



## Personal View

Recognition of lameness: Man versus machine<sup>☆</sup>

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## Introduction

What is lameness and how can it be recognised? These might seem easy questions, but delivery of succinct answers is more challenging. In *Diagnosis and Management of Lameness in the Horse* Mike Ross (2010) gave this definition: 'Lameness is simply a clinical sign, a manifestation of pain or a mechanical defect, that results in a gait abnormality characterized by limping'. The definition is simple, but is perhaps too simplistic and the recognition of low-grade lameness or multilimb lameness may be considerably more challenging. With lameness involving several limbs the horse may perform less well than previously, but recognition of lameness can be difficult. However, when some pain is abolished using diagnostic analgesia obvious lameness may appear in another limb, highlighting the degree of discomfort experienced by the horse. Moreover, we recognise a subset of horses in which pain-related abnormalities of gait are only observed as a compromise in quality of movement, which may be most obvious in canter, not a gait that traditionally has been considered important for evaluating lameness.

What do we actually mean by limping? How may lameness be manifest in horses? It is not as simple as assessing the movement of the poll and the tubera coxae and tubera sacrale, especially when evaluating a horse in circles, particularly a ridden horse (Dyson, 2009, 2011, 2013). The compensatory ways in which horses adapt to pain causing lameness are complex and incompletely understood (Buchner et al., 1996; Kelmer et al., 2005; Gómez Álvarez et al., 2007, 2008). This is especially so when there is more than one lame limb (Dyson, 2013).

## Lameness detection

It has been clearly demonstrated that veterinary surgeons vary in their ability to both detect and grade lameness seen in straight lines (Keegan et al., 1998, 2010; Arkell et al., 2006; Fuller et al., 2006; Hewetson et al., 2006). This probably reflects the inadequacy of training of what to look for, the lack of practice in the application of grading schemes, the variety of grading schemes used (Dyson, 2011), and the inherent subjectivity of these judgements. The very fact that most of the studies only evaluated the horses trotting away from and towards the assessor and not from the side, that horses were not assessed at the walk, and that not all studies utilised audio recordings means that such studies themselves have limitations. At the walk, the slower footfalls allow better appreciation of various aspects of gait than at the trot. Some lamenesses may be more obvious at the walk because of the relatively longer stance phase of the stride compared with trot. There is much information that can be gained from sound: the loudness of the footfall, listening to the rhythm, and hearing a toe drag. Assessment of a horse from the side (compared with from behind or in front) allows better assessment of the overall step length of the forelimbs and hindlimbs. The relative step lengths of the left and right limbs, how well the horse pushes from behind, the height of arc of the foot flight of each limb and the degree of extension of the left and right metacarpophalangeal and metatarsophalangeal joints can all be evaluated.

The ease with which head and neck movement can be assessed from the side, the front or behind depends on the position of the head and neck relative to the trunk. Head and neck oscillations from side to side may confound interpretation of a head nod, particularly in short striding horses. Assessment of the horse from behind should not just focus on movement of the tubera coxae and tubera sacrale. We need to evaluate the straightness of the horse or whether it drifts to one side, thus tending to move on three tracks. Is the limb flight straight, or does one or both hindlimbs deviate in under the body during protraction? Does the horse toe out on one or both

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hindlimbs? Is the horse base-wide or does it plait? Does the horse wobble a hindlimb during the stance phase and/or does the limb lean out during the stance phase, either as a consequence of pain or related to abnormal conformation and/or trimming and shoeing which may predispose to pain causing lameness?

Paradoxically, asymmetrical movement of the hindquarters is sometimes easier to assess as the horse comes towards the observer, especially in a horse with a high tail carriage which obscures the tubera sacrale. It goes without saying that for accurate interpretation the horse should be trotting straight, not bent towards the handler, and at a consistent speed. Excessive speed may mask lameness, as can natural exuberance of a fresh horse. We have to bear in mind that hindlimb lameness may induce a head nod and, less commonly, forelimb lameness may induce asymmetrical movement of the hindquarters.

### Assessment of a horse moving in circles

When assessing a horse as it moves in a circle there is the option of running with the horse or lunging it. I prefer the latter, because I believe it allows assessment of more aspects of the horse's gait and how it adapts to lameness (Dyson, 2013). Does the horse lean into its body inwards? Does it look out of the circle? Does the inside hindlimb cross in under the body during protraction towards the contralateral forelimb? Is the step length of the forelimbs and hindlimbs what I would expect for a horse of this type and level of training? Are each of the forelimbs lifted to a similar height? Is there adequate hindlimb impulsion and engagement? Is there a visible or audible toe drag? How differently does the horse move on the left and right reins? Does the horse swing through its back, or is the back held rigidly? Does the horse balance itself differently on the left and right reins? It also allows evaluation of the horse in both trot and canter. Although I can rarely identify a single lame limb in canter, I can observe abnormalities of gait that I believe are pain-related. This is based on the observation that I can alter these characteristics by diagnostic analgesia, which proves to me that the gait modifications are pain-related. Such modifications of canter include placing the hindlimbs closer together than normal both spatially and temporally; being croup high; four-time canter; trailing hindlimbs; changing legs behind; unwillingness to sustain canter, with a tendency to break to trot spontaneously. Observation of the horse performing transitions from walk to trot, trot to canter, canter to trot and trot to walk allows assessment of how well the horse pushes from behind in an upward transition and how well the hindlimbs are engaged in a downward transition.

I expect a normal horse to look reasonably symmetrical on the left and right reins. There should not be a head nod. The balance of the horse will depend on its age and musculoskeletal strength and coordination. Balance, stride length and impulsion will vary among horses depending on their athleticism, but is normally reasonably symmetrical on the left and right reins. It is important that veterinarians spend time looking at normal horses, so that they are familiar with the normal variations and can differentiate these from pain-related gait abnormalities.

The assessment of a horse moving on a circle on a firm surface is influenced by the nature of the surface. I consider that it is crucial that the horse should feel confident moving on the surface otherwise any shortening of stride may reflect apprehension rather than a response to pain. It is therefore important that the surface is genuinely non-slip and for this reason I prefer a gravel surface, with the option to move the horse onto a firmer non-slip surface, provided that the horse is trotting in a settled, safe manner. The use of a gradient is often helpful to accentuate forelimb lameness.

### Ridden exercise

Historically, ridden exercise has not been routinely used as part of a lameness assessment, but I consider this essential unless the horse is too lame to assess ridden (Dyson, 2009, 2011, 2013). There are many lamenesses that are only apparent in a ridden horse, so assessment in hand and on the lunge is only part of the whole picture. A horse can manifest lameness when ridden in a remarkable number of ways in trot: overt lameness, a hopping-type gait mimicking the horse breaking to canter, reluctance to go forwards, leaning on one rein, being difficult to turn, reluctance to work 'on the bit', unsteady head carriage, being 'behind the bit', loss of rhythm, swinging the hindquarters out, bolting, rearing, bucking. The horse may come 'above the bit' in upward transitions from walk to trot or trot to canter, fail to 'engage the hindlimbs' in downward transitions from canter to trot or trot to walk, step short on one hindlimb in a downward transition, have poor hindlimb impulsion and engagement, or have a bilaterally symmetrical short cranial phase of the step of the forelimbs and/or hindlimbs. The horse may hold its back rather stiffly, especially with bilateral forelimb or hindlimb lameness.

It is important that the observer recognises that lameness can be altered by the diagonal on which the rider sits; usually with hindlimb lameness the horse is lamer when the rider sits on the diagonal of the lame(r) limb. Forelimb lameness may also be altered, but in a less predictable way. In canter the horse may be reluctant to lead with the correct (inside) forelimb, or land after a jump with the correct forelimb (the forelimb in the direction to which the horse is turning) leading. The horse may become disunited behind, have a four-time canter, or be crooked (hindquarters placed to the inside of the circle), trail the hindlimbs (i.e., lack hindlimb impulsion and engagement), have a stiff, stilted canter, or be croup high. The horse may have a restricted forelimb step length and appear 'earth-bound' in association with a bilateral forelimb lameness. The horse may perform flying changes incorrectly, or be reluctant to perform flying changes. It may fail to jump squarely across a fence because of unequal push off from the hindlimbs. In lateral work (e.g., half pass, shoulder in) the rhythm may become irregular. In movements requiring increased collection, such as canter pirouettes, the horse may try to 'jump out of the movement'.

Horses may appear completely normal if allowed to work in a 'novice outline' but when asked to collect, the horse may look very different, because greater biomechanical demands are being placed on the musculoskeletal system, particularly the back and hindlimbs. Likewise a horse may appear relatively normal when trotting around the periphery of an arena, but if asked to trot in 10-m circles or in figures-of-eight (sequential 10-m diameter circles to the left and right) the picture may be very different. Overt lameness may become apparent; the horse may slow its rhythm and become 'behind the bit'; the hindquarters may swing outwards and the inside hindlimb may cross in under the body towards the contralateral forelimb.

If you are completely baffled by this language, you are possibly not qualified to assess low-grade or multilimb lameness in sports horses and racehorses (the latter show similar problems if you look!). I believe that all of these observations are important, because I know that all of them can be improved hugely by diagnostic analgesia, indicating that they are a reflection of pain-related problems. Can objective assessment of gait help us to assess whether or not a horse is lame, and which is/are the lame limb(s)?

### Objective gait assessment

There are fairly convincing data that assessment of a unilaterally lame horse can be more accurately assessed using inertial measurement units (IMUs) placed on the poll and the tubera sacrale (and/or the tubera coxae) compared with subjective assessment by

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