PAPER

Chiropractic abnormalities of the lumbar spine significantly associated with urinary incontinence and retention in dogs

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Objectives: To retrospectively summarise chiropractic findings in dogs presented in a veterinary practice with urinary incontinence and urinary retention over a 6-year period, and compare these to non-urinary patients presented during the same time period.

Methods: Twenty-two cases were included in the study. They all first underwent a standard clinical examination to rule out or treat other possible causes of their urinary problems. They then underwent chiropractic examination and hypomobility findings were recorded using Gonstead listings. Odds ratios (ORs) were calculated for the occurrence of chiropractic findings in urinary *versus* non-urinary patients for each vertebra in the lumbar, sacral and ilial regions.

Results: All patients had chiropractic findings in the lumbar region that differed from non-urinary patients. The urinary patients were significantly more likely to have chiropractic findings in L3 (OR=4·81; 95%CI: 2·02 to 11·44; P=0·0004), L4 (OR=6·85; 95%CI: 2·63 to 17·84; P=0·0001) and L5 (OR=3·98; 95%CI: 1·64 to 9·69; P=0·0023). In addition, urinary patients were significantly less likely to have chiropractic findings associated with the ilium (OR=0·26; 95%CI: 0·11 to 0·66; P=0·0043).

Clinical Significance: This is the first report of an association between chiropractic findings in the lumbar vertebrae and urinary incontinence and retention in dogs.

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INTRODUCTION

Chiropractic treatment was established in the late 1800s and remains widely used nowadays. Human chiropractors are available across the world, and veterinary chiropractic is increasingly integrated into veterinary practices. Vertebral "subluxations" (termed segmental hypomobilities in chiropractic) are believed to either: (1) encroach on the intervertebral foramen or the adjacent spinal canal, (2) alter the afferent input to the central nervous system or (3) lead to a distortion of neural impulses within the spinal cord through interactions via the denticulate ligament (Henderson 2012). Although biomechanical, muscular reflexogenic and neurophysiological processes have been proposed for chiropractic, there is no fully accepted mechanism of action (Potter *et al.* 2005) and a mode of action of chiropractic intervention remains elusive (Cramer *et al.* 2006). Nevertheless, one study performed in anaesthetised cats offered support for a muscular reflexogenic process, although this does not rule out other concurrent mechanisms (Pickar & Wheeler 2001, Pickar & Kang 2006).

Human studies suggest effects of chiropractic intervention for various conditions such as low back pain (Schneider *et al.* 2010), fibromyalgia (Terhorst *et al.* 2011) and many other conditions (Cramer *et al.* 2006). In 1993, the Canadian Ministry of Health published an elaborate study evaluating the use of health care resources in treatment of low back pain which supported the efficacy, safety, scientific validity and cost-effectiveness of chiropractic treatment (Manga *et al.* 1993). Further, the US Agency for Health Care Policy and Research lists chiropractic treatment as a safe treatment modality for relief of discomfort in patients

with acute low back pain (Bigos *et al.* 1994). Similarly, spinal manipulation and chiropractic techniques have found increasing use in equine practice although available evidence for treatment effects is limited (Haussler 2010). Despite this apparent public acceptance, the chiropractic modality remains controversial and widely discussed in veterinary medicine (Keating & Ramey 2000, Ramey *et al.* 2000). One reason for this controversy appears to be the variable levels of agreement observed between chiropractic examiners (Keating *et al.* 1990, Boline *et al.* 1993, Schneider *et al.* 2008, Woodfield *et al.* 2011). Another reason is undoubtedly the very limited objective evidence currently available documenting effects of treatment and application in veterinary medicine. Patients with urinary incontinence and nocturnal enuresis represent one human patient category for which chiropractic intervention has been described and where some treatment effects have been documented (Kreitz & Aker 1994, Stude *et al.* 1998, Glazener *et al.* 2005). This information has been extrapolated to veterinary medicine, where similar urinary problems are often mentioned as eligible for chiropractic therapy. However, no peer-reviewed articles are currently available to document effects of chiropractic in veterinary cases of urinary incontinence or retention.

The aim of this study was to determine whether chiropractic findings can be associated with urinary problems in canine patients.

MATERIALS AND METHODS

This study was carried out with written consent from the owners of the treated dogs. Only standard and well-established chiropractic methods were used and no experimental interventions were carried out.

All dogs examined and treated with chiropractic methods by the author during 2008 to 2014 were included in the study. Patients were categorised as having either primary complaints of urinary incontinence or non-urinary complaints (such as lameness, neck pain, thoracic pain, gastrointestinal problems).

The chiropractic evaluation in our practice involves the following steps: (1) an interview with the owner, (2) a gait evaluation at walk and trot, (3) palpation and evaluation of the pelvic and sacral areas for signs of abnormal joint mobility, (4) palpation of the entire vertebral column for signs of abnormal joint mobility, (5) evaluation of reactions to stimulation of the bladder meridian and bladder acupuncture point (Schoen 2001) and (6) palpation of limbs.

The chiropractic examination is aimed at identifying subtle changes in joint mobility and also signs of pain; Gonstead listings (Cooperstein 2003) are used to describe the findings (Table 1). When a joint is found to have decreased or altered mobility, a chiropractic treatment is carried out on that specific joint, taking into account the angle of the articular surfaces. Treatment aims at normalising the joint mobility by applying a specific thrust with the fingers with low amplitude and high velocity.

Statistical analysis

Odds ratios were calculated using MedCalc version 14.10.2 software (MedCalc Software bvba, Ostend, Belgium) for the risk of chiropractic findings in the urinary compared to non-urinary patients for each of the lumbar vertebrae (L1 to L7) as well as the iliac and sacral bones. Confidence intervals (95%) and P-values were generated. All results were interpreted at the α=0·05 significance level.

Table 1. Chiropractic diagnoses used in this study and their commonly used abbreviations

Gonstead listing	Description of motion unit
	Cervical vertebrae
BL (body left)	Hypomobility towards the right
BR (body right)	Hypomobility towards the left
	Thoracic and lumbar vertebrae
PL (posterior left)	Hypomobility towards the ventral right
PR (posterior right)	Hypomobility towards the ventral left
	Sacral apex
SAR (sacral apex right)	Hypomobility towards the left
SAL (sacral apex left)	Hypomobility towards the right
	Sacroiliac joint
LPI (left ilium posterior, inferior)	Hypomobility of left sacral tuberosity in the ventrocranial direction
RPI (right ilium posterior, inferior)	Hypomobility of the right sacral tuberosity in the ventrocranial direction
LAS (left ilium anterior, superior)	Hypomobility of the left saral tuberosity in the dorsocaudal direction
RAS (right ilium anterior, superior)	Hypomobility of the right saral tuberosity in the dorsocaudal direction

The terminology describes in which direction of movement a certain motion unit has hypomobility

RESULTS

Dogs with urinary problems represented 4·1% (22/543) of all the chiropractic canine patients treated during the 6-year study period (2008 to 2014) and clinical signs are summarised in Table 2. Of these, 18 had signs of urinary incontinence and the remaining four had urinary retention. The severity of incontinence varied from minor occasional leaks to moderate, often nocturnal leaks. Non-urinary patients were evaluated for complaints of lameness (152), other conditions, including kurtosis (105), non-specific pain (57), thoracic and lumbar pain (55), non-symptomatic check-up evaluations (28), neck pain (13) and constipation (1). The remaining patients (110) had complaints of two or more of these categories.

Figure 1 presents the prevalence of chiropractic findings for the entire vertebral column for the 22 urinary patients and the 521 non-urinary patients presented in the clinic during the same time period. Table 3 presents odds ratios (ORs) for chiropractic findings associated with each of the lumbar vertebrae, as well as the ilial and sacral bones for the canine urinary patients compared to non-urinary patients. Findings at lumbar vertebrae 3, 4 and 5 were disproportionately detected in dogs with urinary signs.

DISCUSSION

This study provides numerical evidence documenting an association between chiropractic findings in the lumbar region

Table 2. The 22 patients presented in the clinic with either urinary incontinence or urinary retention

Patient	Age*	Gender	Breed	Category	Symptoms	Duration	Other findings	Gonstead listings
1	0·5	Male	Irish Glen terrier	Incontinence	Small leaks	Unknown	Back pain	L1PR, L3PR, L6P
2	9	Male	danish pointer	Incontinence	Small leaks	Unknown	Lameness	T12P, PL, L1PR, PL, L2PL, PR, L3PL, PR, L4PL, PR, RPI
3	2·5	Male	Irish wolfhound	Incontinence	Moderate leaks	9 months	Lumbar pain	L4 P, PR, L5 P, PR, SAR
4	2	Female	mini bullterrier	Incontinence	Small leaks	1 month	Lameness	C3BR, C6BR, T11PR, T12P, L2P, L5P, L6P, RPI, SBP, SAL
5	6	Castrated male	Labrador mix	Incontinence	Small leaks	36 months	—	L5PR
6	2	Female	Cairn terrier	Incontinence	Moderate nocturnal leaks	12 months	—	L4PR
7	2	Male	Doberman	Retention	Forced urination	1 week	Lameness, hip dysplasia	L4 PR, L5 PL, SAR
8	10	Castrated male	English mastiff	Incontinence	Moderate leaks	Unknown	-	L3PL, L4 PL, L5 PL
9	7	Spayed female	Labrador retriever	Incontinence	Small leaks	6 months	Spondylosis	T11, T12, T13P, L5PL, L6P, L7P, RPI
10	3·5	Male	Labrador retriever	Incontinence	Forced urination	2 weeks	Lameness back pain	L3 PL, PR, L4 PL, PR, L5 PL,PR
11	1	Male	Rottweiler	Incontinence	Small leaks	Unknown	Lumbar pain	L4 P, PR, L5 P, PR SAL, RPI
12	6	Female	Labrador retriever	Retention	Forced urination	Unknown	Back pain	L5PL, SAR
13	7	Male	American Staffordshire terrier	Retention	Forced urination	6 months	Enlarged prostate	T8 PL, L4 PR, L6PR, L7 PR, SAR
14	9	Spayed female	Labrador retriever	Incontinence	Nocturnal leaks	2 weeks	Lumbar pain	L3P,PR, L4P,PR, L6PR
15	8	Male	golden retriever	Incontinence	Small leaks	1 month	Lameness, lumbar pain	C4BL, L2PL, L4PL, L6PR, RPI, SAL
16	10	Male	Border terrier	Incontinence	Moderate leaks	1 month	Enlarged prostata	L1 PL PR, L2 PL PR, L3 PL PR, L5 P RPI
17	2	Spayed female	Labrador retriever	Incontinent	Moderate nocturnal leaks	2 months	—	L3 PR, L4 PR, L5 PR
18	3	Spayed female	Berner Sennen	Incontinence	Moderate nocturnal leaks	2 weeks	—	L3, L4,L5, L6 P, PR
19	10	Spayed female	Labrador retriever	Incontinence	Small leaks	1 month	Lameness	T13P, L2P, PL, L3PL, L4P, PL, L5P, PL, PR, SAL
20	2	Male	German shepherd	Retention	Forced urination	18 months	—	L3P,PR, L4PL, PR, L5PR, SAL
21	4	Female	Labrador mix	Incontinence	Moderate nocturnal leaks	1 month	Lumbar pain	L3, L4, L5, L6, PL, PR
22	4	Spayed female	Giant Schnauzer	Incontinence	Moderate nocturnal leaks	3 months	—	L2PR, L3PL, PR, L4PR

*L Lumbar vertebrae, T Thoracic vertebra, PR Posterior right, SAR Sacral apex right, RPI Right ilium posterior, inferior, SBP Sacral base posterior, SAL sacral apex left, C Cervical vertebra
A brief description of each patient with symptoms, duration and other findings. Gonstead listings assigned are presented as well

and urinary problems manifesting as retention or incontinence in dogs. It is important to emphasise that the patient material presented here represents an all-inclusive collection of canine patients presented in our clinic with urinary retention or urinary incontinence during a 6-year period. Thus, the potential impact of selection bias on data collection and the associated statistical analysis has been eliminated. However, it should be pointed out that the chiropractic examiner was not blinded to information about urinary tract disease status, which could constitute a potential source of bias. Additionally, it should be pointed out that a statistical association does not automatically imply a causal relationship, and more work is needed to elucidate the possible relationship between the chiropractic findings and the urinary problems studied here.

The association between segmental hypomobilities in the lumbar region and urinary retention and/or incontinence suggests a possible neurophysiologic explanation for the observed urinary problems. The nerve supply to the urinary bladder and urethra originates from the lumbar and sacral sections of the spinal cord (Purinton & Oliver 1979, König & Leibich 2009). Hypomobility of the facet joints in this area could be postulated to cause oedema leading to an increased pressure on the nerves originating here. This, in turn affects the blood supply to the nerve. In dogs, the nerves originating in the L1 to L4 spinal cord segments are involved with sympathetic innervation of the bladder, whereas the somatic innervation of the urethra originates in the S1 to S2 area (Purinton & Oliver 1979, König & Leibich 2009). Taken together, the significant differences found between groups for the L3 to L5 segments in this study could suggest an interaction with the sympathetic innervation of the bladder as a mechanism behind the urinary retention and incontinence in the study population. These observations are in line with experiences made with chiropractic treatment of human cases of dysuria and urinary incontinence (Stude *et al.* 1998, Glazener *et al.* 2005). However,

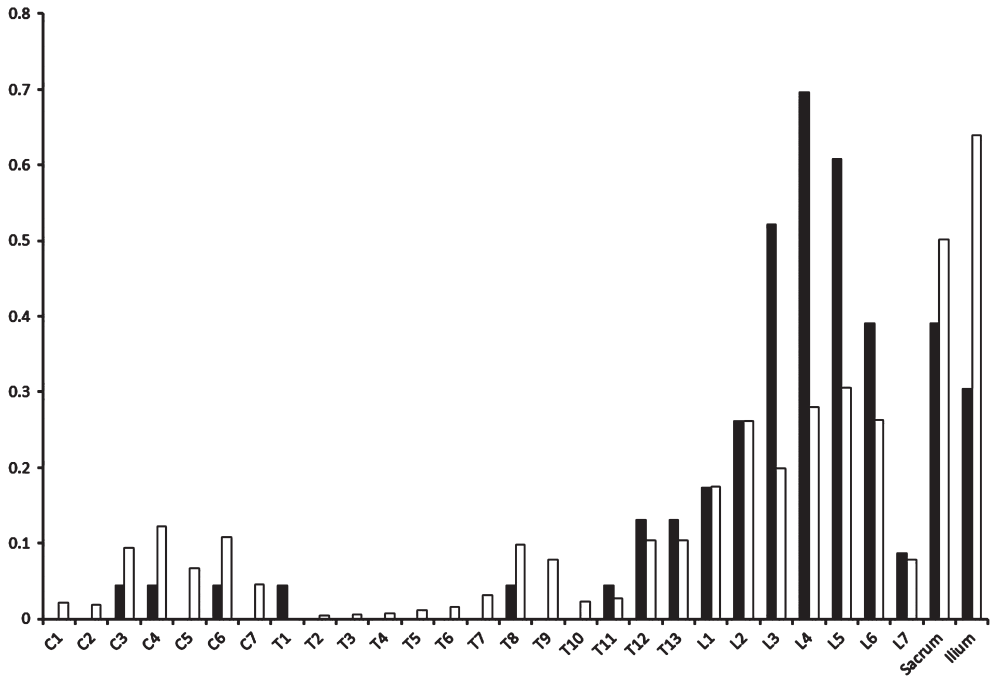

FIG 1. Prevalence of chiropractic findings in canine patients with urinary retention and, or, incontinence (black columns) and non-urinary canine patients (white columns). Data presented for the entire vertebral column except for the coccygeal vertebrae. C Cervical vertebrae, T Thoracic vertebrae, L lumbar vertebrae

Table 3. Odds ratio calculations for the occurrence of chiropractic findings in the lumbar vertebrae (L1 to L7), as well as ilial and sacral joints in patients with urinary problems (n=22) compared to all other patient categories (n=521) treated between 2008 and 2014

	Odds ratio	95% Confidence interval	P-values
L1	1·00	0·33 to 2·99	0·9926
L2	1·06	0·41 to 2·77	0·9027
L3	4·81	2·02 to 11·44	0·0004
L4	6·85	2·63 to 17·84	0·0001
L5	3·98	1·64 to 9·69	0·0023
L6	1·94	0·81 to 4·64	0·8355
L7	1·17	0·26 to 5·19	0·8355
Sacrum	0·69	0·29 to 1·64	0·4010
Ilium	0·26	0·11 to 0·66	0·0043

the under-representation of chiropractic findings associated with the ilial bone in these patients remains to be understood. One explanation could be that the majority of other canine patients presented to us for chiropractic treatment exhibited either lameness or back pain, which could be more commonly associated with hypomobility of the sacral bone. Nonetheless, this should be a topic of further investigations.

Despite mounting evidence in human medicine, the value of chiropractic treatment is still debated in veterinary medicine, where scientific evidence documenting its effects remains scarce (Keating & Ramey, 2000, Ramey *et al.* 2000). Very few peer-reviewed publications exist within veterinary medicine, and most of these are single case presentations. By presenting statistical evidence, we have added to the body of evidence supporting chiropractic treatment as a valid supplement to traditional approaches in veterinary medicine. It is worth emphasising that, for the cases presented here, other conventional treatment options were already exhausted. In this context, chiropractic should be viewed as a low-cost and non-invasive treatment option involving minimal discomfort and no apparent side effects to the patient. In the mind of the client owning a dog with urinary incontinence or retention, chiropractic treatment is often worth trying.

The findings presented here have led to an adjustment of the examination protocol for dogs with urinary incontinence and/or retention in our practice. First, we evaluate the dog clinically to rule out cystitis. If no signs of cystitis are encountered, the next step is to perform the chiropractic evaluation as described in this report. If treatment outcomes are not satisfactory, we proceed with diagnostic imaging such as ultrasonography and/or radiology. The latter will incur increased costs to the owner, which is the reason for the lower priority of these procedures.

Dogs with urinary incontinence and dysuria represent a small, but significant, proportion of cases in veterinary practice and constitute a well-defined and identifiable patient category in which chiropractic treatment can be attempted. Our experience is that chiropractic represents a valid diagnostic supplement to conventional veterinary medicine in dogs with urinary incontinence and dysuria.

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Conflict of interest

The author is co-owner of a small animal veterinary practice, in which the presented cases were encountered. The author has no financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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