Diagnosis of pelvic limb lameness in dogs

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Examination of the patient
Examination of the patient with musculoskeletal disease should start with a general physical examination. Then one should pay particular attention to areas of inflammation, contusion, deformity, malfunction/disuse, atrophy/hypertrophy, increased/decreased range of motion, disarticulation or fracture. Patient type (or signalment) may give important clues to the diagnosis. In many cases the breed, age, sex and use of the animal will narrow the differential list considerably.

History
The patient's history should be documented in chronological order. Important general questions relate to the use of the animal (working/pet), diet, vaccinations, etc. The animal's level of exercise, episodes of previous illness or previous musculoskeletal disease may be relevant to the current situation. The animal's accommodation may be important (is it kept with other animals?)

The present problem should be investigated with straightforward and simple questions. Owners often blame musculoskeletal disease on an episode of minor trauma so be careful in interpreting their responses. The rate of onset (acute/chronic) is often important and informative. Is the problem getting worse or better, or is it stable? Is it worse after rest or exercise? Has there been any response to previous treatment? Is the animal off colour, or suffered any weight loss? Does the owner know of siblings with similar problems?

There is increasing interest in the use of clinical metrology instruments (owner questionnaires) for musculoskeletal disease. Whilst such instruments cannot replace the well constructed consultation, they do serve to formalise collection of some basic data and also to “stage” the condition as seen by the owner. The scores generated by such instruments can be useful to track clinical progression and response to treatment.
We have recently published an owner-administered clinical metrology instrument and this has been validated in dogs with joint disease (Hercock and others 2009; Walton and others 2013). Other clinical outcomes measures have also been partly validated (Brown and others 2008; Hielm-Bjorkman and others 2003).

**Clinical examination**
There are definite sections to a logical examination:
- Observation
- Palpation: muscle mass, pain, swelling, heat
- Manipulation: joints, muscles, tendons, spine
- Neurological function

**Observation**
Locomotion can be divided into phases. These are "swing" and "stance" and are detailed below:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Motion</th>
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<tbody>
<tr>
<td>Swing</td>
<td>Flexion</td>
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<tr>
<td></td>
<td>Early extension</td>
</tr>
<tr>
<td></td>
<td>Stance</td>
</tr>
<tr>
<td></td>
<td>Beginning weight-bearing</td>
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<td></td>
<td>Propulsion (active extension)</td>
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There are several types of gait in the dog:
- Walk
- Trot (opposite limbs in-phase): Most dogs
- Pace (adjacent limbs in-phase): Cats, some dogs
- Gallop

Observation with the dog at rest allows assessment of conformation, deformity, distribution of bodyweight - uneven distribution points to discomfort. Ask yourself the following questions:

- Is weight distributed forward?
- Is weight distributed backwards?
- Is weight distribution asymmetric?
- Is weight shifting?

**Palpation and manipulation**
It is important to remember that thoracic limb lameness can also be caused by cervicothoracic diseases such as caudal cervical disc disease and brachial plexus disease. In addition, pelvic limb lameness can be caused by lumbosacral disease.
The pelvic limb

Pes
With the claws and pads, look for uneven wear or fraying. Cuts, lacerations and entry wounds are common. The digits should be flexed and extended.

Tarsus
The tarsus may be the site of instability in older dogs. Plantar ligament rupture can lead to a plantigrade stance, often of insidious onset; this can be easily missed by owners. Careful examination of the tarsus with reference to the bony landmarks will highlight the problem.

Figure 1: Plantar ligament rupture in a 7yo Sheltie

The tarsus should also be tested for collateral stability in flexion and extension; the anatomy of the collateral ligaments dictates that partial collateral ligament tears may only be detected in extension or flexion but not both.

Stifle
The stifle joint is probably the most common seat of lameness in older dogs. Cruciate ligament failure is very common in middle-aged and older dogs and it may be accompanied by meniscal injury. The stifle should be tested for cranial draw, cranial tibial thrust and patella luxation. Collateral ligament injuries are usually traumatic in origin and are therefore relatively infrequently presented.
Hip
The hip joint is a common site of osteoarthritis, most commonly as a consequence of hip dysplasia but also secondary to other developmental diseases and trauma. The hip should be taken through a full range of motion and if the hip is painful, there is often a response on full extension or abduction.

Lumbosacral region
Lumbosacral disease is an uncommon cause of pelvic limb lameness. Compression of the cauda equine most commonly results from disc protrusion of the lumbosacral disc but there may be other soft tissue changes which add to compression. Pain on palpation of this region, or lordosis of the LS spine can raise suspicion of this condition.

Neurological function
It is important to test neurological function, especially if there is any suspicion of lumbosacral disease. Local reflexes should also be assessed including:
- pedal withdrawal reflex
- cranial tibial reflex
- perineal reflex

Further diagnostic tests
Joint disease is very common in older small animals. This discussion outlines the basics of the various diagnostic aids and processes as they apply to joint diseases. Joint disease may present as lameness or in milder cases there may be stiffness following rest.

Radiography
Radiography is the standard tool for initial investigation of joint disease. The changes seen in and around joints are listed below:
- Swelling of soft tissues
- Joint effusion
- Osteophytosis
- Enthesiophytosis
- Displacement of joint structures (e.g. sesamoids, tibia w.r.t. femur)
- Fractures
- Intra-articular mineralisation
- Joint mice
- Subchondral sclerosis
- Erosion
- Altered width of joint space
- Subchondral bone cysts

Two orthogonal views are the minimum requirement. Other more specialist views may be required in certain circumstances. Stressed views may be employed in certain situations such as carpal ligament injury. It is imperative that the radiographs are positioned correctly because otherwise features may be misinterpreted or pathology missed. Knowledge of normal variants should be acquired by reference to appropriate texts. Some common normal variations are listed below:

- The popliteal sesamoid may be seen at the caudal aspect of the stifle on a lateral view and superimposed on the medial joint space on the craniocaudal view.
- The fabellae may be multipartite or at different levels to each other

**Arthrocentesis**
The analysis of synovial fluid is probably under-used. It is in most cases a very straightforward procedure and may be carried out under heavy sedation for most joints although the shoulder and hip may require general anaesthesia. The area for insertion of the needle should be clipped and washed with an antiseptic (e.g. chlorhexidine) and sprayed with alcohol. If the area is to be handled, gloves should be worn. 20’-22’ 1”-1.5” needles are used in most cases.

**Figure 3: sites for arthrocentesis in the dog**

The most common problem with fluid aspiration is iatrogenic blood contamination. This is recognised as a “string” of blood within the fluid whereas a joint with haemarthrosis will have sanguinous fluid which is consistent in its colour.
The handling of the sample will depend somewhat on the differential diagnosis and the volume available. A subjective assessment of colour, turbidity and viscosity can be made. Direct smears may be made for cytological assessment and a differential count and this should be done promptly.

A total cell count can be performed and the sample should be placed in an EDTA tube (since there may be fibrinogen present).

The viscosity of fluid may be assessed by the mucin clot test. This involves dropping some fluid into 5% acetic acid. Good viscosity produces a tight mucin clot whereas poor viscosity does not. The viscosity is a function of the length of the hyaluronic acid chains in the fluid. These are shorter than normal in inflammatory conditions such as infective arthritis or polyarthritis but near normal in osteoarthritis (OA). Effusion in OA may dilute the fluid and make it appear less viscous.

The table below summarises the properties of normal and pathological SF. These are guidelines only.

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>OA</th>
<th>Infective</th>
<th>Immune mediated</th>
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<tbody>
<tr>
<td>Volume</td>
<td>0-0.75ml</td>
<td>1-3ml</td>
<td>1-4ml</td>
<td>1-10ml</td>
</tr>
<tr>
<td>Viscosity</td>
<td>High</td>
<td>High¹</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>TCC(x10⁹/L)</td>
<td>0.75</td>
<td>0.75-5.0</td>
<td>5.0-100+</td>
<td>5.0-90</td>
</tr>
<tr>
<td>PMN’s (%)</td>
<td>0-1</td>
<td>1-5</td>
<td>95-98</td>
<td>20-80</td>
</tr>
</tbody>
</table>

**Arthrography**

The use of positive contrast within joints may be employed when suspecting or investigating certain diseases. Arthrography can give information on:

- the articular surface
- integrity of the synovial capsule
- position of cartilaginous joint mice
- adhesions in bursae

A needle is placed as for arthrocentesis (q.v.) and synovial fluid aspirated. The contrast is injected, the needle removed and the joint manipulated. Radiographs should be taken immediately.

**Ultrasonography**

This is of limited use but can be used to image soft tissues (tendons, ligaments, meniscus, cartilage)

**Arthroscopy**
Arthroscopy is increasingly common in small animal practice, particularly referral practice where it is now an indispensable tool. Although arthroscopy can be used for operative procedures, it is also commonly used for diagnosis of intra-articular diseases. Arthroscopy is used mainly in the shoulder, elbow and stifle although the carpus, hip and hock can also be examined. It is an extremely valuable modality for assessing joints.

**Computed tomography**
CT is very useful for evaluation of certain problems such as some growth deformities or selected joint problems.

![CT images](image)

**Figure 4:** Left, CT images of the pelvic limbs of a St Bernard with bilateral tibial deformities; Right, CT image showing stifle OCD (arrow) in a 7mo Gordon Setter.

**Magnetic Resonance Imaging**
MRI is becoming more available for imaging the joints of small animals. However, the expense limits the use of MRI in all but select cases and for research purposes. Probably the most common indications are for investigation of the internal structures of the stifle joint (menisci and cruciate ligaments) when the diagnosis is not clear.
Figure 5: MR images of canine stifle showing medial meniscus

References and further reading