

Distinguishing Musculoskeletal from Neurologic Disease

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You have asked...

How can I tell the difference between primary shoulder and neurologic disorders in dogs presenting with thoracic limb lameness or gait changes?

The experts say...

Disorders of the shoulder are commonly confused with cervical spinal disease because of the common presenting complaint of thoracic limb lameness or gait changes. Determining the primary source of lameness can be challenging, yet it is important to discriminate between the two body systems in order to optimally guide advanced diagnostics, treatment, and prognosis.

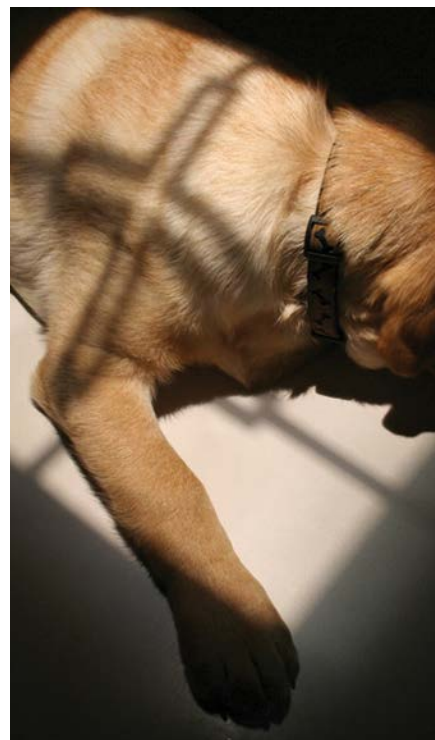
The following is a review of the clinical presentation, physical examination, and diagnostic imaging modalities that may aid in distinguishing the source of lameness and briefly addresses common musculoskeletal and neurologic conditions that are often confused with each other (see **Diagnostic Differentials for Musculoskeletal Disorders** and **Diagnostic Differentials for Neurologic Disorders**, page 102).¹⁻⁹ It is beyond the scope of this article to address the treatment of each condition; however, the intent is that the practitioner will be able to establish a plan of care that may include referral to the appropriate specialist (neurologist, surgeon, rehabilitation veterinarian, or sports medicine specialist).

When evaluating a patient with a suspected musculoskeletal or neurologic condition, it is important to perform a thorough physical examination, including a complete orthopedic and neurologic examination. The following focuses on the shoulder with respect to the orthopedic examination and the cervical spine for the neurologic evaluation.

Orthopedic Examination

Gait Evaluation

Animals with musculoskeletal disorders of the shoulder typically present with mild-to-moderate weight-bearing lameness.¹⁰ In dogs with shoulder tendinopathy or medial shoulder disease, lameness is often exacerbated with exercise or sporting events and may not be readily apparent during clinical evaluation. Shoulder osteoarthritis may present with mild-to-moderate weight-bearing lameness that may be exacerbated after



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long periods of rest or exercise. Acute trauma, neoplasia, and septic arthritis will likely present with severe weight-bearing to non-weight-bearing lameness.

Contracture of the infraspinatus muscle is an uncommon diagnosis but typically presents in medium- to large-breed athletic dogs (typically hunting dogs) with a characteristic gait of partial weight bearing with circumduction of the limb and failure to extend the shoulder fully. When sitting, the limb is often held with the shoulder flexed, elbow adducted, and distal limb externally rotated and abducted.

Palpation

With the dog standing, muscles should be palpated for symmetry, elbow effusion and medial periarticular thickening, carpal effusion, and conscious proprioception. Moderate atrophy of the supraspinatus and infraspinatus muscles suggests medial shoulder instability; more severe atrophy may be a sign of neoplasia or a neurologic origin.

Shoulder range of motion is often easiest to assess with the dog in lateral recumbency. It is essential that the elbow be assessed independently and before the shoulder assessment. Shoulder

flexion testing should be performed with the elbow in a neutral to flexed position. Discomfort or decreased shoulder flexion is often associated with osteochondrosis or osteoarthritis. Shoulder extension is performed with the elbow extended. Decreased shoulder extension is typically a result of decreased muscle flexibility (triceps, latissimus dorsi, teres major).

A biceps stretch test (**Figure 1**) should be performed with the shoulder flexed and the elbow held in extension. Simultaneous palpation of the biceps origin at the glenoid will often elicit pain in dogs with a biceps tendinopathy.¹⁰

Palpation of the supraspinatus musculotendinous junction should be performed with the shoulder in flexion. Palpation at the musculotendinous junction and/or at the tendinous insertion on the greater tubercle of the humerus will often elicit mild-to-moderate pain in dogs with supraspinatus tendinopathy.¹⁰

Spasms (trigger points) of the infraspinatus and deltoid muscles often suggest pathology of the shoulder joint. However, this is a nonspecific finding with regard to the underlying cause. The axilla should be palpated for masses and pain; the detection of either warrants advanced diagnostic imaging.

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The biceps stretch test.



Shoulder abduction angles should be measured. With the patient in lateral recumbency and the shoulder in a neutral position with the elbow extended, the acromion process of the scapula is stabilized with one hand while the opposite hand is placed on the antebrachium with the elbow in extension to abduct the limb to its physiologic limit. A goniometer, used to measure the shoulder angle of abduction, can be placed with the fixed arm along the spine of the scapula and the moving arm abducted with the humerus. In dogs with medial shoulder instability, the affected limb will have significantly greater abduction than the contralateral limb (typically about 30° in unaffected dogs vs more than 50° in affected animals).^{10,11}

Neurologic Examination¹²

Unlike patients with musculoskeletal conditions, those with neurologic disease do not have pain that worsens at different times of day or in relation to exercise. Clinical signs in these patients (eg, pain, weakness, reflex changes) are generally present all the time.

Gait Evaluation

An ataxic pelvic limb gait and short or choppy thoracic limb gait are often signs of cervical myelopathy. This appears as a

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discordant gait—as if there were two separate motors running—the front and rear limbs. Non-weight-bearing lameness can be seen and is frequently referred to as nerve root signature in association with neurologic disease.⁴ Alternatively, dogs with neurologic disease may drag their limbs, which commonly can result in wear on the dorsal aspect of the nails.⁴

Patients with cervical spinal disease hold the head and neck in a neutral position (**Figure 2**). Full-body shakes are uncommon or less vigorous than normal. Patients look up with just their eyes and do not move their head and neck briskly.

Cranial Nerve Examination

Examination of the cranial nerves may show Horner syndrome on the side of the lesion (miosis, ptosis, enophthalmos, and an elevated nictitating membrane) if the sympathetic pathway is affected.⁴ Abnormal cranial nerve examination suggests that neurologic disease is more likely than a musculoskeletal disorder.

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Patient with cervical spinal disease. Note that the head and neck are in a neutral position and the patient is looking up with just its eyes rather than its neck.



Proprioception

Proprioceptive testing is essential for detecting neurologic dysfunction. It is important to provide adequate support so that the patient with musculoskeletal disease can flip over its paw. Dogs that show signs of pain because of orthopedic disease will often have inadequate or slow paw replacement, which can be misinterpreted as a proprioceptive deficit. True proprioceptive deficits are a sign of neurologic disease.⁴

Palpation

Localized cervical pain is a good indication of cervical spinal disease. Cervical spine palpation is achieved by applying pressure on the transverse process on each side of the neck. Signs of neck pain may include tensing of muscle, trigger points (intense spasming and flinching when pressure is applied), or a cry of pain. Cervical range of motion should be attempted cautiously, if at all, as range of motion can worsen some neurologic diseases. In most cases, neck range of motion is best used when cervical disease is not suspected but should be ruled out.

Muscle atrophy may suggest either neurologic or musculoskeletal disease. The timing and extent of the atrophy may be helpful in determining the underlying cause. Severe atrophy over days to weeks suggests a neurogenic cause, whereas disuse atrophy may take weeks to months and is mild to moderate. Cervical myelopathies can result in observable muscle atrophy; however, atrophy is most common with nerve root pathology. Nerve root tumors or brachial plexus trauma can result in profound muscle atrophy. The nerve affected will determine the muscle(s) that show atrophy. Lesions localized above the brachial plexus may result in atrophy of paraspinal and cervicocephalic muscles.

Nerve root tumors are often very painful. Deep palpation of the axillary area usually results in severe pain in these patients.

Reflex Testing

Reflexes are typically tested with the dog in lateral recumbency. The most reliable forelimb reflex is the withdrawal reflex, which is achieved by applying mild-to-moderate pressure on the digits. The reflex will result in retraction of the limb by flexion of each joint and withdrawal of the limb. It is common for middle-aged and geriatric patients to have reduced or absent patellar reflexes; this does not represent a pathologic process. This can

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Diagnostic Differentials for Musculoskeletal Disorders¹⁻³

- Biceps tendinopathy
- Supraspinatus tendinopathy
- Neoplasia
- Osteoarthritis
- Osteochondrosis and osteochondritis dissecans
- Medial shoulder instability



incorrectly suggest a multifocal localization that is often misinterpreted as diffuse lower motor neuron disease during forelimb evaluation. Likewise, dogs with decreased range of motion or increased tone should not be assumed to have decreased withdrawal reflexes.

Diagnostic Imaging

No single diagnostic tool can show all aspects of the shoulder and cervical spine. Often two or more imaging modalities are needed for adequate evaluation of shoulder disease.

Radiographs are rarely an endpoint for a definitive diagnosis; rather, they are used to rule out obvious problems, such as osteochondrosis/osteochondritis dissecans, diskospondylitis, bony neoplasia, and osteoarthritis. Mineralization of the biceps or supraspinatus tendons is seen occasionally but can also be an incidental finding; advanced imaging should be pursued if physical examination findings also suggest tendinopathy.

Ultrasound can be useful for imaging the biceps, infraspinatus, and supraspinatus tendons. Visualization of other structures (eg, medial shoulder compartment) via ultrasound is limited but has been reported.¹³

Arthroscopy is used to evaluate the intra-articular structures and major stabilizers of the shoulder. Arthroscopy can provide a definitive diagnosis of biceps tendon injury and medial shoulder instability.¹⁴

Neurologic disease is most accurately and commonly evaluated with MRI performed at referral practices. In addition to evaluating for neurologic disease, MRI can identify many shoulder arthropathies.

Diagnostic Differentials for Neurologic Disorders⁴⁻⁹

- Intervertebral disk disease
- Cervical spondylomyelopathy (wobbler syndrome; facet joint or disk associated)
- Fibrocartilaginous embolism
- Neoplasia
- Diskospondylitis
- Meningitis
- Trauma



Alternative three-dimensional and cross-sectional imaging modalities are used in some cases depending on availability and clinician preference. These include CT and CT myelography as well as standard myelography.

Additional tests to aid in diagnosis of neurologic disease may include CSF analysis, electrodiagnostics (electromyography, nerve conduction studies), muscle or nerve biopsies, and blood and urine cultures. These are utilized on a case-by-case basis and augment the previously mentioned diagnostics.

Treatment

Treatment of shoulder tendinopathies may include the initial recommendation of pain medication and rest; however, most dogs with chronic biceps or supraspinatus tendinopathy and/or medial shoulder instability will not improve with conservative management. Additional treatment recommendations may include physical rehabilitation (therapeutic exercise, manual therapy, and activity modification), extracorporeal shockwave therapy, and regenerative medicine. Further studies are indicated to establish the most effective treatment of these conditions. Surgery should be considered in cases of severe shoulder instability or biceps tendon rupture or if nonsurgical management has failed.

Neurologic disease is commonly treated with antiinflammatory drugs, including steroids (0.5 mg/kg PO q12h, tapering over 2–6 weeks), or cyclooxygenase-inhibiting NSAIDs, and additional pain medications, rest, and time. Physical rehabilitation or a neck brace may be employed. It is also important to recommend using a harness as opposed to a neck lead or collar.

Surgery should be considered if medical management has failed, neurologic deficits are moderate to severe, or pain cannot be controlled. ■ **cb**

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