Average Time until Micturition and Ambulation were regained after Surgical Treatment of Thoracolumbar Disk Herniation in Relation to the Preoperative Neurological Score in 54 Dogs

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Objective of the Study

• To investigate the time necessary to regain controlled micturition and ambulation after surgical treatment of thoracolumbar Hansen type I intervertebral disk herniation and correlate this time to the preoperative modified Frankel score (MFS).
Clinical Interest?

• IVDE herniations are presented in many cases as emergencies

➢ First care-takers are often non-specialists

– Information about treatment outcome is necessary for the discussion with the owners
– Ideally this information should be based on easy available data
Final Outcome of IVDE with Surgery

- Older and newer studies agree, that the outcome with surgery is successful in 86-96% of the non-ambulatory patients with intact DPP, finally regaining ambulation and bladder control.

- Loss of DPP. The success rate in these patients after surgery is reported 0-76%, with an average around 50% (prognosis can be more accurate with MRI).
Deep Pain Perception

- Process by which pain is recognized and interpreted by the brain
Final Outcome of IVDE with Surgery

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• Do you NEED more to know?
Outcome of IVDE with Surgery

• Older and newer studies agree, that the outcome with surgery is successful in 86-96% of the non-ambulatory patients with intact DPP, finally regaining ambulation and bladder control

• Do you NEED more to know?

➤ Time of recovery is important for the owner!! (morbidity and costs)
In clinical cases, the time needed to regain control of the bladder often determines the duration of hospitalization.
Bladder Physiology: Simple Switch-On Mechanism

- Filling the bladder and keep the sphincter closed is controlled by sympathetic nerves and the pudendal nerve
- Emptying the bladder and open the sphincter is mainly controlled by parasympathetic nerves
Mechanisms of Spontaneous Recovery in the Spinal Cord

➢ After injury, the spinal cord can spontaneously recover to varying degrees through a variety of biological mechanisms.
➢ Whatever recovery of function that occurs naturally after a spinal cord injury is largely the product of plasticity in the surviving neurons.

• Remyelination by Schwann cells entering the spinal cord after injury
• Remyelination by oligodendrocyte precursors
• Recovery of conduction in demyelinated axons
• Strengthening of existing synapses
• Regrowth and sprouting of intact axons to form new circuits
• Release of growth factors and guidance molecules
• Shift of function to alternate circuits
Walking Physiology: Complex Mechanism

- Brain coordinates the movements
- Central pattern generators in the spine contribute to locomotion
Walking Physiology: Complex Mechanism

- Brain coordinates the movements
- Central pattern generators in the spine contribute to locomotion

Central Pattern Generator (CPGs)

F flexor motoneurons
E extensor motoneurons
DC dorsal columns
DRG dorsal root ganglion

Rossignol, 2011
Walking Physiology: Complex Mechanism

- Experiments performed by Shik, Severin, and Orlovsky in the 1960s provided evidence of a central pattern generator (CPG), which is a complex circuit of neurons responsible for coordinated rhythmic muscle activity, such as locomotion.
Outcome Prognosis based on Neurologic Status

• Most studies found a correlation between the severity of clinical signs and time to ambulation. The reported average time until ambulation is 7-14 days in chondrodystrophic patients.

• Less information could be found in the literature regarding a correlation between the necessary time to regain control of urination and the preoperative neurological status.

➢ In a publication, the average time to regain urination was 4.2 to 7.4 days. However, this study did not take into consideration the preoperative neurological scores and treated the hemilaminectomy patients as a single group.
Study: Material and Methods

- 57 consecutive cases met the inclusion criteria during the study period (2015). 3 dogs with loss of DPP were euthanized during the study.
- All dogs had pre-operative MFS 4-0
- The Dachshund was the most common breed in this study (27)
- Mixed breed dogs (10), French Bulldogs (5), and Welsh Corgis (4). Bichon Havanais, Chinese Crested Dogs, Drevers, Cavalier KCS comprised the other affected breeds
- The mean age was 5.6 years (range 2-10 years)
- Twenty-four patients were males, and 19 patients were females, seven castrated males and seven sterilized females were included in the study.
- The mean bodyweight was 9.46 ± 5.4 kg (ranging from 3 to 20 kg).
<table>
<thead>
<tr>
<th>Type</th>
<th>Name in Literature</th>
<th>Extruded Material</th>
<th>Clinical Features</th>
<th>Imaging Features</th>
<th>Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type I a</strong></td>
<td>Hansen type I</td>
<td>degenerated NP</td>
<td>acute to slow progressing</td>
<td>compression with</td>
<td>surgery if non-ambulatory,</td>
</tr>
<tr>
<td></td>
<td>Subtype I and 3</td>
<td></td>
<td>onset, mainly</td>
<td>partly calcified NP</td>
<td>prognosis often good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>chondrodystrophic breeds</td>
<td>over 1-2 vertebrae</td>
</tr>
<tr>
<td><strong>Type I b</strong></td>
<td>DEEH,</td>
<td>degenerated NP</td>
<td>peracute/acute onset,</td>
<td>partly calcified NP</td>
<td>surgery (often extensive)</td>
</tr>
<tr>
<td></td>
<td>Hansen I subtype 3</td>
<td></td>
<td>often severe symptoms</td>
<td>mixed with blood</td>
<td>prognosis good to guarded</td>
</tr>
<tr>
<td></td>
<td>Dispersed IVDE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type I c</strong></td>
<td>ANNPE, Traumatic IVDE,</td>
<td>non-degenerated NP</td>
<td>peracute onset with</td>
<td>often no compression,</td>
<td>conservative if no</td>
</tr>
<tr>
<td></td>
<td>High velocity- low</td>
<td></td>
<td>trauma,</td>
<td>intramedullary changes</td>
<td>compression, prognosis</td>
</tr>
<tr>
<td></td>
<td>volume IVDE, Hansen 3</td>
<td></td>
<td>often severe symptoms</td>
<td>visible in MRI</td>
<td>good to guarded</td>
</tr>
<tr>
<td><strong>Type I d</strong></td>
<td>IVDE</td>
<td>non-degenerated NP</td>
<td>peracute onset with</td>
<td>often no compression,</td>
<td>If intramedullary nucleus</td>
</tr>
<tr>
<td></td>
<td>High velocity- low</td>
<td></td>
<td>trauma,</td>
<td>intramedullary nucleus</td>
<td>material visible on MRI,</td>
</tr>
<tr>
<td></td>
<td>volume IVDE, Hansen 3</td>
<td></td>
<td>often severe symptoms</td>
<td>visible in MRI</td>
<td>surgery sometimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>indicated</td>
</tr>
<tr>
<td><strong>Type I e</strong></td>
<td>HNPE</td>
<td>mildly degenerated NP</td>
<td>peracute/acute onset,</td>
<td>compression ventrally</td>
<td>conservative or surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>trauma,</td>
<td>often no pain, mainly</td>
<td>with material isointense</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>often severe symptoms</td>
<td>in the cervical spine</td>
<td>prognosis good to NP in MRI</td>
</tr>
<tr>
<td><strong>Type I f</strong></td>
<td>Far lateral IVDE</td>
<td>degenerated NP</td>
<td>radicular pain</td>
<td>NP in the foramen</td>
<td>surgery, perineural injection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and lateral of the IVD, prognosis good</td>
</tr>
</tbody>
</table>
Modified Frankel Score MFS

Score 5: Normal gait with spinal hyperesthesia
Score 4: Ambulatory paresis
Score 3: Nonambulatory paresis with detectable muscle tone
Score 2: Paralysis with intact pain perception
Score 1: Paralysis with absent superficial pain perception
Score 0: Paralysis with absent deep pain perception

➢ Patients were daily examined and their progress documented. During hospitalization an individual rehabilitation program started immediately after surgery
Results: Age, Gender, Localisation, Compression, Duration

- No correlation between these parameters and the duration of recovery (ambulation and urination) was found in this study.

- This is in agreement with the literature.
Results

➢ 54 patients (95%) recovered from an IVDE after surgery

➢ Recovery time for ambulation was 13.8 ±25.1 days
➢ The correlation with the MFS was r=-0.64

➢ Recovery time for urination was 4.1 ± 4.4 days
➢ The correlation with the MFS was r=-0.63
Results: Neurological Scoring

• A significant correlation between this parameter and the duration of recovery (ambulation and urination) was found in this study

➤ Results of the healing time within the different Frankel score groups

<table>
<thead>
<tr>
<th>Preoperative MFS (n)</th>
<th>Days to urinate</th>
<th>Days to ambulate</th>
<th>P u vs a</th>
</tr>
</thead>
<tbody>
<tr>
<td>All (n=54)</td>
<td>4.1 ± 4.4</td>
<td>13.8 ± 25.1</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>4 (n=17)</td>
<td>1.9 ±1.98</td>
<td>1 ±0</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>3 (n=23)</td>
<td>2.86 ±1.1</td>
<td>6.9 ±3.8</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>2 (n=10)</td>
<td>6 ±3.5</td>
<td>28.8 ±32.8</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>0 + 1 (n=4)</td>
<td>15.5 ±7</td>
<td>71 ±38</td>
<td>n. a.</td>
</tr>
</tbody>
</table>

Correlation

\[ r = -0.63, P < 0.001 \]

\[ r = -0.64, P < 0.001 \]
Preoperative MFS

- Ambulation, $r = -0.64$
- Healing rate 95%

Days Postop.
Days Postop.

Preoperative MFS

- Micturition, $r = -0.63$
- Ambulation, $r = -0.64$

* $P < 0.05$
Tax så mycket