FORELIMB LAMENESS: THE GREAT IMPERSONATOR

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Diagnosis of forelimb lameness in canine patients can often be a labor-intensive and time-consuming process, often with multiple factors being taken into account, regardless of the actual diagnosis. The dog's age, activity level, co-morbidities, job and environment can be key players. Close examination of the dog in motion (in hospital and at home) can be helpful when determining type and degree of lameness, and may frequently assist the clinician in determining next appropriate diagnostic tests and treatment plans. This lecture will focus on differentials associated with forelimb lameness in dogs, current diagnostic tests and potential treatments available, and finally prognoses and outcomes for specific types of shoulder forelimb lameness in dogs.

Lameness Evaluation

The forelimb skeleton consists of the thoracic or pectoral girdle and the bones of the forelimb. The canine scapula itself is positioned close to the sagittal plane, and the humeral head is less rounded (as compared to the human head) to assist with weight bearing. The radius takes the majority of weight-bearing in the antebrachium. And, although small, the many sesamoid bones in the carpus/paw allow for biomechanically advantageous alignment of angles of insertion of tendons at their attachments.[1] While there can be tremendous variation in the sizes of the bones themselves comparing dog to dog, the literature have reported a roughly 60% body weight distribution in the thoracic limbs.[2]

As a clinician evaluates a patient, lameness is a key element of that examination. As often as possible, using trackable outcome measures may give the clinician better tools to evaluate a lameness, and monitor the progression over time in response to treatment. Pressure sensitive walkways and force plate analysis have been evaluated in the literature, but are quite expensive and may not always be readily available. A limb lameness score, often out of a score of 5 or 9, can be a simple, consistent tool to add to each evaluation, and one the clinician can track over time. As appropriate, a clinician can consider observing the patient going up and down stairs, utilizing a curb, and navigating different terrains (concrete, rubber mat, soft carpet, etc.), which may also better characterize the lameness.

Lameness Scale (out of 5)*

0: Lameness not perceptible under any circumstances (walk, trot, under/over obstacles, etc.).
1: Lameness is difficult to observe, or may be inconsistent (on stairs, different surfaces).
2: Lameness is difficult to observe when the dog is walking in a straight line at a walk or trot, but consistently seen (on stairs, different surfaces, turning to one side in a circle).
3: Lameness is consistently observable at a trot.
4: Lameness is obvious at a walk, and may not fully weight bear at stand.

5: Lameness produces minimal/non weight bearing in motion and/or at rest or a complete inability to move.

*Credit: American Association of Equine Practitioners (AAEP), aaep.org

Forelimb Lameness Differentials

If a forelimb lameness is identified, localizing the lameness may provide insight and focus the differentials. Bear in mind that palpation may not elicit abnormalities, and as is frequently the case, there may be more than one component (joint, muscle, tendon, ligament) involved in the lameness. As an example, possible shoulder differentials could include MSI (medial shoulder instability), OCD (Osteochondritis dissecans), osteoarthritis, biceps tendinopathy, supraspinatus tendinopathy, to just name a few. This list is by no means exhaustive, but elbows can include any component of elbow dysplasia, associated osteoarthritis, tendinopathies (for example the biceps which may be causing both shoulder and elbow clinical signs), or congenital abnormalities. The carpus and digits should also be fully evaluated, as there may be osteoarthritis, collateral ligament injury, hyperextension injury, flexor or extensor pathology, sesamoid disease, digit subluxations, etc.

The appropriate diagnostic plan (including pain control) is dependent on the patient's age, specific physical exam and clinical signs, and goals for function in their normal environment. Advanced diagnostics (CT, musculoskeletal ultrasound, MRI, bone scans) and therapeutic plans (joint injections, PRP, regenerative medicine) may be considered and utilized to treat musculoskeletal forelimb injuries. Current evidence from the literature should be discussed with clients prior to instituting a treatment protocol.

Biceps and/or Supraspinatus Tendinopathy

<u>Active stabilizers (scapulohumeral joint)</u>

mm. supraspinatus [3]
<u>Origin:</u> Supraspinous fossa, including the spine of the scapula
<u>Insertion:</u> Greater tubercle of the humerus, by means of a thick tendon
<u>Action:</u> Extension of the shoulder joint, shoulder joint stabilization

mm. infraspinatus [3]
<u>Origin:</u> Infraspinous fossa
<u>Insertion:</u> Lateral aspect of the greater tubercle
<u>Action:</u> Extend or flex the joint, abduct shoulder, rotate forelimb laterally, stabilize the joint

mm. subscapularis [3]
<u>Origin:</u> Subscapular fossa
<u>Insertion:</u> Lesser tubercle of the humerus
<u>Action:</u> Adduction, extension, and medially stabilize the shoulder joint

mm. teres minor [3]
Origin: Distal 1/3 of the caudal edge of the scapula (by means of an aponeurosis)
Insertion: Crest of the greater tubercle above the deltoid tuberosity
Action: Flexion of the shoulder joint, external rotation

mm. biceps brachii [3]
Origin: Supraglenoid tubercle by means of a long tendon of origin
Insertion: (2 insertions) The larger tendon inserts on the ulnar tuberosity and the smaller one inserts on the radial tuberosity
Action: Elbow flexion, shoulder extension and shoulder joint stabilization

Lesser degree: long head of *mm. triceps brachii, mm. deltoideus, mm. teres major* [4]
For biceps tendinopathies, affected dogs are often evaluated because of a chronic weight-bearing lameness that may be worse after exercise, possibly caused by chronic repetitive stress. The tendon sheaths act to reduce friction in locations where there is marked change in tendon direction. There is an inner visceral layer closely attached to the tendon and outer parietal layer attached to adjacent connective tissue or periosteum (connected via mesotendon). The biceps tendon itself is avascular, surrounded by a tendon sheath with synovial membrane lining and synovial fluid. The disease may be in dogs secondary to intra-articular pathology, but may be considered primary.

A dog may come in for evaluation of a forelimb lameness. Clinically, they may have sensitivity upon direct palpation of either biceps or supraspinatus tendon, and/or on the biceps distally in the area of insertion onto the antebrachium. Alternatively, the dog may be showing lameness, but without localizing to the shoulder. Because the radiographic changes in the biceps region can be subtle, a skyline view (proximocranial to distocranial) may be utilized to get better visualization of the cranial proximal humerus and intertubercular groove, and potentially highlight any mineralization of the tendon.[4] If you do not see any changes, however, it does not fully rule out a biceps tendinopathy. Alternatively, you may see mineralization in the area of the supraspinatus tendon, but may or may not be of clinical significance. Depending on the radiographic findings, contrast arthrography, musculoskeletal ultrasound, CT, and MRI have been documented in the literature. Often as part of a shoulder work up, you can also consider goniometry of the joints, and ranges have been published. For example, in healthy adult Labrador Retrievers, shoulder flexion and extension angles have been reported as 57° shoulder flexion, 165° shoulder extension.[5] Sedated shoulder abduction angles have also been published,[6] and can be a component of the overall exam. If a biceps tendinopathy diagnosis is confirmed, surgical treatment, intra-articular therapy, and conservative rehabilitation therapy have been documented. If there is a suspicion of supraspinatus pathology, there is published data on the use of extracorporeal shockwave therapy as a treatment modality.[7]

Rehabilitation Strategies

Rehabilitation focuses on decreasing inflammation within the tendon, increasing weight bearing slowly in the affected muscle/tendon, and controlled stretching and return to function over 8-12 weeks.

Goal A: Decrease pain and inflammation (utilizing manual therapy in the form of PROM, cryotherapy, laser therapy, e-stim).

Goal B: Improving joint function (utilizing the above).

Goal C: Muscle strength (therapeutic exercises initially focusing on isometric work, moving to concentric work, working with obstacles during leash walks and adding in eccentric exercises, +/- Cavaletti work for active concentric exercises, UWTM for active resistance training, manual/laser/e-stim therapy as needed).

A very important consideration in all cases, however, is a patient's prognosis is entirely dependent upon their diagnosis, and these different pathologies may require different treatment strategies.

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Additional references are available from the author upon request.