

Biceps Injury in Agility Dogs

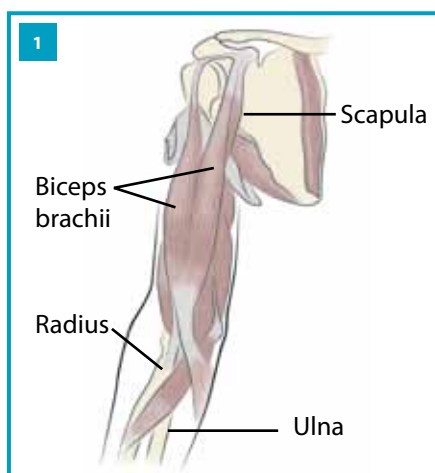


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The biceps brachii is a muscle of the front limb that is responsible for shoulder extension and elbow flexion. It originates from the supraglenoid tubercle

of the scapula (shoulder), runs through the intertubercular groove of the humerus (along the upper forelimb) and inserts on two different attachments respectively on the radius and the ulna (elbow). See **Figure 1**. The biceps tendon crosses the shoulder joint and is both responsible for motion (extension) and stabilization of the shoulder.



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Biceps Injury

Problems affecting the biceps tendon of dogs have been reported as a frequent cause of forelimb lameness. Recognized conditions affecting the biceps tendon of dogs include tendinopathy (a chronic change to the tendon due to repetitive injury with lack of inflammation), tendinitis (injury with associated inflammation), tenosynovitis (injury of the tendon and associated synovium in the shoulder joint with inflammation), and partial or complete rupture, as well as other conditions.

Biceps tendinopathy is commonly seen in agility and working dogs due to the repetitive nature of their sport or work. It is seen in middle age to older medium to large breed dogs. *Tendinopathy* is a general medical term to describe a disease of a tendon from repetitive injury with a lack of inflammation. This is different from the commonly noted *tendinitis*, which is an acute tendon injury accompanied by inflammation. *Strain* is a broad term used to describe an injury to a muscle and/or tendon. See **Table 1**.

Table 1: Strain grading scale

	Definition	Description	Treatment
Grade 1 (mild)	Overstretching of the tendon, without a tear or loss of function	<ul style="list-style-type: none"> • Simple stretch • Minimal structural involvement • Microscopic tears, no fiber disruption • Inflammation 	Rehabilitation therapy and activity restriction
Grade 2 (moderate)	The general continuity of the tendon is intact though its strength is significantly reduced	<ul style="list-style-type: none"> • Minor fiber disruption/partial tear • Painful 	Rehabilitation therapy, activity restriction and possible help from regenerative medicine (stem cell therapy/PRP)
Grade 3 (severe)	Complete disruption, avulsion or tearing of the tendon	<ul style="list-style-type: none"> • Complete tear • Results in tendon dysfunction 	Arthroscopy, regenerative medicine (stem cell therapy/PRP) in addition to physical rehabilitation

For many years it was assumed that a dog with a forelimb injury isolated to the shoulder area would have only a biceps injury. However, with the advent of musculoskeletal ultrasound it has become noted that biceps injuries are commonly associated with a supraspinatus injury. Injury to the biceps tendon can be either primary due to repetitive trauma to the tendon, or secondary due to concurrent disease such as impingement from the supraspinatus.

The central theme to biceps injuries is a lack of vascularity at the origin of the tendon. This lack of blood supply is thought to pre-dispose the tendon to injury, which overtime will result in fraying and mechanical breakdown of the biceps. Once strained, the injury will result in inflammation of the tendon and surrounding sheath (which is then called tenosynovitis). Synovial villous hypertrophy (inflammation of the synovium) and vascular prominence are consistent histological findings in the early stages. Given the lack of vascular supply the tendon is unable to

completely heal so areas of fibrosis (scar) develop in the tendon, which decreases its ability to function correctly. Other possible causes of biceps damage include the developmental disease, osteochondritis dissecans (OCD) of the caudal aspect of the humeral head. The OCD flap may migrate cranially into the bicipital bursa and may trigger a tenosynovitis. Finally, in cases of medial shoulder syndrome, with secondary compensation of the supraspinatus, the enlargement of the supraspinatus tendon can create biceps impingement (rubbing).

Diagnostics

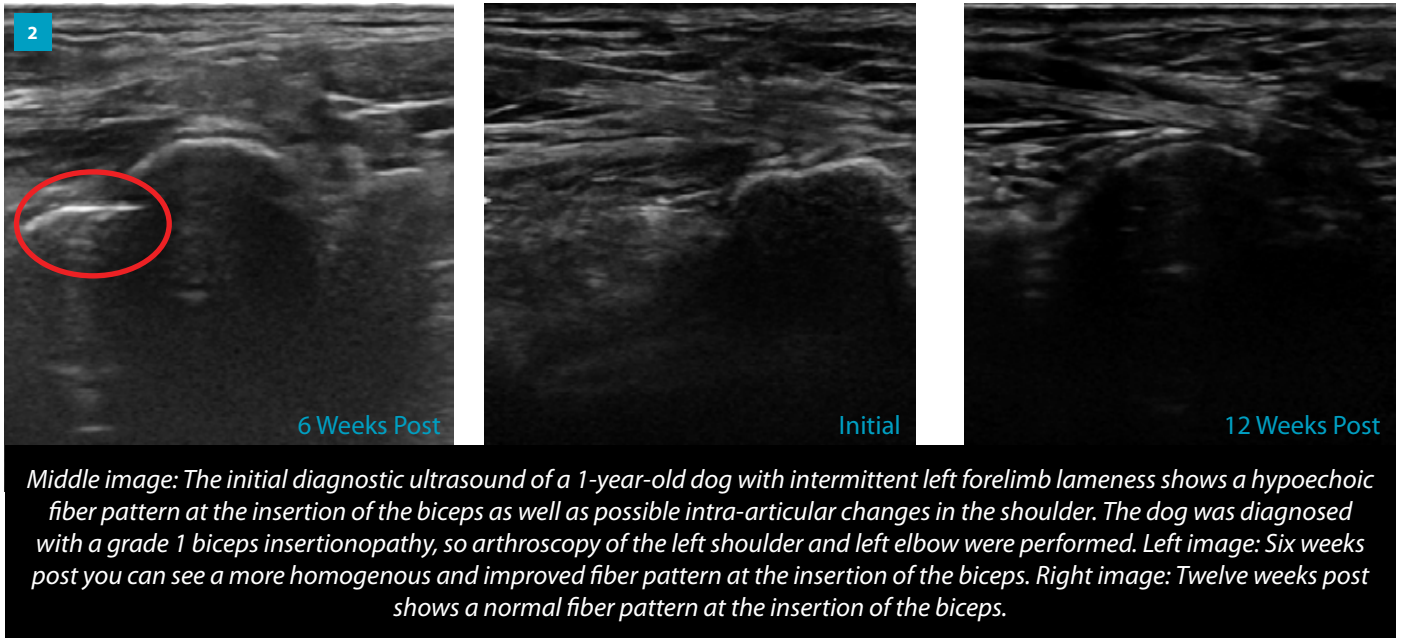
A forelimb lameness can be difficult and frustrating to not only diagnose, but also treat. Often dogs will have mild and intermittent lameness with little to no reaction on orthopedic examination. Numerous conditions exist which result in forelimb lameness so it must be differentiated if the condition is due to a neurologic disease, or an orthopedic disease. If it is due to an orthopedic disease, then it must be differentiated if the condition is affecting the shoulder, elbow, or both. Oftentimes, diagnosis requires various diagnostic tests to determine the cause.

Initially, your dog is evaluated with an orthopedic examination. With a biceps injury, pain is often elicited on direct biceps tendon palpation while the shoulder is flexed and the elbow extended (biceps stretch test), although general shoulder pain may also elicit a response. In many cases, dogs with shoulder injuries will not cry out or pull away. Veterinarians should be looking for very subtle signs such as dilation of the pupils, a stop in panting, muscle spasm, or tightness in the muscle tendon unit.

Shoulder and elbow radiographs are commonly performed to rule out other problems in those joints. Because the biceps tendon is a soft tissue structure, it won't be visualized on a radiograph. However, with long-standing biceps injuries, mineralization within the biceps groove may be noted on radiographs. What this means is that a radiographs alone do not rule out a biceps injury.

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To gain a better appreciation of the soft tissue structures of the shoulder in a minimally invasive way, diagnostic musculoskeletal ultrasound is the modality of choice at VOSM to diagnose biceps disease. During the ultrasound a small area is shaved for evaluation of the tendons around the shoulder (supraspinatus, biceps, infraspinatus, etc.) as well as to determine if there is excessive fluid build up inside the shoulder along with the condition of the joint capsule. Both shoulders are typically evaluated so the normal side can be used for comparison. Ultrasound of the biceps tendon when tendinopathy is present may reveal an enlarged, hypoechoic tendon with fiber pattern disruption. A lucent line around the tendon indicating fluid within the sheath may be seen and an irregularity to the bicipital groove from osteophytes (a marker of osteoarthritis) is seen in chronic cases. If there is a significant change noted inside the shoulder, then shoulder arthroscopy is indicated. **Figure 2.**

Treatment

Pending the findings of the ultrasound, treatment recommendations can be made so that we have the best chance at resolving the issue. For example, should the diagnostic ultrasound reveal mild changes (grade I) within the biceps tendon, the patient would enter a formal rehabilitation therapy program with strict activity restriction. Typically, physical rehabilitation program will include

low-level laser therapy, extracorporeal shockwave therapy, therapeutic ultrasound, joint mobilization, manual therapy, and stretching and strengthening techniques. It is recommended that rehabilitation therapy only be completed with individuals with specific training in canine rehabilitation. Conservative management can be successful with low-grade strains; however, return to normal activity too early can disrupt the healing, slow the recovery, and cause chronic lameness.

Should moderate to significant changes (grade II+) be noted on diagnostic ultrasound, or if the patient has failed a more conservative approach, regenerative medicine should be considered including platelet rich plasma (PRP) and stem cell therapy. The use of regenerative medicine is becoming more popular as more research is being published to support its use. At VOSM it has become part of our standard of care to aid in tissue healing. The goal of regenerative medicine is to supply a large concentration of growth factors and anti-inflammatory mediators to an area of poor healing. The two main components of regenerative medicine are PRP and stem cells. PRP is essentially a high concentration of platelets. It is created by taking a sample of blood from your dog and processing it in our in-house regenerative medicine laboratory. Within the high concentration of platelets is a large reservoir of growth factors to help injured tissues heal naturally. Stem cells are present in virtually every tissue of the body. At VOSM we harvest either bone marrow or fat to process the stem cells. When combined, PRP and stem cell therapy can together help regenerate and heal injured tissue, decrease inflammation, stimulate new blood supply to support healing, activate resident stem cells, create a scaffold for healing tissue, protect cells from death, and break down scar tissue.

If severe changes are noted (grade III) and/or the patient does not improve after medical management (activity restriction, formal rehabilitation therapy, and/or regenerative medicine) then surgical treatment may be required. The reported surgical treatment options for biceps tendon disease include tenotomy (biceps release) or a biceps release with a tenodesis (reattachment below the shoulder). Indications and recommendations for tenotomy versus tenodesis vary among types of pathology, patient age, activity level and expectations, and surgeons' preferences.

Surgical transection of the tendon eliminates the repetitive trauma from the tendon stretching across the shoulder joint. The biceps can be released through an open surgical approach or through a minimally invasive arthroscopic procedure (the preferred method at VOSM). Arthroscopy allows direct visualization of the tendon and its origin and allows transection of the tendon with minimal tissue trauma. Arthroscopic biceps release results in excellent outcome in most dogs with many experiencing im-

mediate pain relief. The clear benefits of arthroscopy over an open procedure are the reduced risk of postoperative complications as well as increased comfort immediately after surgery. For all treatments options, activity restriction and physical rehabilitation is mandatory.

Key Points

- The clinical signs are variable but usually include chronic intermittent forelimb lameness that worsens with exercise.
- Pain may be elicited on direct biceps tendon palpation while the shoulder is flexed and the elbow extended.
- Imaging techniques, including radiographs, diagnostic ultrasound;

arthroscopy may be useful to help in the diagnosis and treatment of biceps diseases.

- Biceps injuries have been associated to direct or indirect trauma, joint mouse entrapment (OCD flap), tendon strain (partial to complete rupture or avulsion) or impingement.
- Treatments are based on the severity of the disease and can incorporate activity restriction, physical rehabilitation, regenerative medicine, or surgery when medical management is unrewarding.
- Prognosis is typically good with great return to function.

Resources

Special thanks to Patricia Douglass for allowing VOSM to share Tess's story.

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Dr. Lauri-Jo Gamble grew up in Montreal, Canada, and earned her Doctor of Veterinary Medicine at the University of Montreal. Afterwards, Dr. Gamble completed a small animal rotating internship at Carolina Veterinary Specialists in Charlotte, North Carolina. She is currently completing an internship in sports medicine and rehabilitation at Veterinary Orthopedic & Sports Medicine Group in Annapolis Junction, Maryland, as well as working toward a certificate in Canine Physical Rehabilitation with the University of Tennessee (CCRP). Her professional interests include gait analysis, pain management, regenerative medicine, and physical rehabilitation.

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