

Shoulder Injuries: Getting to the HEART of it!

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Objectives:

- Attendees will hear an osteopathic approach to persistent shoulder injuries using the vascular and myofascial concepts.
- Examining the possible advantages of different rehabilitation concepts and protocols.

Introduction

Shoulder injuries, such as biceps tendonitis or medial shoulder instability (MSI), are commonly reported in the veterinary literature. I am presenting this lecture because I wonder why these injuries occur so often and why are they so hard to resolve with permanent, pain-free, full ROM of the shoulder? Are we missing a piece of the pie? Let's have a look at this from an osteopathic approach where we believe the body will protect an injured area around a **hierarchy of importance of structures**:

1. Vascular system (arterial/venous), lymphatic system and fascia
2. Central, peripheral and autonomic nervous system
3. Organs (visceral motility)
4. Endocrine system
5. Musculoskeletal system

So, keeping this protection hierarchy in mind, will an agility dog who does a lot of jumping over time perhaps build up some vascular restrictions (acute/chronic) in the joint or muscle tissues of the shoulder? Will those vascular restrictions cause abnormalities of the mechanics of the shoulder joint? This might be a plausible explanation of why so many dogs do not really have lasting improvements with traditional physical therapy and/or rehabilitation programs.

Osteopathic Vascular Model

Let's review our vascular concepts from the previous lecture. When a **traction** and/or **compression injury** occurs to the vasculature (vascular wall dysfunctions) of the muscle or tendon, the blood vessels will go in a permanent vasoconstriction mode in order to protect itself from more damage. This vasoconstriction pattern establishes a **three-dimensional** impact to the surrounding tissues, affecting especially the neurological and vascular supply of the intra and extra-articular tissues in the area. Because of these alterations, you will see joint and/or soft tissue restrictions with loss of normal **glide/slide mechanics** in the damaged tissues. As a result, there will be a **three-dimensional vascular stagnation**, or hemostasis, in the affected arteries, capillaries and veins of the injured area. The fluid, or pressure, dynamics of the area will be altered, and tension on the surrounding tissues will build up. The rhythms of the involved tissues will be altered as well, and the body will start to compensate and eventually break down from the altered pressure and restricted flows. This can happen in the fluid components of the fascia, muscles, tendons etc.

The *greatest* stagnation generally will be in the venous flow: the venous blue print of the body will be most altered by the injury. If there is stagnation of venous flow, there might

be also an indirect reduction of the arterial flow in that area; as a consequence, the tissue healing of the tendon will be slowed down in that area of the body. The tensegrity (the balance between compression and tensile forces) of the involved restricted tissues will be diminished, as well as the **mobility** and **motility** of tissues.

We have previously discussed a simplistic model regarding the two **muscle functions**: Muscles are MOVERS, or muscles are PROTECTORS! Their *primary* function is to contract and move two or multiple bones; here the muscles are doing the “right thing.” But, if a muscle is in spasm and not moving anything, the muscle is protecting around something! Now, if there are vascular restrictions in the muscles of the shoulder, neck, or chest, the muscles will go in a “protective” mode altering the shoulder mechanics, and biceps tendonitis or other abnormalities of the active and passive stabilizers of the shoulder may develop.

Now the question is, what blood vessel(s) in the neck/shoulder/chest region will be the most affected by persistent trauma as well as altering the mechanics of the shoulder the most? Let’s look at the anatomy of the area.

Anatomy

To understand the shoulder better and the concepts presented above, we have to know all the bony structures, the vasculature, nerves and muscles in that region. The shoulder and neck region from a cat or dog is a very complex anatomical area with a variety of important vascular, neurological and myofascial structures running through it.

Thoracic Inlet Syndrome

The small oval opening into the cranial part of the thoracic cavity is called the **thoracic inlet** (apertura thoracis cranialis). (This description of the thoracic inlet comes from Miller’s Anatomy of the Dog. Anatomically in humans there are two key openings within the thorax: the superior (cranial) thoracic aperture, also called the thoracic inlet, and the inferior (caudal) thoracic aperture also called the thoracic outlet. In dogs, the terms “thoracic inlet” and “thoracic outlet” seem to be used interchangeably.)

According to Miller’s Anatomy of the Dog, the first pair of ribs and their cranially extending costal cartilages borders the thoracic inlet bilaterally. The aperture is wider dorsally than ventrally. The first thoracic vertebra and the paired longus colli muscles bound the thoracic inlet dorsally; the manubrium of the sternum bounds it ventrally. Important structures passing through the thoracic inlet include the trachea, esophagus, vagosympathetic nerve trunks, recurrent laryngeal nerve, phrenic nerve, first two thoracic nerves, and several major blood vessels.

Blood vessels that pass through or are near the thoracic inlet, which, if restricted, may affect the shoulder, include:

- **Arteries:** The *brachiocephalic trunk* and the *subclavian arteries and their continuations*. The brachiocephalic trunk and the left subclavian arise directly from the aortic arch, while the right subclavian arises as a terminal branch of the brachiocephalic trunk. At the cranial border of the first rib on each side the subclavian continues as the *axillary artery*.
- **Veins:** The *cranial vena cava* is the most ventral of the structures in the thoracic inlet. It is formed by the convergence of the two *brachiocephalic veins* cranial to the thoracic inlet. The *subclavian*, *axillobrachial*, *omobrachial*, *axillary veins*, and all

are found near the shoulder. The *internal* and *external jugular veins* return blood from the head, joining the brachiocephalic veins just cranial to the formation of the cranial vena cava.

Muscles of the shoulder include:

- The trapezius, the omotransversarius, the rhomboideus, the serratus ventralis cervicis, the latissimus dorsi, the deep and superficial pectoral muscles, and the active stabilizer (or “rotator cuff”) muscles of the shoulder, such as the supraspinatus, infraspinatus, teres minor, deltoideus, subscapularis, teres major, and, of course, the biceps brachii.

Rehabilitation Concepts

Knowing the anatomy of the region better allows us to formulate a detailed treatment plan based upon our physical examination findings. For example, if we have a compression and/or traction injury to the subclavian artery and vein in the thoracic inlet area, we likely will see a hypertonicity of the surrounding muscles. The **primary**, or most immediately affected muscle here is the longus colli; **secondarily**, any of the muscles described above, especially the pectoral muscles, may also be affected. This will lead to an alteration of the mechanics in the shoulder joint as a result of the tightening or spasms of the muscles, and the biceps may have to compensate. Over time, restriction of extension and external rotation of the shoulder can develop into a tendonitis of the biceps tendon, or we might see *neurological* entrapment in the cervical region developing (C5-6), for example.

A Treatment Technique for Thoracic Inlet Vascular Restrictions: the Heart Reflex or Heart Roll Rhythm

• **Position of the heart:**

The heart is located ventral to T2 or T3 - T6 or T7, deep in the ventral thorax, just above the sternbrae 4 to 8, depending on the breed. Positioning is oblique: the base of the heart faces cranial/ventral and the apex faces caudal/dorsal at an angle of about 45 degrees. At the base of the heart, the aorta is located to the left of midline at the craniodorsal aspect of the heart, and the cranial and caudal vena cava are to the right of midline.

• **Movement of the Heart:**

Because of the oblique orientation of the heart fibers, it makes a roll upwards (dorso-cranially) when it contracts/empties, and rolls backwards (ventro-caudally) when it fills. The blood moves symmetrically in and out of the heart, creating a corresponding rhythm that is about 8 times slower than the actual heart rate. This creates an **ENERGETIC HEART REFLEX** of emptying and filling you can follow with your hand on the ribcage over the heart. (if you are farther away from the heart, the slower the rhythm is). The heart reflex follows the “figure of eight” emptying and filling phases of the heart.

When you use the heart reflex, you can follow the blood vessels for the arterial and venous cycle through the body. If you are following the vasculature with one hand, and have your other hand drawn into the heart rhythm, and the heart roll suddenly stops, there is a vascular restriction at that place in the vasculature. Depending upon which phase the stop occurs (heart emptying or filling), you know if it is an arterial or a venous restriction.

Treatment Using the Heart Reflex:

Draw into the heart roll reflex with one hand, preferable the left hand. Use the other hand on the restricted area to draw in and put the restricted blood vessel tissue at slight *tension* (we call this neurovascular stimulation) away from (arterial restriction) or towards (venous restriction) the heart.

VENOUS: When it is a *venous* problem, you put a slight energetic pull to the heart and emphasize the heart roll every time the heart is in the filling phase. Most of the time, the restricted blood vessel will open up at the fourth stroke of the heart roll.

ARTERIAL: When it is an *arterial* problem, you put a slight energetic pull away from the heart and emphasize the emptying phase of the heart roll. Most of the time, the restricted blood vessel will open up at the fourth stroke of the heart roll.

RULES:

- If both venous and arterial restrictions are present at the same area, start with the VENOUS restriction first, then emphasize the arterial restriction to bring in new blood. You can't add any more blood if it is still FULL with a venous drainage problem.
- Start treating vessels closest to the HEART first, then work your way away from the heart to more peripheral vessels; this allows blood from the periphery to flow unrestricted back to the heart in venous restrictions. Remove one restriction at a time to clear the pathway for blood flow towards or away from the heart.
- Check the Caudal Vena Cava on the right side of the ribcage first to see if there is no diaphragm restriction before treating the aorta.
- General ORDER of treatment (this optimizes circulation in the major vessels of the body before treating more localized issues such as shoulder problems):
 1. Caudal and cranial vena cava, and aorta
 2. Pulmonary veins and arteries
 3. Subclavian veins/arteries
 4. Kidneys (right first, then left)
 5. Portal system

Conclusion

Releasing the vascular restriction(s) of the major blood vessels to the shoulder, such as the subclavian arteries/veins and/or the brachiocephalic trunks, often relax the hypertonic musculature around the shoulder, and normal biomechanics can be restored. Position of shoulder blade in relationship to the ribcage improves, and the arthro-mechanics of the gleno-humeral joint will be restored. Excessive stresses on the tendons and/of fascia of the biceps and other stabilizers of the shoulder muscles are now reduced, and blood flow improves in that area. Chronic soft tissues irritations can now start to heal finally. Once the vascular restrictions are released and muscle hyper tonicity diminished, laser and other physical therapy modalities will help support and speed the healing process.

If you want to put the “thoracic inlet” syndrome in a total osteopathic model of hierarchy thinking, you have to include the following thoughts of *diagnosis* and *treatment*:

1. Vascular structures: Subclavian, brachio-cephalis trunk and aorta
2. Nerves: Direct: C7-T1 and T1-2 nerve roots, indirect: C5-6, phrenic nerve, recurrent laryngeal nerve, and vagosympathetic nerve
3. Organs: Esophagus, trachea and cranial lob lung
4. Endocrine system: Thyroid and thymus
5. Musculoskeletal system:
 - Muscles:
 - Longus colli mm, trapezius, and pectorals
 - Rotator cuff mm: biceps, subscapularis and infraspinatus
 - Capsel: Gleno-humeral joint

Reference

Evans, Howard E: Miller's Anatomy of the Dog, Third Edition, 1993. W. B. Saunders Company