have a complication including urinary tract infection or diarrhoea
Treatment

• Treatment Options
  • Non-Surgical
    • The use of any form of steroids is not currently recommended either as part of conservative management or prior to surgery.
Treatment

• Treatment Options
  • Surgical
    • Most ataxic or paralysed dogs
    • Dogs with pain not responding to conservative treatment
    • Over 90% of ataxic or paralysed dogs recover after surgery -
      • Dogs with more severe signs may have residual deficits
      • Recovery may take several weeks
      • Intensive nursing required if paralysed +/- incontinent
    • Paralysed dogs without pain sensation have a worse prognosis
      • Between 50 and 60% are expected to recover the ability to walk
      • Prompt surgery is essential (under 24 hours)
Treatment

• Surgical Treatment
  • A window is created in the vertebra to allow access to the spinal cord
  • This is usually done from the side of the bone in the back, although in the neck the underside of the bone is used
  • Extruded disc material is carefully retrieved from around the cord
Treatment

- Surgical Treatment
  - Hemilaminectomy
Treatment

- Surgical Treatment
  - Hemilaminectomy
Treatment

- Surgical Treatment
  - Hemilaminectomy
### Treatment

#### Treatment Outcomes

<table>
<thead>
<tr>
<th>Neurological Grade</th>
<th>Non-surgical treatment</th>
<th>Surgical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Pain Only</td>
<td>100%</td>
<td>97%</td>
</tr>
<tr>
<td>2 - Ataxia / Weakness - walking</td>
<td>84%</td>
<td>95%</td>
</tr>
<tr>
<td>3 - Weakness - not walking</td>
<td>84%</td>
<td>93%</td>
</tr>
<tr>
<td>4 - Paralysis - with pain sensation</td>
<td>81%</td>
<td>95%</td>
</tr>
<tr>
<td>5 - Paralysis - no pain sensation</td>
<td>7%</td>
<td>64%</td>
</tr>
</tbody>
</table>

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<tr>
<th>Neurological Grade</th>
<th>Non-surgical treatment</th>
<th>Surgical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrence Rate</td>
<td>34-40%</td>
<td>0-15%</td>
</tr>
</tbody>
</table>
Prevention
Prevention

• Genetics
  • Heritability of disc disease
    • Much recent work by Vibeke Jensen in Denmark
    • She showed disc degeneration to be highly heritable in Dachshunds (heritability estimate, 0.47 to 0.87)
    • Heritability of 1 indicates that all variation is genetic in origin and a heritability of 0 indicates that none of the variation is genetic
    • Incidence varies significantly between different lines
Prevention

• Genetics
  • Mechanism of inheritance
    • Not a single gene (e.g. ABO blood group in humans)
    • Severity of disc disease determined by the effects of several genes and environmental factors
    • Dachshund body shape does not promote disc degeneration
    • Hypochondroplasia gene........
      • .....is thought to be a major genetic factor in the development of chondroid metaplasia......
      • .....but is responsible for the typical Dachshund conformation
      • So can we keep one without the other.....??
Prevention

• Genetics
  • Mechanism of inheritance
    • Probably!
    • Since several genes are involved, a reduction in the prevalence of disc disease should be possible by selective breeding without changing the characteristics of the breed
Prevention

• Breeding Programs
  • Criteria for success
    • The characteristic must have a significant genetic basis
      • Heritability estimate
    • The characteristic must be measurable before the animal breeds
    • Measurement of the characteristic must be accurate
    • A high proportion of the population must take part
    • Affected dogs must not be used for breeding

The story of hip dysplasia........
**Prevention**

- **Breeding Programs**
  - Criteria for success
    - Cannot use disc rupture itself as measured characteristic -
      - Disc disease may not manifest until after breeding
      - Some dogs with severe disc degeneration will never show signs, but will pass on the problem
    - **We need an early measure of the severity of disc degeneration in a potential breeding dog**
    - Disc calcification has been suggested
      - Known to be related to severe degeneration
      - Can be measured with an X-Ray at 2 years of age

- **BUT... Is disc rupture strongly associated with disc calcification?**
Prevention

• Jensen et al (JAVMA 2008)
  • 61 Dachshunds -
    • All X-Rayed when 2 years old
    • Surviving dogs X-Rayed at 8 years old
    • All episodes of disc rupture causing disease or death recorded
  • 22 dogs had had disc extrusion diagnosed
  • The number of calcified discs decreased with age
    • Must screen early
    • Nearly 50% of calcified discs probably extruded (some without signs)
Prevention

- Odds of clinical disc rupture increase by 1.42 for each calcified disc
- The risk of euthanasia due to disc disease was -
  - 5% when 4 or less calcified discs
  - 37% when > 4 calcified discs

<table>
<thead>
<tr>
<th>Number of calcified discs</th>
<th>Total number of dogs</th>
<th>Dogs with extrusion</th>
<th>Dogs without extrusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 1 or 2</td>
<td>26</td>
<td>3 (11%)</td>
<td>23 (89%)</td>
</tr>
<tr>
<td>3 or 4</td>
<td>16</td>
<td>7 (43%)</td>
<td>9 (57%)</td>
</tr>
<tr>
<td>5 or more</td>
<td>19</td>
<td>12 (63%)</td>
<td>7 (37%)</td>
</tr>
</tbody>
</table>
Prevention

- Jensen et al (JAVMA 2008)

- In summary -
- There is a quantitative association between the number of calcified discs at 2 years of age and occurrence of disc extrusion.
Prevention

- Breeding Programs
  - Danish Dachshund Club
  - Initially a voluntary scheme
  - Screening between 2 and 4 years old
  - Breeding recommended only when 0,1 or 2 calcified discs
  - If 3 or 4 discs -
    - Only one litter
    - Other parent must have <3 calcified discs
  - Should not breed if >4 calcified discs
Prevention

- **Breeding Programs**
  - **Danish Kennel Club**
  - From 1\textsuperscript{st} July 2009 litters can only be registered if both parents satisfy the Club scheme criteria
  - Some of the problems of HD scheme avoided -
    - Not voluntary!!
    - Registration is binding
    - The owner may not ask the vet to rule on the number of calcifications
    - Test results are published
Prevention

- Breeding Programs
- Danish Kennel Club
- Dogs are given a K-score between 0 and 9 according to the number of calcified discs present
- Too early to know if the program will be successful
Prevention

• Breeding Programs
  • Criteria for success
    • The characteristic must have a significant genetic basis
      • Heritability estimate
    • The characteristic must be measurable before the animal breeds
    • Measurement of the characteristic must be accurate
    • A high proportion of the population must take part
    • Affected dogs must not be used for breeding

The story of hip dysplasia........

IVDD........ is up to you!
Thank You

Any questions?