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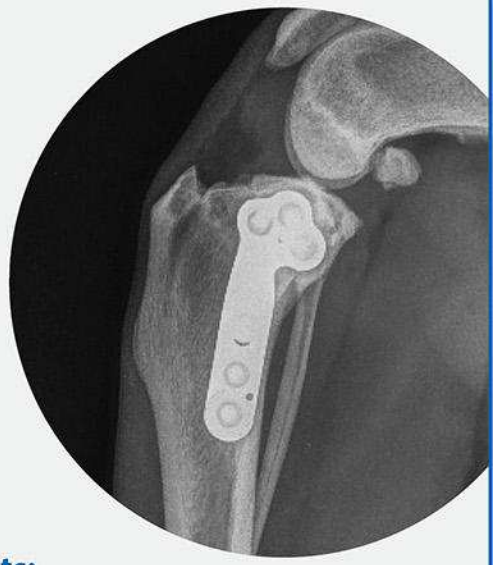

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Veterinary Surgery
36:492–499, 2007

Evaluation of the Success of Medical Management for Presumptive Cervical Intervertebral Disk Herniation in Dogs

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Objective—To determine the success of medical management of presumptive cervical disk herniation in dogs and variables associated with treatment outcome.
Design—Retrospective case series.
Animals—Dogs (n = 88) with presumptive cervical disk herniation.
Methods—Dogs with presumptive cervical and thoracolumbar disk herniation were identified from medical records at 2 clinics and clients were mailed a questionnaire related to the success of therapy, clinical recurrence of signs, and quality of life (QOL) as interpreted by the owner. Signalment, duration and degree of neurologic dysfunction, and medication administration were determined from medical records.
Results—Ninety-seven percent of dogs (84/87) with complete information were described as ambulatory at initial evaluation. Successful treatment was reported for 48.9% of dogs with 33% having recurrence of clinical signs and 18.1% having therapeutic failure. Bivariable logistic regression showed that non-steroidal anti-inflammatory drug (NSAID) administration was associated with success ($P = .035$; odds ratio [OR] = 2.52). Duration of cage rest and glucocorticoid administration were not significantly associated with success or QOL. Dogs with less-severe neurologic dysfunction were more likely to have a successful outcome (OR = 2.56), but this association was not significant ($P = .051$).
Conclusions—Medical management can lead to an acceptable outcome in many dogs with presumptive cervical disk herniation. Based on these data, NSAIDs should be considered as part of the therapeutic regimen. Cage rest duration and glucocorticoid administration do not appear to benefit these dogs, but this should be interpreted cautiously because of the retrospective data collection and use of client self-administered questionnaire follow-up.
Clinical Relevance—These results provide insight into the success of medical management for presumptive cervical disk herniation in dogs and may allow for refinement of treatment protocols.

INTRODUCTION

BETWEEN 13.9% AND 25.4% of dogs admitted to referral clinics for disk herniation have their primary clinical disease located in the cervical vertebral column.[1–3] Most dogs with cervical disk herniation have disk extrusion rather than protrusion.[4] Paraspinal hyperesthesia is the most frequently reported sign,[4,5] although tetraparesis with general proprioceptive ataxia, tetraplegia, radicular pain (root signature), and respiratory compromise may also occur.[6–9] Vertebral column trauma, cervical spondylomyelopathy, atlanto-axial subluxation, spinal tumors, meningomyelitis, and other diseases can have similar clinical appearance to cervical disk herniation.[10,11]

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Submitted November 2006; Accepted March 2007

0161-3499/07
doi:10.1111/j.1532-950X.2007.00296.x

Both medical and surgical management can be used in the treatment of cervical disk herniation in the dog.[10–13] Medical treatment can consist of combinations of cage rest, physical rehabilitation, and administration of analgesics, muscle relaxants, and anti-inflammatory medications (non-steroidal anti-inflammatory drugs [NSAIDs] or glucocorticoids).[10,12] There is little evidence to support the value of each of these interventions, although many authors emphasize the importance of cage rest for cervical disk herniation, which in its most extreme form consists of keeping the dog in a small confined area at all times, for ≥ 6 weeks to allow for ligamentous healing and prevent further disk herniation.[10,12] In human patients, the theoretical benefits of rest can also include reduced intradiskal pressure, decreased vertebral column loading, and improved patient comfort.[13–15]

Medical management is usually selected for dogs with relatively acute paraspinal hyperesthesia, with or without mild ambulatory tetraparesis and general proprioceptive ataxia. Dogs with substantial ambulatory tetraparesis, severe neurologic dysfunction, or chronic cervical spinal cord signs are usually addressed surgically.[6,10,12]

There is limited information on the success of medical therapy for cervical disk herniation in the dog, although it has been suggested that cervical disk herniation is more difficult to manage medically than thoracolumbar disk herniation.[10,12,16] The reasons for the refractory nature of cervical disk herniation to medical therapy are speculative and include difficulty in immobilizing the cervical vertebral column and the potential for larger volumes of herniated disk material in the cervical vertebral column compared with the thoracolumbar vertebral column because of the relatively larger vertebral canal to spinal cord ratio.[9,12,17] Work by Russell and Griffiths[13] suggests a substantially higher rate of recurrence of signs in dogs treated medically (36.3%) compared with surgically (5.6%) for cervical disk herniation. In 32 dogs with cervical disk disease that were administered glucocorticoids, analgesics, or NSAIDs along with acupuncture, initial recovery occurred in 69% of dogs with recurrence of clinical signs in 37%.[18]

Our purpose was to systematically review outcomes in dogs with suspected cervical disk herniation that were managed medically. Variables such as degree of neurologic dysfunction, duration of clinical signs, signalment, weight, duration of cage rest, and administration of various pharmaceuticals were investigated with reference to owner assessment of quality of life (QOL), initial treatment failure, and recurrence of clinical signs. Our hypothesis was that medical management would be successful in many dogs with mild neurologic signs, but would have limited efficacy in those that are severely affected.

MATERIALS AND METHODS

Inclusion Criteria

Case identification, inclusion criteria, data acquisition and data analysis have been described.[19] Briefly, all dogs were seen between 1999 and 2005 at Texas A&M University (TAMU) or at one of 3 locations of Emergency Animal Hospital of NW Austin and were recruited from these clinics' medical records using search terms including "intervertebral disk herniation," "thoracolumbar intervertebral disk herniation," "thoracic intervertebral disk herniation," "lumbar intervertebral disk herniation," and "cervical intervertebral disk herniation."

Each identified record was reviewed by 1 of 2 authors (J.M.L., S.I.J.) to ensure that it met the following inclusion criteria concerning client history, physical examination, and neurologic evaluation that would allow grouping into the category of presumptive disk herniation. Identified records needed to document that medical management was chosen by the client and veterinarian. Client history needed to suggest that neurologic dysfunction was limited to the spinal cord or vertebral column.

Physical examination had to be within normal limits with the exception of disturbances that might be directly related to the neurologic dysfunction (e.g., dehydration, pressure sores) or were considered incidental (e.g., skin disease, low-grade heart murmur). Neurologic evaluation had to show clinical signs limited to the spinal cord or vertebral column. Vertebral column radiography and myelography, when performed, were used to exclude other causes including diskospondylitis, fracture, meningomyelitis, and neoplasia.

Questionnaire

Clients were sent a questionnaire[19] in August 2005 (TAMU) or March–April 2006 (emergency clinics). Briefly, the questionnaire consisted of a series of questions using multiple formats including yes/no, multiple choice, close ended, and open ended. Those that did not respond, but had valid addresses received either telephone follow-up (TAMU) or repeated written communications (emergency clinics). Returned questionnaires were grouped into either presumed cervical or presumed thoracolumbar disk herniation based on veterinarian diagnosis; only the results of the dogs with presumed cervical disk herniation are reported here. Dogs with possible involvement of both the cervical and thoracolumbar vertebral column were included in both groups.

For dogs that had surveys returned, signalment, weight, duration of neurologic dysfunction, neuroanatomic localization, time between initial visit and return of the survey (follow-up time), previous history of vertebral column surgery, and prescribed medications at the time of initial evaluation were retrieved from the medical record.

Neurologic Assessment

A modified numerical Frankel score[20–22] (neuroscore) was established by reviewing neurologic examination data from

the record. Dogs were classified as having paraplegia or tetraplegia with no deep nociception (grade 0), paraplegia or tetraplegia with no superficial nociception (grade 1), paraplegia or tetraplegia with nociception (grade 2), non-ambulatory paraparesis or tetraparesis (grade 3), ambulatory paraparesis or tetraparesis and ataxia (grade 4), or spinal hyperesthesia only (grade 5). In dogs where modified Frankel score could only be estimated as a range of values (e.g., 1–2 or 2–4), an approximated grade defined as the middle of the range was used. If a modified Frankel score could not be established based on the medical record, the dog was excluded from portions of the analysis that depended on that value.

Outcome

Dogs were classified into 3 outcome groups based on their response to medical management: (1) successful outcome, (2) initial success with recurrence, and (3) initial failure of therapy. Dogs that were classified as having as successful outcome were reported by the owner to be completely normal or substantially improved after therapy and lacked evidence of recurrence of clinical signs. Dogs in the initially successful with recurrence group were reported to have been either completely normal or substantially improved after treatment, but had episodes of paraspinal hyperesthesia, ataxia or weakness after recovery.[19] Initial failure was defined as decline or lack of improvement after the completion of medical management or necessity for surgery or euthanasia within 1 month of the completion of medical management. Overall QOL was reported as a numerical score that ranged from 0 to 10 with 10 being the highest QOL.

Recurrence

Dogs were classified as having mild, moderate, or severe recurrence based on the number, length, and severity of episodes. Severe recurrence was defined as a worsening of neurological signs that resulted in a dog becoming non-ambulatory or requiring euthanasia or surgery. Dogs with recurrence that could not be classified as severe had the number of days/year recorded during which episodes of neurologic worsening occurred. A median days of recurrence/year value was determined for this group and dogs above the median were assigned as moderate recurrence whereas dogs below the median were grouped as mild recurrence.

Statistical Methods

Statistical methods have been described in the previous paper.[19] Briefly, success proportions were compared across categories of measured factors using χ^2 tests. Owner-reported QOL was compared across categories using Mann–Whitney U or Kruskal–Wallis tests depending upon the number of categories. Continuous variables were compared between success groups using Mann–Whitney U tests.

Bivariable logistic regression was used to investigate the association between measured variables and success. Multivariable logistic regression was used to estimate associations while controlling for the potential confounding effects of other variables. Bivariable ordinal logistic regression was used to investigate the effect of study variables on owner-reported QOL scores. Dogs with both cervical and thoracic disease were excluded and the proportion of successful treatment between these locations was compared using χ^2 tests. Owner-reported QOL was compared between cervical and thoracic groups using a Mann–Whitney U test.

A random sample of 10% of the non-responders from each institution was selected and information concerning signalment, duration of clinical signs at admission, and neuroscore were recorded. Categorical variables were compared between responders and non-responders using χ^2 tests. Continuous variables were compared between these 2 groups using Student's t-tests. All statistical analyses were performed with software (SPSS version 11.5, SPSS Inc., Chicago, IL) and results were interpreted at the 5% level of significance.

RESULTS

Inclusion Details

Results for the number of records identified by searches at each institution, number of dogs meeting inclusion criteria, questionnaire response, and final number of responses are detailed in a companion report[19]; 303 dogs with correctly completed questionnaires were identified.

Signalment

Of 303 dogs for which surveys were returned or telephone follow-up was obtained, 88 were classified as having presumptive cervical disk herniation; 8 of these dogs were also included in the presumptive thoracolumbar disk herniation group based on examination findings.

Represented breeds were Dachshund (25; Miniature and Standard grouped together), Mixed breed (13), Beagle (4), Cocker Spaniel (4), Chihuahua (3), Jack Russell Terrier (3), Poodle (3; Toy and Miniature grouped together), Rat Terrier (3), Bichon Frise (2), Boston Terrier (2), Doberman Pinscher (2), Great Dane (2), Greyhound (2), Maltese (2), Pomeranian (2), and 1 each of 16 other breeds.

Five dogs had vertebral column radiography that was either within normal limits or supported disk herniation (disk space collapse, mineral opacity in the vertebral canal, small intervertebral foramen, or increased articular process overlap). Two dogs had myelography, 1 had computed tomography and myelography, and 1 had computed tomography of the cervical vertebral column; all advanced imaging studies supported a diagnosis of cervical disk herniation.

Descriptive statistics summarizing follow-up, clinic, sex distribution, weight, age, duration of clinical signs,

Table 1. Descriptive Statistics and Comparison of Potential Confounders Between 43 Dogs with Successful and 45 Dogs with Unsuccessful Treatment of Cervical Intervertebral Disk Disease Using Medical Management from 2 Clinics (1999–2005)

Variable	Number of Dogs	Number Successful (Proportion)	*P*-Value*	Number Successful or 10 QOL (Proportion)†	*P*-Value*	QOL Mean (Min, Median, Max)	*P*-Value‡
Clinic			.276		.134		.71
TAMU	24	14 (0.58)		17 (0.71)		7.09 (0, 9, 10)	
Emergency clinics	64	29 (0.45)		34 (0.53)		7.52 (0, 9, 10)	
Sex			.718		.851		.670
Intact female	4	2 (0.50)		3 (0.75)		9.25 (7, 10, 10)	
Female spayed	31	16 (0.52)		18 (0.58)		6.97 (0, 9, 10)	
Intact male	12	4 (0.33)		6 (0.50)		6.40 (0, 9, 10)	
Male neutered	41	21 (0.51)		24 (0.59)		7.81 (0, 9, 10)	
Duration of clinical signs			.652		.441		757
$\leq$ 1 day	52	23 (0.44)		27 (0.52)		7.21 (0, 9, 10)	
>1–7 days	20	11 (0.55)		13 (0.65)		7.75 (0, 10, 10)	
>7 days	15	8 (0.53)		10 (0.67)		7.31 (0, 9, 10)	
Neuroscore at admission§			.062		.072		.289
0	0	0		0		NA	
1	1	0 (0.0)		0 (0.0)		0	
2	1	0 (0.0)		0 (0.0)		NA	
3	1	0 (0.0)		0 (0.0)		0	
4	17	6 (0.35)		8 (0.47)		7.43 (0, 8.5, 10)	
5	67	36 (0.54)		42 (0.63)		7.59 (0, 9.5, 10)	
Duration of cage rest			.659		.973		.360
None	30	16 (0.53)		18 (0.60)		8.10 (3, 9, 10)	
$\leq$ 1 week	23	13 (0.57)		14 (0.61)		7.25 (0, 10, 10)	
>1–3.5 weeks	16	6 (0.38)		9 (0.56)		5.31 (0, 8, 10)	
$\geq$ 4 weeks	13	6 (0.46)		7 (0.54)		8.09 (0, 10, 10)	
NSAID‖ Administered			.033		.078		.429
Deracoxib	21	14 (0.67)		16 (0.76)		8.39 (0, 10, 10)	
Carprofen	18	10 (0.56)		11 (0.61)		7.61 (0, 8.5, 0)	
Other	4	2 (0.50)		2 (0.50)		4.33 (0, 3, 10)	
Any	43	26 (0.60)		29 (0.67)		7.72 (0, 10, 10)	
None	45	17 (0.38)		22 (0.49)		7.10 (0, 9, 10)	
Glucocorticoids administered			.100		.123		.274
Yes	30	11 (0.37)		14 (0.47)		6.82 (0, 9, 10)	
No	58	32 (0.55)		37 (0.64)		7.69 (0, 10, 10)	

*P-value based on χ^2 test.

†Includes mild and moderate recurrences in which the owner reported a QOL score of 10.

‡The first 5 categories (0–4) were combined before performing statistical testing because of the small number of observations.

§P-value based on Mann–Whitney U test for comparison of 2 categories and Kruskal–Wallis for $\geq$ 3 categories.

‖Statistical testing based on the comparison between any NSAID and none.

NSAID, non-steroidal anti-inflammatory drug; NA, not applicable or missing; TAMU, Texas A&M University; QOL, quality of life.

modified Frankel score at admission, duration of cage rest, NSAID, and glucocorticoid administration are reported in Tables 1 and 2.

Outcome

Forty-three (48.9%) dogs were managed successfully (no episodes of recurrence reported by owner), 29 (33%) had recurrence (7 mild, 12 moderate, 10 severe), and 16 (18.1%) had treatment failure. Mean time between initial examination and receipt of the questionnaire (follow-up) was 2.83 years (range, 0.25–7.25 years) in dogs with a successful outcome and 2.59 years (range, 0.92–6.75 years) in the dogs without a successful outcome. Chronic pain was reported in 20 dogs, weight gain in 11, weight loss in 9, urinary incontinence in 7, and fecal incontinence in 4. Five dogs had a previous history of vertebral column surgery.

Odds ratios (OR) estimated from bivariable logistic regression (Table 3) showed that NSAID administration was significantly associated with a successful outcome ($P = .035$; OR = 2.52). Multivariable adjustment of the NSAID association for duration of clinical signs, duration of cage rest, duration of follow-up, hospital type, neuroscore at admission, age, and weight resulted in an OR of 7.32 (95% confidence interval [CI] 1.33–40.2). Dogs with higher modified Frankel scores were more likely to have a positive response to therapy, but

Table 2. Descriptive Statistics and Comparison of Potential Confounders Between 43 Dogs with Successful and 45 Dogs with Unsuccessful Treatment of Cervical Intervertebral Disk Disease Using Medical Management from 2 Clinics (1999–2005)

	Success		Not Success	
Variable	Mean (Median)	Minimum, Maximum	Mean (Median)	Minimum, Maximum
Duration of follow-up	2.76 (2.33)	0.25, 6.58	2.58 (2.16)	0.92, 6.75
Weight	32.3 (20.2)	6.0, 100.8	31.1 (18.0)	5.7, 118.1
Age	6.6 (7.0)	0.6, 14.0	7.2 (6.0)	1.0, 15.0
Duration of clinical signs	9.87 (1)	1, 180	8.57 (1)	1, 180
Neurology score at presentation	4.85 (5)*	4, 5	4.51 (5)*	1, 5
Duration of cage rest	1.51 (0.50)	0, 12.0	3.06 (1)	0, 52.0

*$P = .051$ using a Mann–Whitney U test.

this association was not significant ($P = .051$). Dogs administered glucocorticoids were less likely to have a successful outcome, but this association was also not statistically significant ($P = .10$). Bivariable ordinal logistic regression (Table 4) suggested that neither NSAID nor glucocorticoid administration was associated with owner-reported QOL. Increasing age ($P = .002$; OR = 0.83) and weight ($P = .025$; OR = 0.98) were negatively associated with QOL. The duration of cage rest was not significantly associated with either success or QOL.

The success proportion of the thoracolumbar (0.55) and cervical (0.49) cases were not significantly different ($P = .35$). Respondent-reported QOL measures for the thoracolumbar (mean 7.99; median 9) and cervical (mean 7.28, median 9) groups were also not different ($P = .69$).

Twenty-four non-responders were randomly selected and mean (minimum, median, maximum) age, duration of signs at admission, and neuroscore were 6.6 years (0.5, 6.0, 15.0), 10.9 days (1, 1, 180), and 4.5 (2, 5, 5), respectively. Dogs of owners that were non-responders were not significantly different than those that responded based on sex, breed (chondrodystrophoid versus non-chondrodystrophoid), age, duration of clinical signs, and neuroscore at admission.

Table 3. Bivariable Logistic Regression for the Prediction of a Successful Outcome as Defined by Initial Success of Medical Therapy Without Recurrence During the Follow-up Period from 2 Clinics (1999–2005)

Variable	Parameter Estimate ($\hat{\beta}$)	*P*-Value (Wald)	Odds Ratio (95% CI)
Neuroscore at presentation	0.940	.051	2.56 (1.00, 6.58)
NSAID use	0.924	.035	2.52 (1.07, 5.94)
Glucocorticoid use	−0.754	.102	0.47 (0.19, 1.16)

NSAID, non-steroidal anti-inflammatory drug; CI, confidence interval.

Table 4. Bivariable Ordinal Logistic Regression for the Prediction of Quality of Life (QOL) During the Follow-Up Period from 2 Clinics (1999–2005)

Variable	Parameter Estimate ($\hat{\beta}$)	*P*-Value (Wald)	Odds Ratio (95% CI)
Weight (lbs)	−0.018	.025	0.98 (0.97, 1.00)
Age (years)	−0.189	.002	0.83 (0.73, 0.93)
Neuroscore at presentation	0.729	.071	2.07 (0.94, 4.58)
Duration of cage rest (weeks)	−0.035	.372	0.97 (0.89, 1.04)
NSAID use	0.311	.452	1.36 (0.61, 3.07)
Glucocorticoid use	−0.399	.360	0.67 (0.29, 1.57)

QOL categorized as 0–6, 6.5–8, 8.5–9.5, and 10 for modeling.
CI, confidence interval; NSAID, non-steroidal anti-inflammatory drug.

DISCUSSION

Our results suggest that medical management of presumptive cervical disk herniation is frequently successful. Only 18.1% of dogs had treatment failure, as defined by need for euthanasia or surgery, and 48.9% had complete success with no episodes of paraspinal hyperesthesia or ataxia over a mean follow-up of 2.83 years. A recent study[4] on the surgical management of cervical disk herniation in dogs reported a 99% initial success rate with 10% of dogs having recurrence of cervical hyperesthesia. This may indicate that medical management has a higher rate of recurrence and failure than surgical management for cervical disk herniation.

Some sources[12,16] indicate that presumptive cervical disk herniation in dogs is difficult to manage medically when compared with thoracolumbar disk herniation, although objective, evidence-based data in support of this contention are lacking. In human medicine, cervical disk extrusion may be viewed similarly.[23] A recent survey-based study on medical management in human patients, however, showed that over a 2.3 year mean follow-up period, 24 of 26 persons felt their therapy was successful.[23] In our report, there was no significant difference between dogs with presumptive thoracolumbar or cervical disk herniation with regard to success or QOL scores. It is possible that the number of dogs in this analysis was insufficient to detect significant differences, but those differences would likely be small based on the fact that success proportions were numerically very similar between groups.

NSAID administration was significantly associated with the success of medical management in dogs with presumptive cervical disk herniation ($P = .035$; OR = 2.52), despite not being significantly associated with QOL. Several authors have expressed the opinion that NSAIDs may be beneficial in dogs with disk

herniation that is being managed medically[1–12,16] and in humans with medically managed cervical[14,23] or lumbar[24–26] disk herniation. NSAIDs can block the activity of cycloxygenase, which leads to a reduction in tissue prostaglandins, improved analgesia and a blunted inflammatory response.[27] The anti-inflammatory actions of NSAIDs may limit facet joint and nerve root inflammation secondary to disk herniation in humans.[26] It has also been suggested that the analgesic effect of NSAIDs may be important in recovery from a variety of orthopedic and neurologic diseases, as reduced pain may aid in early mobilization and prevention of disuse muscle atrophy.[28] Side effects, such as gastrointestinal ulceration, gastrointestinal perforation, coagulation disorders, and nephropathy, can occur with NSAID administration, especially if combined with glucocorticoids.[27,29] There was no evidence in this report of a beneficial effect of glucocorticoids or other analgesics on success or QOL scores.

Cage rest duration was not significantly associated with success or QOL scores in our population of dogs with medically managed presumptive cervical disk herniation. A similar lack of association between cage rest duration and successful outcome was found in our report on dogs with medically managed thoracolumbar disk herniation.[19] Whereas the number of questionnaire responses could certainly limit our ability to resolve differences between groups, the power of the statistical test to compare no cage rest with all other levels had 71% power to detect a 1.6 times better success proportion in those reporting any cage rest. Although cage rest traditionally has been considered one of the cornerstones of medical management for disk herniation in veterinary medicine, these results indicate that long-term strict confinement is not beneficial. Some authors suggest that bed rest in humans with cervical disk herniation be limited to 48–72 hours and that ''relative rest'' (a period of limited activity with physical rehabilitation) should be advised for several weeks.[14,23] Although bed rest in humans with disk herniation may initially relieve paraspinal hyperesthesia and vertebral column loading, prolonged strict rest may result in altered disk nutrition, vertebral column unloading, and muscle atrophy, which can negatively impact the patient.[30–34] Various forms of physical rehabilitation have been suggested to be beneficial for spinal cord disorders in dogs, such as degenerative myelopathy[35] and fibrocartilaginous embolic myelopathy,[36] and likely help in recovery from disk herniation.[37] It is our opinion that an initial period of strict cage confinement may be beneficial, but that prolonged strict rest at the expense of physical rehabilitation may not have any benefit. This would be consistent with the finding that duration of cage confinement was not associated with successful outcome in this report. Clearly, further careful investigation of this issue is needed before definitive recommendations are made.

The small number of dogs in our study may have precluded the detection of a relationship between degree of neurologic dysfunction, duration of neurologic dysfunction, and outcome. Only 3 of 87 dogs were non-ambulatory at admission and whereas none of these dogs had successful outcome or QOL scores >0, data were insufficient to detect statistical significance or make definitive recommendations. The statistical test comparing the success proportion in the non-ambulatory group with grades 4–5 only had 3% power to detect a success proportion of ≤ 0.33 in the more severely affected group. Similarly, only 15 dogs had clinical signs that were present for >7 days. Based on data from our report on presumptive thoracolumbar disk herniation,[19] poorer neurologic function and a longer duration of neurologic signs would seem to be negative prognostic indicators, although this could not be demonstrated with the cervical cases. In humans with soft cervical disk herniation (analogous to disk extrusion in dogs), this is also believed to be the case.[38] Interestingly, age and weight were linked with QOL score, with older and heavier dogs having lower values.

Our report has several limitations, including the lack of a definitive diagnosis in most dogs, the use of client-based measures of outcome, the retrospective assignment of modified Frankel scores based on initial neurologic examination, and the small number of dogs identified. Definitive diagnosis of cervical disk herniation requires advanced imaging, such as myelography, computed tomography, or magnetic resonance imaging, but these procedures are rarely performed in dogs for which medical management is initially chosen.[10,12] In 2 reports on the medical treatment of presumptive cervical disk herniation in dogs, similar criteria were used to identify dogs as in our study.[13,18] Whereas it is likely that some of our dogs did not have cervical disk herniation, the methods of diagnosis are similar to those used by many veterinary practitioners, which makes the data relevant. Another potential study limitation is the lack of veterinarian assessment of dogs after initial evaluation. Investigations into the recurrence of surgically treated disk herniation[39,40] and conservatively treated cervical disk herniation[13,18] also have used owner-based assessments. It is possible that owner assessments might have differed from that of a veterinarian, as was the case in a study investigating client and veterinarian perception of lameness and pain in dogs with hip osteoarthritis.[41] Also, data were not available to validate the questionnaire or assess the repeatability of individual questions and therefore the reliability of results must be interpreted accordingly. Finally, the small number of cases and retrospective nature of modified Frankel score assignment may have limited

the results of our study. Retrospective determination of neurologic dysfunction could potentially lead to imprecise measurements.

All epidemiologic studies are subject to bias, especially those based on retrospective data and owner completed questionnaires. In our study there are a number of potential sources of bias, especially selection bias. Selection bias will occur if respondents are systematically different than non-respondents and it is not possible to determine the effect that this error would have on study results. We attempted to reduce selection bias by using a systematic approach of owner contact and follow-up. Responders were not significantly different than a random subset of non-responders based on information available from medical records. Data collected from retrospective sources and questionnaires can also result in misclassification of the outcome or exposures of interest, including drug administration. Success was defined conservatively to reduce subjectivity in outcome classification. Misclassification present in data should be non-differential and therefore bias our results toward the null value (no association). In this manner, the true associations might actually be larger than what was measured in the study. Multivariable modeling was used to address the potential for confounding; however, residual confounding could still be present in our results because of improperly measured or unmeasured variables.

Based on the results of this study and our report on presumptive thoracolumbar disk herniation,[19] it is difficult to make definitive recommendations regarding medical management of presumptive disk herniation. It is our view that dogs that are mildly affected and have a relatively acute history of dysfunction are the best candidates for medical management. Although we did not find an association between cage rest duration and success, a brief period (1–2 weeks) of strict rest is still likely warranted as there was no harm seen with this and there is some suggestion that this may reduce pain and nerve root inflammation in humans.[14] Prolonged strict cage confinement, for a month or more, may help prevent further disk herniation and allow for tissue healing, although experimental studies and reports on humans with medically treated cervical or lumbar disk herniation have not supported this.[14,23,31,42] After strict rest is completed, early, controlled remobilization and physical rehabilitation combined with rest would seem reasonable; however, objective information that this is beneficial is not available. Evidence from humans with cervical[43] and lumbar[44] disk herniations that were medically managed suggests that over time, the size of the prolapsed material may decrease leading to improvement; the exact mechanism by which this happens is unknown.

NSAIDs seem to be associated with success in dogs with presumptive cervical disk herniation and were also related to higher QOL scores in the thoracolumbar group.[19] These would be reasonable to administer so long as there was no recent history of glucocorticoid administration, gastrointestinal disturbance, or nephropathy; NSAIDs also can be combined with oral opioid drugs in dogs that have severe paraspinal hyperesthesia. Physical rehabilitation is likely to be beneficial in the medical management of both cervical and thoracolumbar disk herniation based on limited studies of its use in other veterinary vertebral column disorders, although this issue was not specifically investigated in this study. Finally, dogs that are not improving with medical treatment should receive ancillary diagnostics such as CSF analysis and advanced vertebral column imaging to determine the best mode of intervention.

ACKNOWLEDGMENT

We would like to thank Ms. Alisha Onkst for her assisting with data collection.

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