Supraspinatus Tendinopathy

By Sherman O. Canapp, Jr., DVM, MS, CCRT, DACVS, DACVSMR

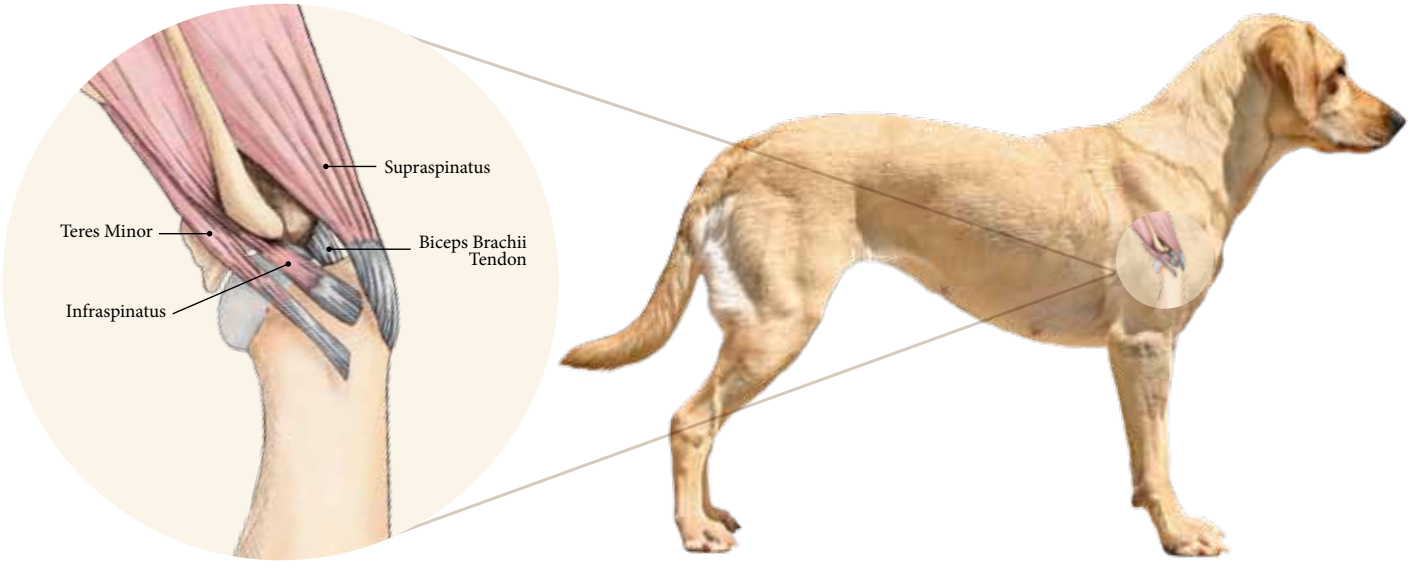
© DIANE LEWIS PHOTOGRAPHY

COURTESY OF VOSM

The responses to a survey of agility dog handlers, recently published in the *Journal of the American Veterinary Medical Association,* found that 1 in every 3 agility dogs sustained a sports-related injury. A majority of these, more than 70%, involved injuries to tendons and ligaments with the shoulder as the most commonly injured site. These findings are not surprising. It has been well established that shoulder conditions are the most common cause of forelimb lameness in performance dogs. Supraspinatus tendinopathy (ST) is frequently the cause or a component of lameness, especially in agility dogs. In a retrospective study of 203 dogs diagnosed with ST treated at Veterinary Orthopedic & Sports Medicine Group (VOSM), agility dogs accounted for more than 50% of all performance dogs affected.

Anatomy

The canine shoulder joint is dynamic with the ability to move in all directions but its primary function during ambulation is flexion and extension. Stability and function relies on an intricate network of soft tissue structures, particularly those of the rotator cuff, which includes the supraspinatus, infraspinatus, teres minor, and subscapularis. The supraspinatus is a passive stabilizer of the shoulder joint and is responsible for shoulder extension. It originates in the supraspinous fossa of the scapula and crosses the shoulder joint to its insertion on the humerus at the greater tubercle.



© CINDY TELLEY

Lateral view of the shoulder anatomy. The supraspinatus is a passive stabilizer of the shoulder and is responsible for shoulder extension.

Cause

Several degenerative disorders involving the supraspinatus tendon have been identified in humans and canines including rotator cuff tears, calcifying tendonitis (bony mineralization within the tendon) and tendinosis (microtears within the tendon). Overuse is believed to be an important factor in many of these disorders. Tendinopathy is a generic descriptive term used to describe clinical conditions in and around tendons arising from overuse.

In dogs, overuse due to chronic repetitive activity appears to be the most common cause of ST. Activities such as landing from a jump with outstretched forelimbs, quick turns, and jump-turn combinations place the soft tissue structures of the shoulder joint under extreme stress. These are routine maneuvers for canine athletes participating in sports such as agility.

A strain injury results reducing the tensile strength of the tendon and predisposing it to further injury. Repeated strain leads to disruption of the tendon fibers and in some cases mineralization within the tendon and bony remodeling at its insertion may occur. Additionally, a rapidly growing nodule often develops within the supraspinatus tendon (supraspinatus bulge) compressing the biceps tendon increasing discomfort.

Further, other structures within the shoulder joint may be affected by overuse. In our retrospective study, pathologies of other soft tissue structures within the shoulder were noted in 92.6% of dogs. Lameness may be exacerbated by elbow pathology. The same activities that lead to ST can also cause traumatic fragmentation of the medial coronoid process (TFMCP) or there may be other pathologies present such as a non-traumatic fragmented coronoid process (FMCP) or medial compartment disease (MCD).

Presentation and Orthopedic Evaluation

In our retrospective study, the age range of dogs affected was 8 months to 14 years. The average age was 6.4 years and the median age was 6 years. Males comprised 57.6% and females 42.4% of our caseload. Breeds affected ranged from toy breeds to giant breeds with Labrador Retrievers most commonly affected. Not surprising, Border Collies had the highest incidence in the performance and agility dog groups.

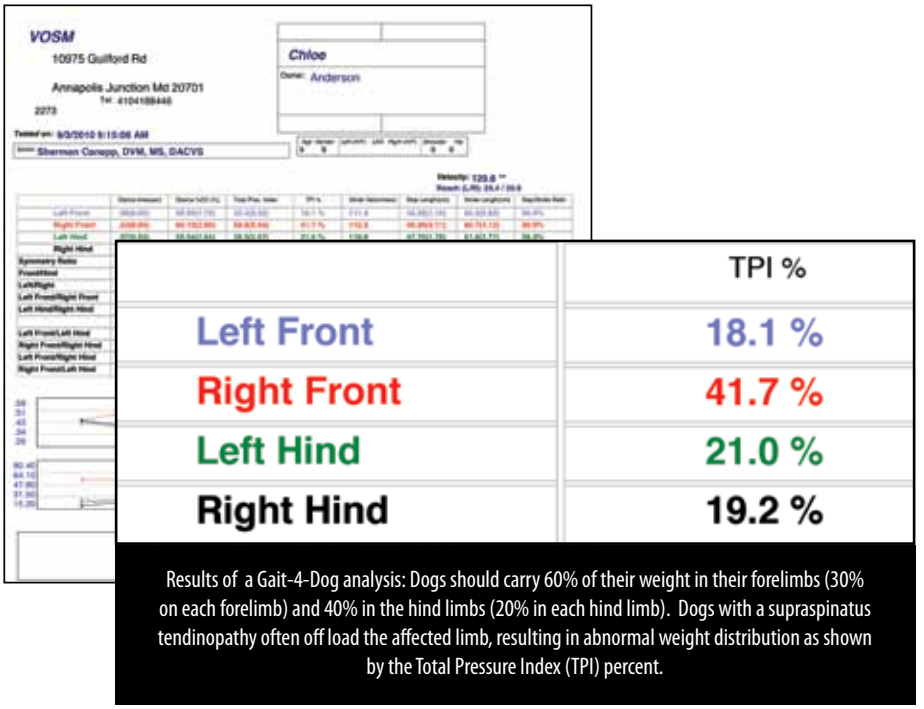
Our study revealed a 2 to 1 ratio of unilateral versus bilateral lameness, respectively. Dogs present with varying degrees of lameness, from a shortened stride to a significant weight-bearing lameness. Complaints specific to agility dogs include knocking bars, pulling out of weaves, or taking wide sweeping turns. Symptoms often worsen with activity and are nonresponsive to rest and non-steroidal anti-inflammatory (NSAID) therapy. In many cases, prior rehabilitative therapy has also failed to

resolve the discomfort and lameness. Our study results confirm these observations with 75.9% of dogs failing to respond to rest and NSAID therapy and rehabilitation therapy ineffective in 50.2% of dogs.

On physical examination, discomfort is noted when stretching the supraspinatus (shoulder flexion) and on direct palpation of the tendon. Atrophy may also be noted. Pain or spasm is also often noted on direct palpation of the biceps tendon and when performing a biceps stretch (shoulder flexion with elbow extension). This may be due to a supraspinatus bulge causing compression of the biceps tendon or may indicate concurrent biceps tendon pathology. Discomfort on shoulder abduction (moving the limb away from the body in a lateral motion) and extension may also be noted.

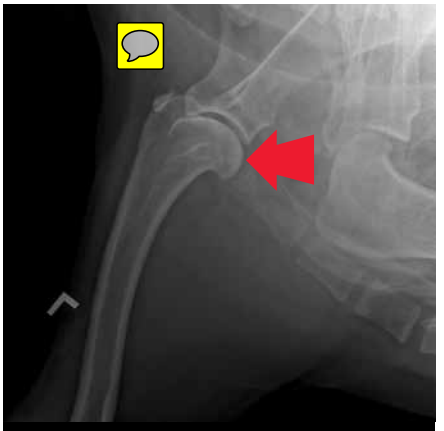
For dogs with concurrent elbow pathology, discomfort may be detected on range of motion of the elbow or on direction palpation of the medial compartment. Unfortunately, a lack of pain response does not rule out the presence of elbow pathology.

At VOSM, objective gait analysis is performed as part of a comprehensive sports medicine evaluation. This objective analysis can identify and quantitate lameness, stride length issues, etc. Gait analysis is repeated at every recheck to allow for an objective measure of response to treatment.



Results of a Gait-4-Dog analysis: Dogs should carry 60% of their weight in their forelimbs (30% on each forelimb) and 40% in the hind limbs (20% in each hind limb). Dogs with a supraspinatus tendinopathy often off load the affected limb, resulting in abnormal weight distribution as shown by the Total Pressure Index (TPI) percent.

Radiographs of the shoulder(s) are performed to rule out other bony disease processes and to identify mineralization with the supraspinatus tendon or bony remodeling at its insertion. In our study, mineralization was noted in 20.9% of dogs.



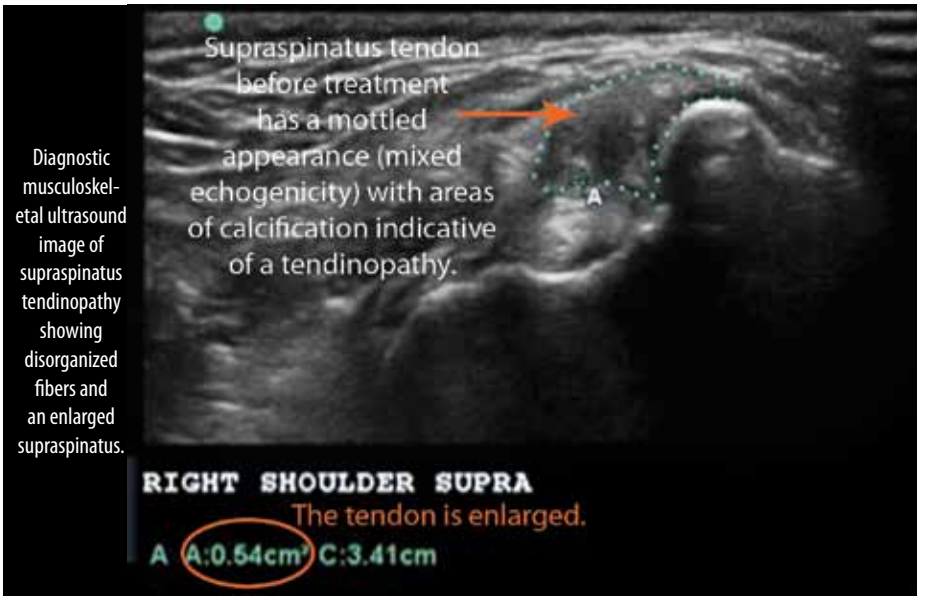
Radiographic image of mineralization within the supraspinatus tendon

Elbow radiographs are also performed, especially if any elbow discomfort was noted on physical examination. Obvious pathology may be detected, however, a lack of radiographic evidence of pathology cannot rule out the presence of disease, such as FMCP.

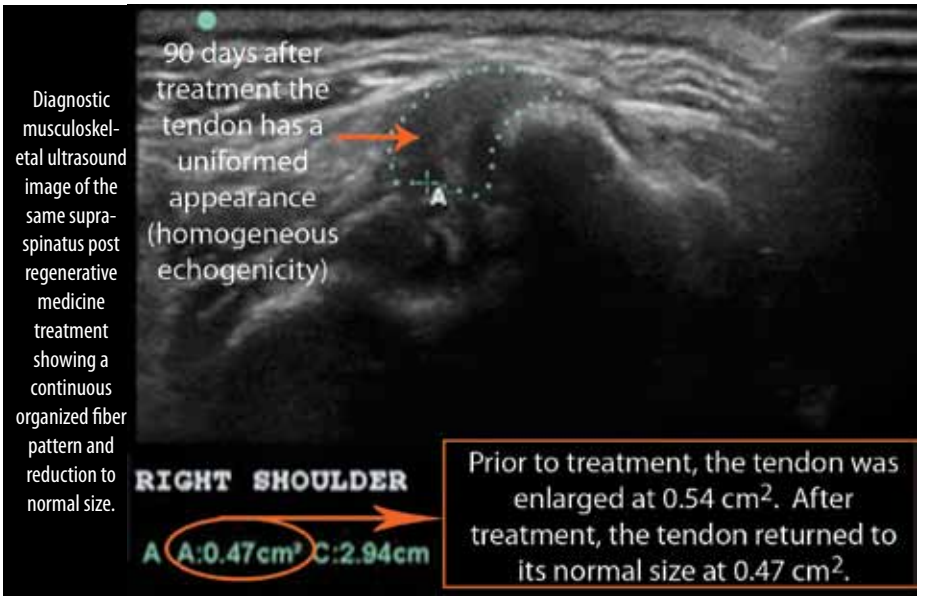
Advanced Diagnostics

Diagnostic Ultrasound

MRI is an excellent diagnostic modality for this condition; however, diagnostic musculoskeletal ultrasound also provides a definitive diagnosis in the hands of an experienced operator. Musculoskeletal ultrasound is a relatively new but rapidly growing diagnostic technique for musculoskeletal injuries in small animal medicine. Therefore, it is important to seek a veterinarian proficient in small animal musculoskeletal ultrasound. Diagnostic ultrasound offers several advantages over MRI: it is quick, more economical, and in a majority of cases, can be performed with the dog awake. In addition, serial ultrasounds performed throughout treatment allow ongoing monitoring of response to treatment. Common findings indicative of ST include changes in size, shape, and echogenecity of the affected tendon. In our retrospective study, dogs with ST had an enlarged tendon with discontinuous or disorganized fiber pattern and non-homogenous echogenecity.



Diagnostic musculoskeletal ultrasound image of supraspinatus tendinopathy showing disorganized fibers and an enlarged supraspinatus.



Diagnostic musculoskeletal ultrasound image of the same supraspinatus post regenerative medicine treatment showing a continuous organized fiber pattern and reduction to normal size.

Arthroscopy

Although the supraspinatus tendon is extracapsular (outside of the joint capsule), arthroscopic exploration of the shoulder and elbow are performed to evaluate and treat any concurrent pathology. As previously mentioned, concurrent pathology is not uncommon. Fortunately many of the commonly found concurrent conditions respond well to arthroscopic treatment.

Treatment

Regenerative Medicine Therapy

As previously stated, conservative management consisting of rest, NSAIDs and rehabilitation therapy often fails. Rest and NSAIDs are ineffective as there is little to no inflammation associated with a tendinopathy. Rehabilitation therapy relies on "healing" through scar tissue formation. Scar tissue does not have the tensile strength nor the flexibility of native tendon tissue; therefore, the tendon is prone to re-injury. Surgical excision is not recommended due to the high morbidity and high rate of recurrence as reported in literature.

Due to the poor outcomes of conservative medical management, rehabilitation therapy and surgical treatment, regenerative medicine therapy has been the standard of care at VOSM for patients with ST since 2008. Research has shown that stem cells and platelet-rich plasma (PRP) can regenerate tissues, increase blood supply and breakdown scar tissue formation, replacing it with regenerated tissue.

Regenerative medicine therapy at VOSM consists of culture expanded adipose-derived stem cells (ADSC) or bone marrow-derived stem cell concentrate (BMAC) combined with platelet-rich plasma (PRP). For ADSC, adipose (fat) tissue is collected from the patient's abdomen. This tissue is sent to Regenerative Medicine Service at Virginia Tech where the stem cells are isolated and cultured (grown). A small amount of the patient's blood is also sent to the laboratory for processing to obtain the PRP. The cells are combined and returned to VOSM two weeks later for injection. The patient's stem cells also banked at the laboratory and can be re-cultured should the patient re-

quire regenerative medicine therapy in the future. BMAC is obtained by collecting a small amount of the patient's bone marrow. The collected bone marrow is processed in VOSM's in-house regenerative medicine laboratory using a validated system. The patient's blood is also processed in-house and the resulting PRP is combined with the BMAC for injection. With BMAC, collection, processing, and injection are performed during the same visit, however, no cells are banked for future use. To date, there have been no studies showing superiority of the stem cell source (fat or bone marrow) and at VOSM we have had excellent outcomes with both. We choose the treatment primarily based on specific case details and client convenience.

The regenerative matrix is injected directly into the injured tendon via ultrasound guidance. Once again it is imperative that the ultrasonographer is proficient in musculoskeletal ultrasound so that cells are guided into the targeted area of the injured tendon. Regenerative medicine therapy can also augment arthroscopic treatment of any concurrent pathologies found in the shoulder and elbow.

Rehabilitation Therapy

Tissue healing is the first step in the recovery process. During this phase, rehabilitation therapy focuses on preservation of range of motion and addresses proprioceptive and compensatory issues. Once the tissues have healed, rehabilitative therapy focuses on strengthening and reconditioning to protect the tissues long-term from re-injury.

Use of some common rehabilitative modalities (Class 4 laser therapy, shock wave therapy, therapeutic ultrasound and the use of NSAIDs) is contraindicated for the regenerative medicine patient as these modalities can actually harm the regenerative cells and/or decrease response to treatment. Therefore, only a certified rehabilitation therapist (CCRP/CCRT) and/or a board certified specialist from the American College of Veterinary Sports Medicine & Rehabilitation with experience in treating regenerative medicine patients should oversee the rehabilitation therapy program.

Tissue healing following regenerative medicine injection requires about three months. In rare cases (10%) a second injection may be needed to achieve complete healing. Once tissues are healed, as confirmed via musculoskeletal ultrasound, the rehabilitative program focuses strengthening and conditioning. Symmetry in tendon size and muscle mass between the forelimbs and a normal objective gait analysis must be achieved before returning the dog to training and competition. In our study, 91.5% of dogs treated with regenerative medicine therapies returned to full activities within 4 to 6 months of treatment.

References:

Cullen KL, Dickey JP, Bent LR, et al. Internet-based survey of the nature and perceived causes of injury to dogs participating in agility training and competition events. JAVMA 2013;243(7):1010-1018. [Journal of the American Veterinary Medical Association]

Canapp SO. Regenerative Medicine for Tendinopathies in the Canine. Proceedings ACVS Symposium 2013, San Antonio, TX. [American College of Veterinary Surgeons]

Canapp SO. Supraspinatus Tendinopathy in Dogs. Proceedings ACVS Synposium 2013, San Antonio, TX. [American College of Veterinary Surgeons]

Canapp SO, Gross Saunders D. Common Conditions and Physical Rehabilitation of the Athletic Patient in Canine Rehabilitation and Physical Therapy, 2ed., Millis DL, Levine D (eds). 2014, Philadelphia, Elsevier Saunders.

Canapp SO, Kirkby KA. Disorders of the Thoracic Limb: Diagnosis and Treatment in Canine Sports Medicine and Rehabilitation, Zink MC, Van Dyke JB (eds). 2013, Ames, Wiley-Blackwell.

Dr. Canapp, owner and Chief of Staff at Veterinary Orthopedic & Sports Medicine Group (VOSM), specializes in orthopedics, sports medicine, minimally invasive surgery, and rehabilitative and regenerative medicine therapies. Dr. Canapp is recognized as a leading authority and lectures worldwide in his areas of specialty. His special interests include the study of conditions common to sporting dogs and the use and development of cutting-edge technologies for diagnosis and treatment of these conditions. He has been servicing the agility community since 2007, offering advanced diagnostic and treatments and in 2010 began an annual free gait analysis clinic for agility competitors. Visit www.vosm.com to learn more about Dr. Canapp and VOSM.