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Topical review

Canine Thoracic Costovertebral and Costotransverse Joints: Three Case Reports of Dysfunction and Manual Therapy Guidelines for Assessment and Treatment of These Structures

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The costovertebral and costotransverse joints receive little attention in research. However, pain associated with rib articulation dysfunction is reported to occur in human patients. The anatomic structures of the canine rib joints and thoracic spine are similar to those of humans. As such, it is proposed that extrapolation from human physical therapy practice could be used for the assessment and treatment of the canine patient with presumed rib joint pain. This article presents 3 case studies that demonstrate signs of rib dysfunction and successful treatment using primarily physical therapy manual techniques. General assessment and select treatment techniques are described.

The articular structures of the thorax comprise facet joints, the intervertebral disc, and costal joints. Little research has been conducted on these joints in human or animal medicine. However, clinical case presentations in human journals, manual therapy textbooks, and anecdotal evidence suggest that dysfunctions in these structures could account for pain in the thorax or functional impairments particularly in the upper extremities or both. [1-5] The purpose of this article is to look at what is known about the costovertebral (CV) and costotransverse (CT) joints in both humans and dogs, present 3 case reports of suspected rib joint dysfunction, and provide assessment and treatment strategies for these structures.

Anatomy of the CT Joints

Each rib has an articulation with the transverse process of the vertebra for which it shares the same number (i.e., rib 2 articulates with the transverse process of the second thoracic vertebra), which is known as the CT joint.[6] The fovea on each transverse process articulates with the tubercle of the corresponding rib. This joint is fixed by the CT ligament, which attaches just distal to the articular capsule of the tubercle, crosses the capsule, and blends with the periosteum of the transverse process of the vertebra corresponding to the rib.[6] Great variations in size and positioning of these ligaments exist in different dogs; however, they are usually largest in the last 4 ribs.[6] Jiang et al.[7] compared the spinal ligaments in the thorax among bipeds (humans), quadrupeds (multiple species, which included dogs), and pseudobipeds (avian species). They found the lateral spinal ligaments (i.e., the superior CT ligament in humans or the anterior transverse ligament and an intertransverse ligament in birds) were absent in any of the quadrupeds studied. They postulated that lateral ligaments developed as a reflection of the mechanical challenges unique to an erect spine and further presented that in reviewing the literature, they were unable to find mention of natural development of idiopathic scoliosis in quadrupeds; however, there are reports of avian models and adolescent models in man.

Takeuchi et al.[2] commented, "The anatomic structures of the canine CV joints and thoracic spine are similar to those of humans, and the range of motion (ROM) or rotations of the thoracic spinal motion segments along 3 axes do not differ markedly from those of humans." Thus, human thorax research may help to expand our perceptions and knowledge of the canine thorax as well. Young et al.[3] studied the pain patterns of the CT joints in normal (human) volunteers. Fluoroscopic-guided injections were made into the CT joints. Subjects reported the pain to be deep, a dull ache, or a pressure sensation, with pain patterns located superficial to the injected point, ranking an average pain of 3.3 of 10 on a visual analog scale. They noted that the T2 CT injections referred pain 2 segments cranially or caudally, but no chest wall or upper extremity or pseudovisceral pains were reported. In humans, innervation of the CT joints is from the lateral branch of the thoracic dorsal rami, whereas the medial branches of the thoracic dorsal rami innervate the thoracic facet joints.[3]

Anatomy of the CV Joints

Additional rib articulations (costal fovea) are located at the cranial and caudal sides of each thoracic vertebra T1-T11 (called the cranial and caudal costal fovea or the demifacets). The rib head 1 articulates with T1 body and sometimes C7. It also articulates with the fibrocartilage between C7 and T1. The body of T12 often lacks a caudal demifacet, and T12 and T13 typically have only 1 complete fovea on each side.[6] The CV joints and rib cage play an important role in providing stability to the thoracic spine.[1] The

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Fig. 1. View of the demifacets of the costovertebral joints in the thoracic spine.

articulation of the rib head, including the support of the radiate ligament, articular capsule, CT ligament, and intra-articular ligament, plays an important role in resisting rotations around the axes in lateral bending.[2] Hence the thoracic spine may be significantly less stable when the CV joints are injured (Figs 1 and 2).

Potential Symptoms

CV joints have been shown to receive sympathetic innervations from the neighboring sympathetic segment and the segment cranial to it.[3] Human case reports have found rib dysfunctions to produce neck pain or head pain or both, shoulder pain (similar to shoulder impingement syndrome signs and symptoms), the sensation of having a useless or heavy limb, the inability to grip efficiently, pain under the scapula that refers to the chest and worsens with coughing, sneezing or deep breathing, and atypical chest pain (occasionally with tachycardia and dyspnea).[8–11] No studies could be found pertaining to clinical presentation of rib dysfunctions in dogs.

Fig. 2. The costovertebral and costotransverse joints.

Canine Case Studies of Rib Dysfunctions

Case 1

A 10-year-old neutered male Labrador Retriever presented to a physical therapist at a canine rehabilitation facility with a veterinary referral that described the problem as “a chronic issue revolving around repeated stretching when at dog parks or when exercising, sometimes accompanied with a yelp. Pain is found repeatedly at the thoracolumbar area on physical examination, and the dog is reluctant to extend the shoulders and elbows, but no further diagnostics have been administered.” The owners reported similarly, stating that the dog has stretched excessively since a puppy, and will even stop playing for stretching (downward-dog position). Over the past year, the owners had noted that the dog was frequently licking his left front paw. It had recently been prescribed a different nonsteroidal anti-inflammatory drug after the first one was not well tolerated. No relevant past medical history that could account for the stretching or paw licking was known or recounted.

On examination, the dog was not lame but did stretch several times during the appointment. The most painful areas on palpation were ribs 1-3 on the left and rib 2 on the right. The ribs throughout the left side of the caudal thorax (T7-13) were also painful on direct palpation. Treatment administered comprised mobilizations to the ribs in the form of rotational glides and distraction techniques (3 repetitions of each, then retesting for pain on palpation, and a repeat of the mobilizations to any ribs that were still painful until there was no longer pain with direct palpation). (Refer to treatment section for technique details.) Dorsal glides to the thoracic spinal facet joints (via the rib cage) were also used, and laser therapy was administered to the CV and CT joints as well. The owners were advised to perform “chest lifts” as a home exercise.

The follow-up appointment occurred 3 weeks later, at which time, the owners reported that the dog was much better and much reduced in his stretching. They had only witnessed him stretch once since his last appointment, and he was no longer licking his left front paw. On examination, there was only minimal pain on palpation of T3 spinous process and ribs 3 bilaterally. Mobilizations (as described previously) and laser therapy were provided at that time, and the dog was discharged from active treatment. Owners were contacted 1 month following discharge, and they reported to see no signs of recurrence of the stretching or licking habits.

Case 2

A 6-year-old neutered male Labrador Retriever presented to a physical therapist in a canine rehabilitation facility with a veterinary referral stating the history of a front leg lameness ongoing for 1.5 months, which worsens with exercise or after prolonged rest. No findings could be made on the veterinary examination. The dog had no relevant past medical history, and pharmaceuticals had not been prescribed.

On examination, the dog demonstrated a very subtle off-loading of the right forelimb in stance and very mild right forelimb lameness at a walk and trot. The most painful areas on palpation were the ribs 1-4 on the right, whereas ribs 1-4 on the left exhibited mild pain on palpation. The dog also had an increased