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<Short Communication>

Surgical treatment of spinal cord compression in client owned dogs with different grades of neurological dysfunction

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Abstract : Our retrospective study reports the clinical findings and population characteristics of 81 surgically treated dogs for spinal cord compression. We compared the outcome of dogs with different grades of neurological dysfunction due to spinal cord compression and focused on the long-term outcome of surgical treatment, for which there are only a few recent records. We recorded a 13.6% recurrence, regardless of the degree of dysfunction. However, the degree of dysfunction negatively affected the recovery length.

Keywords : canine neurological diseases, decompression surgery, modified Griffith's score

Spinal cord injury (SCI) is common in dogs and the consequences can be devastating. The SCI may result in complete or incomplete damage and compromise the major functions of the spinal cord [12]. Despite decades of research to identify the new therapeutics, there has been only limited progress toward the beneficial findings. Thoracolumbar intervertebral disk herniation is the most common naturally occurring spinal disease in dogs and results in compressive and contusive SCI [2, 7, 10]. The most common treatment for SCI is early stabilization of the spinal column followed by surgical decompression and stabilization and minimizing secondary changes [6]. To confirm the presence of spinal cord compression the contrast radiographic technique (myelography) or advanced diagnostic imaging methods [computed tomography (CT) or magnetic resonance imaging (MRI)] are commonly used. When compression is confirmed, the aim of surgical therapy is to eliminate the nervous tissue compression. Such a pressure over a critical period of time may adversely affect the transmission of nerve impulses along axons and impair blood flow in the spinal cord tissue, resulting in ischemia and death of neurons and neuroglia. Prolonged spinal cord compression in experimental animals has been associated with demyelination [14].

We retrospectively analyzed clinical records from 81 client owned dogs treated with either single ventral slot approach (cervical lesions), hemilaminectomy (thoracolumbar lesions) or laminectomy (lumbosacral lesions) as a sole therapy. This was performed by an experienced surgeon in one clinic from May to November in 2012. At presentation, disease characteristics were classified according to the 5-point modified Griffith's score (MGS) [15], where 0 represents a dog with no neurological deficits and 5 represents a dog with loss of deep pain perception. Each patient underwent a plain and contrast radiographic examination of the whole spine in two orthogonal projections. In 13 of these dogs the owners decided also for MRI to confirm the diagnosis and the diagnosis was consistent with the myelography. Successful outcome (neurological recovery) was defined as a dog, which experienced at least one point decrease in MGS (the first improvement) and dog with normal neurological function or only mild ataxia (complete improvement). We analyzed the recurrence rate 36 months after therapy. Recurrence rate was determined as recurrent episodes of pain, ataxia or paralysis, within the reporting period. Analysis was performed using ANOVA and Spearman correlation ($^{**}p < 0.01$, $^{*}p < 0.05$). Data are expressed as mean ± SD, MGS score as mean (min-max). The dogs included 13 breeds and mongrels (Table 1), the number of male dogs was non-significantly higher (48 : 33). Most often there were German Shepherds (21), Dachshunds (14), mongrels (12), Yorkshire Terriers (9), Cocker Spaniels (7), followed by Labrador Retrievers (4), Poodles (3), Pekingeses (3), Jack Russell Terriers (2), Pugs (2), and one dog from each breed: Beagle, Golden Retriever, Weimaraner, and Rottweiler. In the group of chondrodystrophic dogs the average age was 6.6 years, and in the group of non-chondrodystrophic dogs was 4.2 years (data expressed in Table 1). Chondrodystrophic dogs had higher body condition score but it was not significant. The average duration of clinical signs

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Table 1. Description of evaluated parameters in the population of surgically treated dogs

Breed (n)	Mean age (yr)	Male/female	Mean body weight (kg)	Mean MGS (min-max)
German Shepherd (21)	4.5 ± 2.8	11/10	34.9 ± 3.8	2 (1–3)
Dachshund (14)	6.6 ± 3.5	8/6	8.6 ± 2.8	3 (2–4)
Mongrel (12)	5.4 ± 4.2	8/4	9.4 ± 4.8	2.4 (1–4)
Yorkshire Terrier (9)	5.3 ± 1.2	5/4	5.6 ± 0.7	2.6 (2–4)
Cocker Spaniel (7)	4.3 ± 2.5	4/3	14.8 ± 1.2	2.6 (2–3)
Labrador Retriever (4)	3.5 ± 2.1	3/1	35.5 ± 0.7	2
Poodle (3)	7.2 ± 4.6	1/2	14 ± 2.8	3
Pekingese (2)	4.7 ± 1.7	1/2	6.7 ± 1.0	3.5 (3–4)
Jack Russell Terrier (2)	7 ± 2.5	1/1	8 ± 1.0	3
Pug (2)	2.2 ± 1	2/0	8.6 ± 1.7	3
Beagle (1)	5	1/0	14	1
Golden Retriever (1)	6	1/0	30	2
Weimaraner (1)	2	1/0	25	3
Rottweiler (1)	1.5	1/0	40	3

Values of age and weight are expressed as mean ± SD. MGS, modified Griffith's score (1–5).

Table 2. Comparison of recovery time for the most affected breeds with significant differences

Breed (n)	The duration of clinical signs (d)	Time to the first improvement (d)	Time to complete recovery (d)
German Shepherd (21)	18.7 ± 8.3	9.1 ± 10.9	21.8 ± 14.9
Dachshund (14)	5.9 ± 4.5*	7.1 ± 6.5	27.6 ± 18.8
Mongrel (2)	14.4 ± 10.0	12.8 ± 9.3	55.8 ± 41.9
Yorkshire Terrier (9)	13.0 ± 9.3	5.0 ± 7.1	12.0 ± 9.7*
Cocker Spaniel (7)	2.7 ± 4.9*	10.6 ± 6.9	38.7 ± 21.4

Values are expressed as mean ± SD. *Statistical difference among breeds at $p < 0.05$.

prior to therapy was 11.66 days. Details for the most affected breeds are shown in Table 2. Spinal cord injury showed a wide range of clinical signs, from pain (8 dogs, MGS 1), through to significant symptoms of ataxia or paresis (31 dogs, MGS 2), to complete paralysis (21 dogs, MGS 3). Urinary dysfunctions were recorded in 19 dogs (MGS 4) (urinary incontinence: 12 dogs, urinary retention: 7 dogs). In two dogs (MGS 5) there was loss of deep pain perception in affected hind limbs, with no restoration after surgical therapy. The mean MGS in studied dogs was 2.55. Prior to surgery the half of the dogs were assigned MGS 3 and higher, spontaneous movements of the affected limbs were not present. The MGS score was evaluated by the same experienced neurologist prior to surgery and 36 months after the surgery. The predominant lesion location was the lumbosacral junction L7-S1 (35 dogs), followed by the thoracolumbar segments from T11 to L3 (32 dogs). Cervical lesions (C1–C4) were diagnosed in 3 dogs, caudal lumbar lesions (L4–L7) in 5 dogs, and midthoracic (T8–11) lesions in 6 dogs. All dogs were postsurgically given standard dosage of antibiotics for 7 days and NSAIDs depending on the case for 3 to 10 days. For the first 48 hours postsurgically the postoperative pain was attenuated with opioid analgesics.

Table 3. Number of recurrences in dogs with various grades of neurological dysfunction

MGS	Number of affected dogs	Number of successfully treated dogs	Number of dogs with recurrence
1	9	8	2
2	30	30	4
3	21	20	2
4	19	19	3
5	2	0*	

*Statistical difference among MGS groups at $p < 0.05$.

The success rate of surgical therapy was 95% and after deducting recurrences was nearly 82%. The average time for all dogs taken to the improvement was 29.2 days. In Table 2 there are data for most affected breeds. Recurrence of clinical signs was noted in eleven dogs (Table 3) with no statistical difference between dysfunction grades. The mean time of recurrence was 2.3 years after initial successful surgical treatment. Nine dogs were euthanized during the monitored period but they were not included in the study. None of the analyzed factors significantly influenced time to recovery and the recurrence rate. The correlation coefficient indicates only a slight positive correlation between dysfunction score and time taken to the first improvement ($r = 0.46$). Moreover, the average duration of clinical signs prior to surgical therapy was significantly longer (19 days, range 3 to 30 days) in dogs with mild clinical symptoms (pain, ataxia, and paresis: MGS 1-2) than in dogs with paralysis and urinary dysfunctions (MGS 3-5) where mean time of duration of clinical signs was 3 days, range 1 to 7 days ($^{*}p < 0.05$) which can be explained by the owners attitude to the given dog's situation.

The outcome is highly variable, which likely attests to differences in the severity of spinal cord damage. The predominantly affected dogs in our study were German Shepherds and Dachshunds as also show some other studies [8, 11]. More than the half of the evaluated dogs in our study belonged to the chondrodystrophic breeds, with the majority of lesions in the thoracolumbar segment as described in other literature. Chondrodystrophy is a skeletal disease caused by gene mutation, which affects the development of cartilage. Since the intervertebral disc has the character of cartilage, in chondrodystrophic breeds there is often seen very early degeneration. The incidence of SCI is generally higher in males than in females [4]. Published data shows that the rate of onset of clinical symptoms is unlikely to affect recovery in dogs with preserved deep sensitivity [13] and cannot be used as the predictor of the restoration of locomotor function [9]. Similarly, according to our study based on the duration of clinical symptoms it cannot be determined whether there will be a return of function and how long will it take to complete recovery. Several studies confirmed that the duration of paraplegia prior to a dog receiving decompressive surgery is not important in predicting whether or not the animal would be able to recover locomotor ability [9], suggesting functional rather than structural impairment in some cases [5]. The success rate of dorsal decompression in our study is comparable with previously published results [3, 16]. Necas [8] indicated recurrence at the level of 14.59%, which is comparable with our results. The age of surgically treated dogs in our case was lower compared with previous studies [2, 4, 8, 9], which may be associated with large percentage of chondrodystrophic dogs, for which the incidence age is lower. There is no single effective therapy to definitively cure SCI. It is necessary to test new possibilities for multimodal therapies. Physical therapy is one area tested in clinical studies [1]. Our results (not linked to this study) showed that physical therapy and rehabilitation accelerates the process of restoration (unpublished data) through stimulation of nerve pathways and overall metabolism in muscles and the surgical therapy remains the most effective choice of treatment for confirmed spinal cord compressions and vertebral column instability causing neurological dysfunctions.

The degenerative diseases are predominant in dogs, in comparison to traumatic or inflammatory spinal diseases and they usually show their clinical signs at a later age. Most often affected are the German Shepherds and Dachshunds. In addition to certain breed predisposition, the contributing factor for degenerative and also traumatic spinal diseases is also excessive physical load not only in working dogs. One of the significantly contributing causes mostly in chondrodystrophic dogs is their weight. The success rate of surgical therapy depends primarily on the severity of neurological dysfunction, but also on the total patient care before and after surgery, and proper rehabilitation. All patients with SCI, no matter the type of therapy, require a sufficient time for rehabilitation and recovery.

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