Orthopaedic examination of the dog

1. Thoracic limb

Gareth Arthurs

The purpose of an orthopaedic examination is to evaluate a patient for the presence or absence of orthopaedic disease and to localise any abnormalities found. This examination is arguably the most critical part of an orthopaedic work-up as it is at this point that important decisions are made with regard to selecting further diagnostic tests and/or discussing treatment options and prognosis. This article, the first of two, considers the need for a systematic approach to the orthopaedic examination and discusses how this might be applied to the thoracic limb. Part 2, to be published in the April issue of In Practice, will discuss how to perform an orthopaedic examination on the pelvic limb. An article published in the January issue described the use of orthopaedic examination as part of an approach to forelimb lameness.

General approach

Orthopaedic examination is not a substitute for, and should always be preceded by, thorough history taking and a full clinical examination. An animal's history invariably provides valuable information with respect to the likely causes or aetiology of its lameness. The clinical examination may identify other conditions that a dog may be suffering from, which may possibly be related to orthopaedic disease. Findings from a general physical examination may subsequently influence a dog's suitability for sedation, general anaesthesia or a particular treatment option.

Orthopaedic examination is only one part of the diagnostic work-up of a dog that may be lame, exercise intolerant, collapsing, ataxic or recumbent. It is arguably the most important part of such a work-up, as the results will dictate the direction of further diagnostics and treatment options for the individual patient. However, as with all diagnostic tests, the orthopaedic

Table 1: Important questions to consider when taking a history

<table>
<thead>
<tr>
<th>Question</th>
<th>Reason for asking the question</th>
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<tbody>
<tr>
<td>Which limb is the dog lame on?</td>
<td>Important opening question to establish which limb the owner is concerned about. This may seem obvious, but there is often confusion regarding which limb(s) is/are affected</td>
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<tr>
<td>Is it always the same leg? Is it ever another leg?</td>
<td>This can help to establish whether bilateral disease or more than one condition is present. One problem may dominate, thus resulting in lameness almost exclusively in one limb, but occasionally in another</td>
</tr>
<tr>
<td>What makes you sure it is this limb that your dog is lame on?</td>
<td>Forelimb lameness can be particularly confusing and difficult to lateralise. This question encourages the owner to think about the lameness and to describe it, and helps the veterinary surgeon to better understand the lameness. For example, the owner might report that the dog holds the limb off the ground, or has a characteristic head nod when walking. By listening to the owner's description of the lameness, it can be possible to lateralise the lameness when the owner is otherwise unable to do so</td>
</tr>
<tr>
<td>How long has your dog been lame? or When did the lameness start?</td>
<td>Chronic lameness since the dog was a puppy suggests a developmental condition such as elbow or hip dysplasia. More recent or acute-onset lameness in an adult dog suggests an acquired condition such as bicipital tendon tenosynovitis or cranial cruciate ligament disease</td>
</tr>
<tr>
<td>Non-specific question</td>
<td>Owners may initially answer 'no' to this non-specific question as they may not have thought about the lameness in detail. More specific questioning will challenge owners to help differentiate between the following conditions:</td>
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<tr>
<td>Is there a pattern to the lameness?</td>
<td>• Degenerative joint disease. Lameness that is usually worse when the dog first gets up from lying down and subsequently improves with exercise</td>
</tr>
<tr>
<td>Specific questions</td>
<td>• Cranial cruciate disease. Lameness that is constant or deteriorates with exercise</td>
</tr>
<tr>
<td>Is your dog lame first thing in the morning?</td>
<td>• Muscle/tendon/ligament disorders. Lameness that may get worse during exercise</td>
</tr>
<tr>
<td>Is your dog lame during exercise? If so, is this evident at the beginning, during or end of exercise?</td>
<td></td>
</tr>
<tr>
<td>Is the lameness worse after vigorous exercise?</td>
<td></td>
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<tr>
<td>Is the lameness better if your dog is rested?</td>
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doi:10.1136/inp.d1196
Orthopaedic examination

The orthopaedic examination can be subdivided into three distinct parts that are best performed as described below.

Observe the dog standing and sitting

Start by observing the dog as it is first presented to you in the consulting room. Watch the dog’s behaviour when sitting, standing and lying down and how it moves between these positions. The dog may not fully bear weight on one limb, may hold the limb at an abnormal angle or unusual position, or may frequently shift or redistribute weight away from the affected limb. In addition, note whether:

- The dog struggles to get up on a particular limb;
- The dog stands with all its weight evenly on all four limbs;
- The dog holds one limb up at any stage;
- The digits spread evenly when weightbearing;
- Any of the limbs tremble;
- The limbs are symmetrical;
- One limb appears malaligned;
- The dog sits and lies normally or abnormally (eg, with one limb stuck out to the side);
- The findings of these observations may indicate which limb(s) is/are causing the dog a problem. It may also be possible to appreciate muscle atrophy visually in shorthaired breeds.

Gait observation

Gait observation should further clarify which limb(s) is/are affected and how severely. Take the dog to an area where gait observation can be performed – that is, somewhere the dog can be observed standing, walking and running. The choice of location may limit the scope of the lameness examination (Table 2). The author uses either a long wide corridor (Fig 1) or a private road that has almost no traffic on it (Fig 2). Observe the dog at a number of different speeds:

- Walking at three paces – slow, normal and quick. Observing the gait at different speeds allows the detection of subtle lameness that may only be visible at certain speeds. It may be necessary to watch the dog for some time until it becomes comfortable with its environment and settles into a relaxed moving pace from which the lameness can be appreciated;
- Take a full and comprehensive history. Start with general questions and progress to specific questions relevant to the presenting problem (Table 1). When questioning an owner, be careful to pose questions in a manner that encourages useful answers. This is a skill that is developed and refined with experience;
- Perform a general clinical examination;
- Perform an orthopaedic examination;
- Formulate a list of differential diagnoses. Use this to formulate a list of appropriate diagnostic tests and thus a plan of action.

Table 2: Advantages and disadvantages of locations for gait observation

<table>
<thead>
<tr>
<th>Location</th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Indoor corridor</td>
<td>Convenient Indoor and covered, which means it is warm and the examination can be carried out regardless of the weather</td>
<td>Corridor may not be big or long enough Flooring may be slippery, which can induce an abnormal gait Nervous dogs try to walk as close to the wall as possible, making gait examination difficult Can only observe speeds up to a slow run</td>
</tr>
<tr>
<td>Outdoors (eg, driveway, pavement or road)</td>
<td>Smooth tarmac/concrete surface allows good standardised gait observation</td>
<td>May not be pleasant in poor weather Uneven cobbled, brick or concrete surface will induce an abnormal gait Other traffic (eg, dogs, people, cars and bicycles) may be around, so requires care Unlikely to be able to observe the dog running</td>
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<tr>
<td>Outdoors (eg, field or paddock)</td>
<td>If large enough, this can allow observation of the dog exercising at full speed There is unlikely to be other traffic to consider while conducting the examination</td>
<td>May not be pleasant in poor weather May get muddy, so the assessor needs to wear appropriate clothing Soft ground may mask lameness</td>
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<tr>
<td>Video footage</td>
<td>Allows observation of the dog in its normal environment Allows the owner to demonstrate the animal’s lameness at its worst Provides an opportunity to watch the dog exercising over a long time but condensed into only a few minutes</td>
<td>Video camera must be available Need to make time and have the facilities available to watch the video, which can take some time as the footage is usually unedited Involved at least one additional visit, as the owner has to take the dog away to film it exercising, and then return at a later date Very dependent on the owner’s ability to use the camera to produce a video that is useful and can be interpreted</td>
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</tbody>
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Fig 1: Long, wide, bright corridor with no obstacles, which is ideal for carrying out a lameness examination

Fig 2: Private road, which is generally good for carrying out an orthopaedic examination, but is weather dependent and surfaces can be uneven
Trotting. This may require an assistant to trot the dog as not all owners are able to jog alongside their animal (eg, for health or other reasons). This also requires a sufficiently long stretch of open space to carry out the examination properly; Running. It is usually impossible to directly observe a dog running at full speed in the clinical setting because letting the dog off the lead is usually impractical, and finding sufficient time and space to allow the dog to build up speed is not always possible. If observing the dog running fast is an essential part of the examination (eg, lameness is only visible at high speed), the owners can be asked to take a video of the dog running and to bring the film to the next consultation.

Gait observation can be difficult. Pelvic limb lameness is usually relatively straightforward for both owners and veterinary surgeons alike to correctly identify the affected limb. However, forelimb lameness can be much more challenging. Features that indicate forelimb lameness and that can help to identify the affected thoracic limb include:

- Reduced weightbearing of the affected limb when standing;
- Head nodding. In the case of thoracic limb lameness, the head goes down as the normal limb strikes the ground and up when the affected limb strikes the ground (‘down is sound’);

Forelimb lameness is best assessed as the dog walks towards you (hindlimb lameness is best assessed as the dog walks away from you – see Part 2).

Physical examination
The physical examination is arguably the most informative and critical part of the orthopaedic examination. The preceding steps of establishing the dog’s signalment, history, observations when standing and walking, and gait examination should have identified the affected limb and may allow for a provisional list of differential diagnoses to be compiled. The orthopaedic examination subsequently identifies which joints, bones, tendons or muscles are affected.

The purpose of the physical examination is to consider every area of the dog’s four limbs and spine, and to establish whether there is any orthopaedic disease. Most dogs will allow a comprehensive orthopaedic examination without the use of analgesia or sedation. Full examination with the patient completely conscious may not be possible if the patient is in too much pain or, occasionally, because the animal is too nervous or aggressive. In such situations, chemical restraint using sedation or general anaesthesia is necessary to complete the orthopaedic assessment.

Systematic approach
The key to a successful orthopaedic examination is to be methodical and thorough. Examine every limb carefully and rigorously. It is good to get into the habit of comparing left and right limbs for similarities and differences. Clinicians should develop their own systematic approach with which they are comfortable and familiar, and one which they can repeat easily and reliably without omitting anything. It can be helpful to use a ticksheet as an aide-mémoire and easy method of recording clinical findings (Fig 3), which will ensure that nothing is missed and that everything is recorded appropriately.

Order of examination
Examine the affected limb last. For example, when investigating thoracic limb lameness, the pelvic limbs should be examined first, followed by the unaffected forelimb and finally the affected forelimb. This ensures that any findings of the other limbs are not missed.

Positioning for examination
It is usually more comfortable for the dog, owner and veterinary surgeon if large dogs are examined on the floor (Fig 4) and small dogs assessed on a table (Fig 5). Pelvic limbs are best examined in standing dogs, while thoracic limbs should be assessed with animals in a sitting position (Fig 6). Some small dogs may prefer to be examined on the floor but this may be more awkward for the examiner. Some dogs may prefer to be examined lying down (Fig 7), which is also the most appropriate position for examining giant breed dogs. Animals must be allowed to assume a position in which...
they are comfortable and cooperative, and clinicians may need to alter their approach to accommodate this. The author suggests the following procedure:

- Start with the dog standing and facing away from you;
- Assess the degree of weightbearing on each limb. Ensure the dog is standing evenly, and gently push on the palmar/plantar aspect of the foot just proximal to the stopper pad, with the edge of one or two fingers. The same gentle pressure should be applied to each foot. It takes less pressure to push the foot of the affected limb forwards (due to reduced weightbearing) than the normal limbs (Fig 8);
- Palpate and compare the musculature of both thoracic limbs and both pelvic limbs, specifically assessing and comparing any muscle atrophy and asymmetry that might be associated with chronic lameness;
- Perform a basic neurological examination. This includes assessing conscious proprioception on all four limbs with the dog standing (eg, ‘knuckling’ and ‘paper-slide’ tests) (Jeffery 2001);
- Assess the cervical, thoracic, lumbar and sacral spine for full range of movement and pain on deep palpation and manipulation (Fig 9). If these tests results are normal, further neurological examination is generally not indicated. If findings are abnormal, further neurological assessment is warranted (Jeffrey 2001);
- Deep palpate the lumbosacral joint to check for pain that may indicate lumbosacral disease;
- Perform a ‘tail-lift’ test by lifting the tail vertically (dorsally) upwards and pushing it cranially (Fig 10). A normal dog should tolerate this well. This test is
used to check for lumbosacral disease – a positive pain response is associated with lumbosacral disease but this may also indicate a painful tail;

- Examine each limb methodically in turn, starting with the unaffected limbs. The affected limb(s) should be examined last.

**Examination of the thoracic limb**

Start with the dog standing and assess forelimb muscle bulk/atrophy. Compare the size of the supraspinatus and infraspinatus muscles on the left and right sides – this is relatively straightforward except in obese patients. The spine of the scapula is an easy landmark to palpate – the supraspinatus lies cranial to it, while the infraspinatus lies caudal to it (Fig 11). The affected forelimb is likely to have palpable muscle atrophy.

The author usually examines the thoracic limbs with the dog sitting. Start distally and work proximally. Examine one thoracic limb at a time but compare left and right sides. If a subtle abnormality is found, comparing left and right sides can help to determine whether the finding is significant or not. If bilateral disease is present, comparing left and right sides will ensure that bilateral disease is not missed.

If the patient shows a subtle or unconvincing response to manipulation, repeat the examination at least once to check the reliability of the response. If the dog is clearly in pain, such repetition is not advisable.

**Pes (foot)**

Examine the digits carefully and systematically. The digits have a large range of movement in flexion and extension with a reasonable amount of medial and lateral movement. In all cases, check:

- The interdigital skin for signs of dermatitis, wounds or lacerations (Fig 12);
- The interdigital hair for signs of saliva staining;
- The pads (individual digits and large stopper pads) for wounds or embedded foreign bodies;
- The claws and nailbeds for signs of disease or abnormalities;
- Each of the interphalangeal and metacarpophalangeal joints individually for normal, pain-free range of movement in extension and flexion, and for instability medially and laterally. If unsure, compare any suspicious digit to the adjacent digit;
- Each of the proximal and distal interphalangeal joints and the metacarpophalangeal joints individually for swelling, pain, heat or crepitus;
- The metacarpophalangeal joints specifically for pain on deep palpation in the region of the palmar sesamoid bones (particularly sesamoid bones 2 and 7 in affected breeds such as rottweilers);

- Each of the metacarpal bones individually by moving proximally and palpating to check for swelling, thickening, pain, heat or overlying soft tissue (extensor/flexor tendon) abnormalities.

**Carpus**

The carpus functions as a hinge joint and has a large range of movement through full extension to full flexion (Figs 13, 14). A small degree of carpal valgus and varus movement is also possible. A minor degree of standing carpal valgus is normal in most dogs.

Working distally to proximally, check:

- Carpal range of movement. The normal carpus should move from about 30° of flexion (where the nails/pads touch the antebrachium) to around 200° of extension;
- Medial and lateral carpal stability;
- Carpal swelling/effusion (most easily palpable dorsally);
- Pain, crepitus or limited range of movement associated with any of these manoeuvres.
Antebrachium
Gently palpate the antebrachium, working distally from the carpus and proximally towards the elbow. Palpate the radius distomedially and proximolaterally, the ulnar styloid distolaterally and the caudal ulna and olecranon caudoproximally. The extensor muscles of the carpus and digits are palpable on the craniolateral antebrachium, while the flexor muscles of the carpus and digits are palpable on the caudomedial antebrachium. Gently palpate all these structures, checking for areas of heat, swelling, discomfort or abnormal and irregular texture (Fig 15). The antebrachium of dogs has limited ability to supinate and pronate. Pain associated with simultaneous antebrachial supination and elbow flexion can be observed with some elbow pathology.

Elbow
Palpate the elbow carefully and check:
- The range of movement, which is normally about 40° of flexion (with the antebrachium nearly contacting with the humerus) to around 170° of extension (Figs 16, 17);
- Whether, during manipulation, the animal shows signs of pain or reluctance to allow full movement or crepitus. Stoic dogs with elbow disease may show only subtle signs of pain (eg, they will gently pull the elbow up towards the body during examination, or they may not allow elbow flexion or extension beyond a particular point);
- Whether an effusion is present. This is best palpated laterally, caudal and distal to the palpable lateral aspect of the humeral condyle in the region of the anconeus muscle (Fig 15). A dog that has an elbow effusion will have a soft swelling of variable size in this location. In lean, well-muscled dogs, the anconeus muscle can easily be mistaken for a subtle effusion; conversely, in obese dogs, an effusion could be overlooked.

Humerus
The distal humerus is readily palpated. The condyle, the medial and lateral epicondyles, the characteristic caudal ridge of the medial aspect of the condyle, the supracondylar bone and the distal diaphysis are all relatively easy to palpate. While palpating, check for pain, swelling, discomfort, and irregular or abnormal texture (Fig 18).
Working proximally, the mid-humeral diaphysis is not easily palpated, but the large biceps brachii muscle is palpable cranial to the mid-humeral diaphysis and the triceps muscle group is palpable caudal to the humerus. Palpate these muscles and check for pain, discomfort, swelling, atrophy or abnormal surface texture.

Working further proximally, the proximal third of the humerus is palpable, with the greater tubercle being the most prominent aspect. Palpate the bone for swelling and pain, and check that the shape and texture is normal.

Shoulder joint
The shoulder joint lies relatively deep to the palpable superficial anatomy and therefore cannot be directly palpated. It is also too deep for an effusion to be appreciated. The position of the joint is inferred from the positions of the acromium (distal end of the scapular spine) and the greater tubercle of the humerus (Fig 18). The shoulder is a complex joint, with most movement occurring in the craniocaudal plane – that is, extension and flexion but internal/external rotation and abduction/adduction are also possible. It has been claimed that excessive abduction/adduction is pathological (Cook and others 2005), but this is not universally accepted (Devitt and others 2007). When palpating the shoulder, check:

- The range of movement, which is normally about 60° of flexion to 160° of extension. The dog should tolerate the full range of movement without signs of pain (Figs 19, 20);
The biceps tendon, which lies in the intertubercular groove, just medial to the medial aspect of the greater tubercle. It is difficult to palpate directly but digital pressure can be applied directly to the biceps tendon in the region of the intertubercular groove if the shoulder joint is fully flexed and the elbow joint extended. A pain response suggests biceps tendon pathology (Fig 21).

Shoulder pain can be difficult to differentiate from elbow pain as it is not possible to fully extend and flex the shoulder without extending and flexing the elbow. However, the elbow joint can be manipulated through a full range of movement without full shoulder movement.

Scapula
The acromion, scapular spine, dorsal aspect of the scapula, and the supraspinatus and infraspinatus muscles are easily palpated in all but the most obese patients (Fig 11). Palpate each of these structures to check for discomfort, swelling and a change in texture or shape.

Summary
At the end of an orthopaedic examination, it should be possible to:
- Identify the affected limb(s) and anatomic regions;
- Draw up a list of differential diagnoses;
- Plan diagnostic tests and treatment options;
- Formulate a clear and logical plan of action to manage the patient.

A comprehensive work-up of an orthopaedic case cannot be carried out in a five- to 15-minute consultation. At least 30 to 45 minutes is necessary to allow sufficient time to perform all the steps discussed in this article. If, at the initial presentation, time is limited, it may be better to book the dog in another time when 30 to 60 minutes can be dedicated to the examination. Otherwise, there is a risk that a patient may be admitted for radiographs without knowing which anatomic area is affected and, as a result, many of the radiographs will likely be unnecessary and a waste of valuable time, effort and money.

References and further reading


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In Practice 2011 33: 126-133
doi: 10.1136/inp.d1196

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