



C
F
C
N
e
w
s



Winter 2019

The Rib Issue

This issue will highlight the importance of ribs! It will discuss the importance of finding and treating rib dysfunctions, how they occur to begin with, and their anatomy. First rib dysfunctions are often the source of undiagnosed lameness in our canine patients. We will examine what this type of dysfunction looks like and a treatment option that involves stretching of the scalene muscles. This issue also contains a case study where a ten-year-old lab was continuously stretching and paw licking, with multiple ribs being painful on palpation. In which treating the ribs resolved these issues. Please read on!

Introduction

All structures in the thorax are densely innervated. Therefore, any of the thoracic articulations or soft tissue structures can be a source of pain in the presence of injury. The costovertebral and costotransverse joints can sustain sprains, ligamentous laxity, hypomobility, and subluxations, as can any synovial joint in the body.

If any of the muscles attaching to the ribs directly or indirectly, are injured, in spasm, have increased tone, or trigger points, etc., they can influence the mobility of the ribs and also create dysfunction. As an example, it is very common for tight and painful scalenus muscles to restrict the movement of the first rib and cause a cranial subluxation of the rib. This not only causes pain and dysfunction of the ipsilateral costovertebral joints, but can also affect weight bearing on the limb.

The Canine Fitness Centre Ltd.

Inside this issue

Introduction Cont.	2
Rib Anatomy	3
Rib Anatomy Cont.....	4
A Rib Dysfunction Case Study.....	5
First Rib and The Scalenes.....	6



Canine Fitness Centre
4515 Manhattan Rd SE
403-204-0823
www.caninefitness.com

Introduction continued...

Aside from their function in respiration and the protection of vital organs, ribs are integral in the stability of the vertebral column. Ribs also provide a stable base for the transference of power (via the muscular system and its attachments) between the trunk and the limbs. It is important to include an assessment of the ribs and all of the rib articulations when determining a cause of dysfunction or lameness.

Clinically at the Canine Fitness Centre, we have been able to observe a number of correlations in regards to causes and factors associated with rib dysfunctions. Trauma is an obvious source of rib pain. Dogs might run into something or be run into by another dog, or may suffer a fall off of an elevated object. Additionally we've noted a correlation with thorax issue secondary to hind end weakness (due to neurologic compromise or hip or stifle pain). Such weakness necessitates a dog to pull itself forwards in locomotion and up from a sitting or lying position. This over use can result in thoracic pain. Rib dysfunctions are also common in dogs that do a lot of jumping (ie. agility dogs), pouncing (ie when retrieving a ball), or smaller dogs that routinely jump off of beds or couches. Sometimes the signs of a rib dysfunction are subtle (ie. poorer ability to sit straight or turn). Sometimes handlers of canine athletes notice performance issues. Some dogs have expressed pain while sneezing, yawning or rolling. As well, cranial rib dysfunctions can cause a front leg lameness. Subsequently, therapists at The Canine Fitness Centre routinely check for rib and thoracic spine pain with all of their assessments.





Rib Anatomy

The following is a description of the functional anatomy of the ribs and how these articulations that make up the thorax can be a source of dysfunction and pain for a dog.

The articulating structures of the thorax are comprised of the costovertebral joints, costotransverse joints, costochondral joints, sternocostal joints, intervertebral facet joints, and the intervertebral discs.

The **costovertebral joints** are synovial joints between the head of the ribs and the thoracic vertebral bodies. The heads of rib 2-11 articulate with the costal fovea located at the cranial and caudal sides of each of the thoracic vertebral bodies (the vertebra of the same number and the vertebra cranially). Each costovertebral joint is surrounded by a ligamentous joint capsule, which becomes thickened anteriorly to form the radiate ligament. An intervertebral disc is positioned between the costal fovea. A short, horizontally

placed intra-articular ligament extends from the ventral surface of the head of a rib to the intervertebral disc. Rib 1 articulates with the body of T1 and sometimes with C7 (there is not always a costal fovea on C7), and ribs 12 and 13 typically articulate with T12 and T13 vertebral bodies, respectively.

The **costotransverse joints** are synovial joints between the ribs and the transverse processes of the vertebrae of the same number (i.e. rib 2 articulates with the transverse process of the second thoracic vertebra). The fovea on each transverse process articulates with the tubercle of the corresponding rib. The costotransverse joints are surrounded by a ligamentous joint capsule and secured by the costotransverse ligament.

The image above shows the costovertebral joints (blue arrows) and costotransverse joints (red arrows). The image on the right shows the first rib articulation with T1.

Stumbles in the treadmill

One sign that we've noted at The Canine Fitness Centre Ltd. that might indicate a first or second problem is repeated tripping in the underwater treadmill. Front end tripping can be seen when a dog is walking on dry land as well, however the added resistance from the water in the treadmill can trigger the tripping to happen more readily. If a rib joint is painful the dog may compensate in both posture and movement. Short stepping in the front end is one way that this compensation is seen. Whether due directly to pain, or biomechanical disadvantages, when we note a front leg stumble in a dog while walking in the water treadmill, it indicates that the dog needs to be checked by one of our therapists. It's because of this, that we've been able to identify the correlation between rib dysfunctions and treadmill



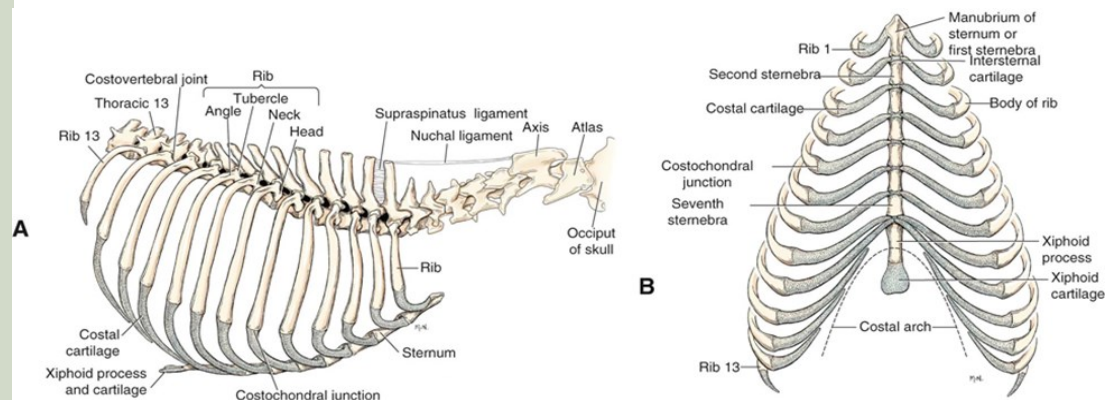
Rib Anatomy continued...

The **costochondral (interchondral) joints** are hyaline cartilaginous joints (synchondrosis) connecting the bony aspect of the rib with the costal cartilage on the ventral aspect of the rib cage.

The **sternocostal (intersternal) joints** are synovial plane joints connecting the costal cartilages of the 'true' ribs with the sternum. The true ribs (sternal ribs, ribs 1-9) are directly connected to the sternum, whereas the 'false' ribs (asternal ribs, ribs 10-12) are indirectly connected to the sternum by attaching to the cartilage of the rib cranial to it on the ventral aspect to form the costal arch, and the floating rib is the most caudal rib (rib 13) whose cartilage ends free in the musculature without attachment to an adjacent cartilage. The articulation of the ribs with the vertebral bodies, the transverse processes, the sternum, and the costochondral cartilage provides stability to the thoracic spine in lateral bending and axial rotation. The thoracic intervertebral discs also regulate the stability of the thoracic spine. It has been demonstrated that unilateral re-

section of the rib head joint after partial discectomy on the ipsilateral side results in a significant decrease in thoracic spinal stability and integrity (1) (2).

There are **multiple muscles** which attach directly to the ribs and can affect the mobility/function of the ribs: intercostal muscles; transversus thoracis; rectus thoracis; rectus abdominus; serratus dorsalis and ventralis; iliocostalis; quadratus lumborum; external oblique; internal oblique; and transverse abdominal. Many other muscles can affect the ribs indirectly through their attachments to the thoracic spine: splenius, longissimus cervicis, longissimus capitis, spinalis and semispinalis cervicis and thoracic, multifidus cervicis, interspinalis, intertransversarii, latissimus dorsi, superficial and deep pectoral, scalenus, longus colli, longissimus, multifidus, and psoas minor.



References:

1. Takeuchi T, Abumi K, Shono Y et al. Biomechanical role of the intervertebral disc and costovertebral joint in stability of the thoracic spine. Spine 24 (14): 1414 - 1420, 1999.
2. Oda I, Abumi K, Lu D, et al: Biomechanical role of the posterior elements, costovertebral joints, and rib cage in the stability of the thoracic spine. Spine 21(12): 1423-1429, 1996.

A Rib Dysfunction Case Study

CFC News Winter 2019

A ten-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 in order to stretch (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 NSAID 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 of mobilizations to the ribs in the form of rotational glides and distraction techniques (three 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). Dorsal glides to the thoracic spinal facet joints (via the rib cage) were also utilized and laser therapy was administered to the costovertebral and costotransverse joints as

well. The owners were advised to perform ‘chest lifts’ as a home exercise.

The follow-up appointment occurred three 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 above) 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.



Chest Lifts

Reference: Edge-Hughes L. Canine thoracic costovertebral and costotransverse joints: three case reports of dysfunction and manual therapy guidelines for assessment and treatment of these structures. *Top Companion Anim Med.* 2014 Mar;29(1):1-5.

First Rib and The Scalenes

First rib dysfunctions are very common in canine patients and often contribute to undiagnosed lameness. Examination of the dog reveals tenderness over the area of the first rib and often a sensation of one rib being in a relatively more cranial position in comparison to the rib on the opposite side. Typical approach to treatment has been a high velocity, low amplitude manipulation to “reposition” the offending rib. However, looking closely at the anatomy of the scalene muscles perhaps we can design a gentler approach to this problem that does not make the dog ‘ouch’ loudly. The scalene muscles are composed of three portions. The ventral portion which arises from the transverse processes of cervical vertebrae 3-6 and inserts on the cranial portion of the middle of the first rib; the intermedius portion which arises from the transverse processes of cervical vertebrae 6 and 7 and insert into the dorsal portion of the lateral surface of ribs 3 and 4; the dorsalis portion which lies between the other two and arises from the transverse processes of cervical vertebrae 4-6 and inserts into the lateral surface of ribs 3-8. The action of these muscles, if activating bilaterally, is to flex the neck. If they are acting unilaterally they will cause side flexion of the neck or, in the case where the head is fixed, they will pull the ribs up. If these muscles are tight it can give the impression that the first rib is in a relatively cranial position. So before a quick manipulation is tried one might utilize these muscles to alter the position of the first rib. If these muscles feel tight on palpation many different soft tissue techniques can be used to gain relaxation. This can then be followed by a prolonged muscle / myofascial stretch of the scalenes. This is best done in sitting with the dog securely held between the therapists legs and supported up against the chest. One hand is kept around the dog’s upper chest, particularly the manubrium, to keep the dog from turning away and therefore making the stretch less effective. Sometimes using a thumb over the first rib helps to increase the amount of stretch, or adding a small mobilization at the same time is beneficial. Since we are addressing fascia as well as muscle, trying to maintain a stretch for at least 30 seconds is desirable. Maintaining a gentle stretch for up to 90 seconds on a co-operative dog can also be done. Sometimes adding a little “pumping” technique of gentle stretch followed by relaxation repeating this several times might also provide a neurophysiological pain reducing effect. This can be followed up with holding the dog securely by the upper chest and asking them to reach for a cookie on a diagonal that is the same as stretching the scalene muscles. This is fairly easy homework for the owner to continue. This technique is effective in more than 50% of the cases that have been seen at The Canine Fitness Centre. If a manipulation or mobilization is still required it will be much easier and less painful for the dog after addressing the scalene muscles

So, if your canine patient or your own dog has pain in the thorax, please give us a call!



We'd be happy to help!

The Canine Fitness Centre

4515 Manhattan Road SE

403-204-0823

www.caninefitness.com