My Patient has a Front Limb Lameness, Now What: Orthopedic Soft Tissue Injuries

Ortho Vet Consulting, LLC

Key Points:
- Supraspinatus and biceps tendinopathy are common causes of front limb lameness
- Diagnosis of supraspinatus and biceps tendinopathy can be challenging so an appropriate orthopedic examination is needed with particular attention to tension, spasm and resistance
- Rehabilitation therapy is the missing link to resolution of supraspinatus and biceps tendinopathies
- Medial shoulder syndrome is a unique and often times frustrating condition affecting the supporting structures of the medial compartment of the shoulder
- Management of medial shoulder syndrome commonly revolves around intra-articular injections, immobilization, and formal rehabilitation therapy

Forelimb injuries are common in the canine; unfortunately, many of them go undiagnosed or considered a "soft tissue injury" without a true diagnosis. The 3 most common orthopedic soft tissue injuries of the front limb are supraspinatus tendinopathy, biceps tendinopathy, and medial shoulder syndrome (MSS).

With many forelimb lameness's a major question need to be asked: is this orthopedic or neurologic? If this is orthopedic then is it the elbow, shoulder or both? For many cases there can be an isolated shoulder problem, isolated elbow problem, or a primary problem with both, or a primary problem and then compensation to the other. While it is not the intention to cover every orthopedic condition in the forelimb it is important to learn to differentiate between shoulder and elbow lameness.

A good solid orthopedic examination is key. For the elbow is there a reduction in range of motion? Does the dog resist elbow extension that could indicate an un-united anconeal process (UAP), is there a reduction in flexion that could indicate medial compartment disease (MCompD) such as a fissured/fragmented coronoid process (FCP), is there any muscle spasm or tightness of during ROM in the elbow especially on the biceps? Is there pain on palpation of the medial aspect of the elbow specifically during flexion and supination (Campbell's test) to indicated MCompD? For the shoulder am I able to fully extend the shoulder, if not could there be an osteochondritis dessicans (OCD) lesion, can I extend the shoulder and abduct it with no pain or spasm, if not is there evidence of MSS? Can I fully flex the shoulder with no pain or spasm; can I palpate the supraspinatus and/or biceps with no pain or discomfort? Can I complete a biceps stretch test? **The biggest thing to remember is we are not trying to make the patient cry out or scream, but rather we are looking for subtle signs of muscle spasm, reduction in range of motion, and possibly discomfort**. Even the most stoic dog will show signs of muscle spasm or tightness. Also, don't forget about some of the other players that can mimic orthopedic conditions such as a brachial plexus injury/tumor, a cervical lesion causing root signature pain, or even neoplasia.

It has been common practice to diagnose a “soft tissue injury” for forelimb lameness’s that we cant seem to figure out. In many cases these injuries don’t resolve or become chronic. We should make every attempt to identify these injuries and move away from using the term “soft tissue injury” and figure out the problem. Many of the companion dogs that present with forelimb injuries are the “weekend warrior”, these are the dogs that lie around all week then become very active on the weekends. Given the lack of conditioning these dogs tend to be prone to soft tissue injuries. Performance dogs are those that compete in agility, fly ball, field trail, obedience, hunt test, etc. Many of these dogs are well conditioned but repetitive injury putts them at risk for soft tissue injuries. Working dogs are those that are police, military, search and rescue, etc. dogs that are subject to either acute soft tissue injury or repetitive injuries. In any regard these dogs return to being lame after exercise restriction or become lame again after stopping an NSAID.

Supraspinatus and Biceps Tendinopathy:

The supraspinatus is a large muscle that originates at the supraspinatus fossa and inserts on the greater tubercle. It is responsible for shoulder extension and is an active stabilizer of the shoulder. It has been shown to be active during about 65-80% of the stance phase. The biceps originates on the supraglenoid tubercle of the scapula then courses distally to insert on both the radius and ulna. The insertion becomes important when discussing potential medial compartment disease. Its primary function is for elbow flexion; however, it does provide stabilization of the shoulder during the stance phase.

The diagnosis of supraspinatus tendinopathy is not well described and the prevalence seems to be increasing, this is likely due to advanced imaging such as MRI or diagnostic musculoskeletal ultrasound (MSK US). These dogs will typically have a unilateral forelimb lameness that appears worse after exercise and heavy activity. They tend to be minimally responsive or non-responsive to NSAIDS and exercise restriction. Many will appear to improve during exercise restriction only to become lame after returning to normal activity. In some cases of biceps tendinopathy there may be a partial response to administration of an intra-articular injection. However, this response is typically on temporary. It has been suggested that Rottweiler's and Labs are predisposed to supraspinatus tendinopathy; however, this was suggested in the late 70’s early 80’s. At our practice we tend to see many different breeds with this condition. Currently the pathogenesis of both conditions is unknown; however, it has been demonstrated that there is a small distinct area of hypovascularity in the tendon of insertion of the supraspinatus. This in conjunction with repetitive microtrauma could result in microtears of the tendon and thus lead to the formation of fibrous tissue and in chronic cases calcification in the tendon. Even though the true cause is unknown **overuse**, which has been described in both human and animal models, is highly suspicious. Repetitive trauma results in a proliferative nodule; the typical inflammatory changes are not seen. During repair there is a poor or dysfunctional response possibly due to the lack of blood flow. The mechanical properties tend to deteriorate resulting in a decreased modulus of elasticity and maximal stress till failure. The origin of the biceps at the supraglenoid tubercle is said to be an area of hypovascularity, which may predispose it to mechanical failure causing either fraying or rupture. Given that the typical inflammatory changes are not seen histopathologically

the term tendinopathy is better used then tendinitis or tendinosis. Because of the lack of inflammatory response patients require lengthy management and often respond poorly to treatments.

From an examination standpoint we want to begin evaluating the dog standing and examine for symmetry of the supraspinatus muscles. Muscle atrophy can be one clue into a chronic problem. From an objective standpoint we want to take muscle mass measurements and compare it to the contralateral side. Furthermore, many of these dogs will have a decrease in shoulder flexion and will resist a biceps stretch test. Goniometry should be measured and compared to the contralateral side; normal shoulder flexion has been reported to be 54-59°. During shoulder flexion palpate the insertion of the tendon for any discomfort, pain, or spasm or for the dog to begin pulling the shoulder away. Subtle changes noted may be a change in breathing (panting stops or starts), the pupils may dilate or the dog may begin licking its lips. Examination of the biceps tendon may reveal a tendon that is thickened and painful; furthermore, there may be decreased muscle mass in the affected forelimb. One of the biggest clues is a response to the biceps stretch test. This is completed by having the shoulder flexed and then placing the elbow into full extension. This will put a direct stretch onto the biceps. Many patients with a biceps tendinopathy either will not let you complete the biceps stretch test or they will be begin to show signs of discomfort and spasm.

After a though physical examination radiographs are typically the next course of action. In acute cases the radiographs are typically normal; however in chronic cases there can be mineralization in the area of the supraspinatus tendon or in the area of the bicipital groove. Granted while this is a nice finding it is very rare. The goal of radiographs is to help rule out other potential issues such as an OCD lesion, osteoarthritis, osteosarcoma, fracture/luxation, etc. MRI can certainly be helpful in diagnosing a supraspinatus or biceps tendinopathy; in addition it can help evaluate the degree of intra-articular effusion. However, MRI is expensive and requires general anesthesia. Furthermore, positioning and appropriate protocols for shoulder MRI are still debated by the radiologists. MSK US is another option to evaluate the canine shoulder. It will give us the tissue architecture and allow us to determine the severity (is this a grade I, II, or grade III lesion). MSK US is a very user dependent modality so training is needed. The probe must be perpendicular to the tendon being imaged. For example just getting off midline by 3-5° can make a normal supraspinatus appear as if there is a grade I strain. In addition radiologists are still debating the best usage of these technologies as to what information we can get, what information we can't get, and how to best achieve what we are looking for. Arthroscopy is not commonly used to diagnosis a supraspinatus tendinopathy; however, it can be useful to evaluate for concurrent conditions. The supraspinatus is extracapsular so it can't be viewed directly; however, with inflammation and swelling of the supraspinatus a bulge can be seen just adjacent to the biceps. Arthroscopy can be utilized as both a diagnostic and therapeutic (biceps release) modality in patients with a biceps tendinopathy.

Previous treatment recommendations consisted of surgical excision of the calcification in the supraspinatus; however, this was met with variable success rates and

the mineralization returns in almost all cases. Furthermore, when surgical removing the calcification one is also removing a portion of an active shoulder stabilizer. Extracorporeal shockwave therapy was an effective treatment in 2 dogs with chronic cases. I tend to base treatment recommendations on the exam, MRI, and/or MSK US findings. In almost all cases there needs to be some down time with exercise restriction and this period needs to be for about 8-12 weeks. Simply only doing this will likely lead to recurrence of the lameness; therefore, formal rehabilitation therapy should be utilized. While exercise restriction will allow the tissues to heal, the tissues will become very tight with fibrous tissue and wont be conditioned to handle daily activities. Rehabilitation allows us to reorganize the fibrous tissue, improve tissue healing, and condition the tissues to correct any muscular imbalances and prevent the issue from returning. If patients are painful then appropriate analgesics should. To further improve healing, I typically recommend peri-lesional (US guided for supraspinatus) injections or intra-articular injections of PRP along with extracorporeal shockwave therapy (750-1000 pules at 0.15 mJ/mm2). I will do this as a series of 3 treatments separated by 2 week intervals.

Rehabilitation for the supraspinatus and biceps tendinopathy is initially geared at releasing of trigger points, stretching and massage. Therapeutic US therapy can be used to heat the tissues to allow maximal stretching while photobiomodulation (laser) therapy can be used to improve blood flow and stimulate healing while reducing inflammation. In the later stages of the supraspinatus and/or biceps strain we will incorporate underwater treadmill therapy; however, open water swimming should be monitored very closely as to not exacerbate the condition. Therapeutic exercises are initially isometric and geared towards improving fatigue of the muscles, after progressing from this stage eccentric exercises can be used.

From a prognosis standpoint there is limited reported data in the literature. A study published recently revealed that in dogs with grade I lesions or first time offenders have about 42% respond to exercise restriction and rehabilitation therapy. Grade II or repeat offenders that were treated with regenerative medicine had an 82% response rate with the addition of exercise restriction, and rehabilitation. Personally, I feel that the response rate to appropriate exercise restriction and rehabilitation therapy alone is around 85%. The biggest issue is many supraspinatus injuries may be secondary to another disease condition. So if a patient fails to return to normal activity then additional diagnostics to evaluate the joint are warranted.

Medial Shoulder Syndrome (MSS):

I tend to refer to the medial aspect of the shoulder as the “dogs rotator cuff” which is probably way off, but owners tend to understand it better. The shoulder joint itself is stabilized by both active and passive stabilizers. The active stabilizers include the supraspinatus, infraspinatus, and others (which is why many patients with MSS have concurrent supraspinatus tendinopathy). The passive stabilizers are the medial glenohumeral ligament (MGL), joint capsule, and subscapularis tendon along with others.

Much like supraspinatus and biceps tendinopathies, dogs suffering from MSS typically have an open diagnosis of unilateral forelimb lameness that is worse after

exercise, and tends to be non-responsive to NSAIDS and exercise restriction. What makes this even more challenging is that some of them will have no lameness at all except during specific activities, which is commonly noted in agility dogs. You may note a shorten stride length or step length and owners may complain about them knocking bars, pulling up or refusing weave poles or taking wide sweeping turns.

On big question is if MSS is a common occurrence or if it something rare? I think it is a common problem not only in the agility world but also in the weekend warrior that is not conditioned and goes out and over does himself or herself, but I believe also that it is rarely diagnosed and usually missed for some type of "soft tissue injury." Unfortunately, there is no real information out there as to what structures or combination of structures need to be damaged to produce clinical signs. For example, one study looked at the stability of the MGL and found that by transecting the cranial arm there was no increased instability in the shoulder. It did result in marked inflammation and the authors speculated that with continued repetitive motion that overtime this could result in shoulder instability. So, this brings to light what structures really need to be damaged before it causes a clinical issue. Could a complete tear of the MGL result in instability, a complete tear of the subscapularis, or do both have to be torn? What if they are frayed or stretched, at what point does this result in a clinical issue? These are issues that have yet to be determined.

On examination one can appreciate pain on shoulder extension with abduction; along with pain there may be spasm on the medial aspect of the humeral head when palpated. With goniometry an increased abduction angle is noted. The typical normal angle is usually 30-32 degrees whereas dogs with MSS may have 50 or greater degrees of shoulder abduction. However, it is very important to compare to the contralateral side and in many cases this is a unilateral disease. Recently the use of abduction angles in determining MSS has been called into question. Jones, et al. presented a study where they looked at the accuracy and precision between and among observers as well as between fluoroscopic measured abduction angles. They found there was poor accuracy between the observer measured abduction angles and the fluoroscopic measured abduction angles. In addition the mean abduction angle with the intact medial structures was 28.34° where as the mean abduction angle after complete transection of the MGL and subscapularis tendon was only 35.63°. This means there was only about 8° of difference in abduction angles between cadavers with completely intact medial structures versus the same cadavers with completed transected medial structures.

Radiographs are typically normal in dogs with MSS; in really chronic conditions there may be some mineralization in the area of the supraspinatus and/or biceps if there is a secondary tendinopathy. MRI and MSK US are more beneficial for showing secondary supraspinatus or biceps tendinopathy; however dynamic instability can't be seen with MRI. MRI can be used to pick up on tears of the MGL and subscapularis tendon. MSK US may reveal joint effusion, and a thickened or irregular joint capsule that is suggestive of intra-articular pathology; however, MSS can't be fully differentiated from other types of intra-articular issues. It should also be noted that from a radiologist perspective, the structures of the medial shoulder can't fully be imaged due to the fact that the US probe

can never be perpendicular to the structures. Shoulder arthroscopy is beneficial for not only the diagnosis of MSS but also treatment in select cases.

The treatment of dogs with MSS is debatable. Some consider this to be a surgical disease while others consider it to be a conservative/rehabilitative disease. From a surgical standpoint there is the option of thermal capsulorrhaphy (radiofrequency), prosthetic reconstruction, biceps transposition, or subscapularis imbrication. With thermal capsulorrhaphy a heat source is applied to the tissues to cause reorganization of the collagen. In other words it "shrinks" or "tightens" the tissue. This is accomplished by using a monopolar radiofrequency probe at 25W and 70°C in a striping technique. It creates scarring and the recovery of the tissues as well as immobilization is very long (5-6 months). One has to be extremely careful when performing this as permanent damage can be created to the tissues. Initially, Dr. Cook found a 93% improvement in patients treated with radiofrequency. A more recent study by Dr. Franklin found an 80% improvement with radiofrequency; however, the improvement was not significantly better than the patients that were treated non-surgically.

Prosthetic reconstruction is another option that may be more useful in severe conditions where there is ligamentous or tendon tearing. This can be done as an open procedure or as an arthroscopic assisted procedure. A recent study with at least 6 month follow up data reported a success rate of 93% and a complication rate of 15%. In addition, another paper showed that patients treated with surgical reconstruction have a higher likelihood of a successful outcome compared to non-surgical management. One problem area is trying to determine what patients benefit from surgery and which patients benefit from conservative management.

Conservative management is my initial approach (unless the condition is severe) where I calm the inflammation with an intra-articular injection series of PRP along with a series of extracorporeal shockwave therapy (750-1000 pules at 0.15 mJ/mm2), place patients in hobbles and place them in a formal rehabilitation therapy program for 8-12 weeks. The hobbles are used for 4-6 weeks with a focus on manual therapy and isometric exercises. If comfortable at the 4 or 6 week mark the hobbles come off and the patients continue a strengthening and conditioning plan for an additional 4-6 weeks before return to function. Another modality that can be used for the conservative management in conjunction with hobbles and rehabilitation therapy is using extracorporeal shock wave therapy at the insertion point of the proximal humerus on the medial side as well as the glenoid cavity. This is completed initially, then 2 weeks later. At the 4-week mark they come out of their hobbles and begin strengthening exercises. If a patient is not improving by the 4 week mark then shoulder arthroscopy is likely important in determining the severity of the disease.

In summary, many of the injuries to the canine front limb involve the structures associated with the shoulder. These conditions commonly are referred to as "soft tissue injuries". Our goal should be to eliminate this term and use diagnostics to figure out what tissue is injured. While exercise restriction is helpful, formal rehabilitation therapy is

really the ticket to success. Tissue healing is long so owners need to be prepared for a period of down time and treatment for about 8-12 weeks.

References:
-Campbell JR: Shoulder lameness in the dog. J Small Anim Pract 1968;9:189.
-Canapp SO, Canapp DA, Ibrahim V, et al. The use of adipose-derived progenitor cells and PRP combination for the treatment of supraspinatus tendinopathy in 55 dogs: a retrospective study. Front Vet Sci 2016 Sep 9;3:61 doi: 10.3389/fvets.2016.00061
-Cook JL, Tomlinson JL, Fox DB, et al. Treatment of dogs diagnosed with medial shoulder instability using radiofrequency induced thermal capsulorrhaphy. Vet Surg 2005;34:469.
-Danova NA: Extracorporeal shock wave therapy for supraspinatus calcifying tendinopathy in two dogs. Vet Rec 2003;152:208.
-Franklin SP, Devitt CM, Ogawa J, et al. Outcomes associated with treatments for medial, lateral, and multidirectional shoulder instability in dogs. Vet Surg 2013;42:361.
-Fransson BA, Gavin PR, Lahmers KK: Supraspinatus tendinosis associated with biceps brachii tendon displacement in a dog. J Am Vet Med Assoc 2005;227:1429.
-Fujita Y, Yamaguchi S, Agnello KA, et al. Effects of transection of the cranial arm of the medial glenohumeral ligament on the shoulder stability in adult Beagles. Vet Comp Orthop Traumatol 2013;26:94.
-Jaegger G, Marcellin-Little DJ, Levine D. Reliability of goniometry in Labrador Retrievers. Am J Vet Res 2002;63:979.
-Jones SC, Kieves NR, Howard J, et al. Measurement of shoulder abduction angles in dogs. An ex-vivo study of accuracy and precision. Abstract VOS 2017, Abstract ACVS 2017.
-Jozsa L, Balint BJ, Reffy A: Calcifying tendinopathy. Arch Orthop Trauma Surg 1980;97:305.
-LaFuente MP, Fransson BA, Lincoln JD: Surgical treatment of mineralized and nonmineralized supraspinatus tendinopathy in twenty-four dogs. Vet Surg 2009;38:330.
-Muir P, Johnson KA: Supraspinatus and biceps brachii tendinopathy in dogs. J Small Anim Pract 1994;35:239.
-O'Donnell EM, Canapp SO, Cook JL, et al. Treatment of medial shoulder joint instability in dogs by extracapsular stabilization with a prosthetic ligament: 39 cases (2008-2013). J Am Vet Med Assoc 2017;251:1042.
-Ulthoff HK, Sarkar K, Maynard JA: Calcifying tendonitis: a new concept of its pathogenesis. Clin Orthop Relat Res 1976;118:164.