

Lameness Evaluation of the Athletic Horse



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KEYWORDS

- Lameness examination • Gait evaluation • Equine • Limb flexion tests
- Ridden gait evaluation • Diagnostic analgesia

KEY POINTS

- Lameness evaluation requires keen clinical and observational skills.
- Examination starts with a thorough physical examination including visual assessment at rest, conformation, and systemic palpation.
- Gait evaluation is performed in a consistent manner over flat firm surfaces. Lunging, riding, and limb flexion tests may enhance detection of lameness.
- Most lame horses do not exhibit pathognomonic gait characteristic gait abnormalities; therefore, accurate diagnosis requires comprehensive evaluation including diagnostic analgesia.

INTRODUCTION

For years, veterinarians have been performing lameness evaluations on athletic horses. Information on the subject is plentiful dating back 100 or more years and is highlighted by today's renowned textbooks, Adams and Stashak's *Lameness in Horses*¹ and Ross and Dyson's *Diagnosis and Management of Lameness in the Horse*.² Throughout time, the basic concept of lameness evaluation persists: keen clinical assessment and observation (the art of lameness) combined with diagnostics (the science of lameness).

Lameness is defined as abnormal stance or gait caused by structural or functional abnormality of the locomotor system. Normal horses should move with balanced and symmetric motion; lame horses have unbalanced and/or asymmetric gaits. Lameness is a clinical sign, not a disease per se. It is a manifestation of pain, mechanical dysfunction, or neuromuscular deficit causing alteration of gait, that is, the horse limps. In certain conditions, characteristic gait abnormalities are pathognomonic, and

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therefore, recognition and location of the problem are straightforward. For example, a horse standing with its hind limb locked in extension and fetlock caudally placed and flexed is the distinctive stance of upward fixation of the patella (“locked stifle”). Unfortunately, most causes of lameness do not exhibit characteristic gait abnormalities, making diagnosis a real challenge. The lameness diagnostician then becomes the lameness detective.

Being a skilled lameness detective is critical because best treatment practices are based on accurate diagnosis of underlying cause or causes of lameness. The lameness evaluation should therefore be performed in an orderly, systemic, and thoughtful fashion except in horses with severe lameness and/or if fracture is suspected. This type of approach can be time consuming, especially when the underlying cause is not obvious. Because pain is the most common cause of lameness in the horse, an essential component of the lameness evaluation is diagnostic analgesia (nerve and joint blocks). Diagnostic analgesia authenticates the site or sites of lameness. It also establishes the clinical relevance (or not) of physical examination and/or previous imaging findings. Although valuable, diagnostic imaging is not a substitute for a detailed lameness evaluation because it is the horse that runs and jumps, not the radiograph. Once the site or sites of pain are localized, targeted therapy is initiated with the goals of returning the horse to its athletic activity.

HISTORY AND PHYSICAL EXAMINATION

A thorough and logical lameness evaluation starts with obtaining the affected horse’s signalment. Age, sex, breed, and athletic use are basic vital facts that influence the predisposition of certain underlying lameness causes. For example, racehorses are prone to stress fractures and bucked shins due to the high-intensity training, whereas older seasoned show horses are prone to osteoarthritis and other degenerative musculoskeletal conditions. The horse’s comprehensive medical history and past performance record are also important. Helpful information includes onset and duration of lameness, management changes, and whether lameness severity improves with rest or exercise. The shoeing interval and type should also be noted. Response to medications and/or exercise modifications, and previous lameness are also important historical data. Additional information from questions tailored to the specific horse is also useful; for example, “the horse won’t pick up the left lead canter” or “the horse lunges when pulling the steer.”

The next step is performing a comprehensive physical examination starting with visual inspection and conformation evaluation. The horse’s demeanor, stance, and body symmetry are assessed. Obvious conformational abnormalities are commonly linked to performance-limiting lameness; however, minor abnormalities may offer little insight to the current and future sites of lameness. Abnormal posture such as “dropped elbow” stance is distinctive for upper forelimb fractures and should be investigated radiographically before observing the horse in motion. Static muscle fascinations should also be noted because they may be due to pain and/or underlying myopathic conditions. Pelvic asymmetry should be noted; however, direct correlation between pelvic abnormalities and underlying pelvic pain should be linked with caution. Muscle atrophy of the gluteal region is a common finding in horses with hind limb lameness regardless of underlying cause (lower limb, hock, stifle, or pelvis). There is no association between asymmetrical tuber sacrale (“hunter’s bump”) and the presence of sacroiliac pain.³ The back and neck are also thoroughly examined. Flexibility, extensibility, and overall muscle development along the topline should also be noted.

To some degree, body and limb conformation determines the way the horse moves and therefore influences its athletic ability and soundness. Conformation assessment pervades performance horse practice and is a cornerstone of presales evaluation. However, determining what is considered ideal is complicated because desirable conformational traits vary between different breeds and athletic use. For example, long sloping shoulders are advantageous in elite show jumpers and dressage horses⁴ but associated with decreased performance in National Hunt racehorses.⁵ Conformation abnormalities are considered undesirable because of resultant changes in gait patterns, unbalanced limb stress, and associated lameness. Horses with base-wide, toed-in front limb conformation tend to wing out or “paddle” when walking, which overloads the medial aspect of the limb, often resulting in lameness.⁶ Sickle hock conformation concentrates load to the dorsal aspect of the hock, which may predispose affected horses to curb (plantar desmitis) and distal hock pain.⁷ Horses with straight hock conformation are at risk for suspensory desmitis.⁸ Although not all conformation faults are detrimental in the athletic horse, most standardbreds and warmbloods have a “toe out behind” conformation,⁶ suggesting this conformational fault is a normal breed characteristic with no impact on performance. Other conformational defects may even be protective for musculoskeletal injury. In racing thoroughbreds, carpal valgus decreases the incidence of carpal fracture.⁹ Although an important part of the physical assessment, abnormal conformation is not synonymous with lameness.

Closer inspection during the physical examination includes systematic palpation of limbs. The hoof size and shape, shoe type, shoe wear pattern, presence of mismatched feet, low heel, upright heel (club foot), and broken pastern-foot angle should all be appreciated. Digital pulses should be assessed and increased pulse quality ascertained. Time-honored hoof tester application maintains value in modern lameness evaluation because foot pain is the most common site of lameness in the front limb. Focal areas of sole sensitivity should be investigated thoroughly. However, only 45% of horses with navicular pain will have a positive response to hoof testers¹⁰; false positive and false negative hoof testers responses do exist. Next, each joint and its associated joint pouches should be palpated; subtle medial femorotibial joint effusion is easily missed without careful palpation. Metacarpal/metatarsal tendon and ligaments should be palpated in the weight-bearing and non-weight-bearing position. Each structure should be isolated during palpation and assessed for focal areas of heat, sensitivity, and enlargement. Deep focal pressure along the proximal suspensory ligament is also beneficial; however, false positive and negative responses are common in horses with authentic injury in this region.⁸ In the upper forelimb and pelvis regions, joint effusion is difficult to appreciate even when present because of their deep locations and overlying muscles. In addition to overall musculoskeletal palpation, it is also important to perform targeted palpation to areas of pain common to the use of the horse. For example, palpation of the dorsal aspect of each carpal bone in non-weight-bearing position is very important in the racehorse because this is a common site of injury for this breed and use.

Static manipulative tests, such as standing flexion and extension of joints, can also yield valuable information. Decreased range of motion in a young athletic horse is uncommon, and if noted, is frequently associated with underlying pain and injury. As with any type of limb manipulation, it is difficult to stress one joint in isolation, and therefore, specificity of lameness to a particular joint is almost impossible. Of all the joint flexion tests, reduced carpal flexion and/or pain during carpal flexion appears to be the most likely to be directly correlated to carpal pain. As with other physical examination findings, palpation and manipulative findings can facilitate localization of pain. However,

many factors, such as individual horse responses to focal pressure and interpretation of pain, can be confounding.

GAIT EVALUATION

Next, and perhaps the most important step, evaluation of gait is performed while the horse is moving, allowing the clinician the opportunity to characterize the nature and severity of the gait abnormality. If fracture is suspected in the acute, severely lame horse, exercise should not be performed or catastrophic breakdown may result. Appropriate imaging is recommended. Key basic questions when performing gait evaluation include the following:

1. Is the horse lame?
2. What leg is lame?
3. What is the severity (grade) of lameness?
4. Is the lameness complicated, that is, observed in more than 1 limb or only under certain circumstances?

These basic inquiries are easy to answer when the horse is severely and consistently lame. However, the answers are not straightforward in the horse with an inconsistent and/or subtle lameness. Fast moving, fit athletic horses frequently exhibit quick changes of pace, speed, and direction, which compounds the clinician's accurate assessment of normal and abnormal gait patterns, especially with complicated lamenesses. Therefore, to enhance recognition of stride abnormalities, it is very important to establish consistency in the lameness examination. The horse should be handled by a skilled horseperson using a loose lead shank so the head and neck position can be evaluated, but not too loosely such that the horse's movement is not contained with a straight line. Ideal surfaces should be flat, firm, and nonslippery. Hard surfaces allow the examiner to listen as well as observe disparity in footfall patterns; the lame limb contacts the ground with less force and therefore less noise. Frequently lameness is more pronounced when exercising in a circle, and most of time, severity is increased when affected limb is on the inside of the circle. Lunging on soft surface may also be necessary, especially when faster but controlled gaits, such as canter, are evaluated. Slowing the speed, small circles, and ridden evaluations are particularly helpful for subtle lameness. In some horses, observation of gaits specific to the horse's athletic use, such as passage in the dressage horse or tölt in Icelandic horse, is also valuable. For consistency, handler, surface, speed, distance, size of circle, and gaits should remain constant and repeatable throughout the entire lameness evaluation.

The methodology to determine, the question number one: "Is the horse is lame?," is clinician preference. The examiner must rely on one's keen observation skills as they formulate the subjective assessment of the horse's gait. First, the diagnostician gets an overall impression of the horse's movement. The horse is observed as it walks away (evaluating from behind) and then as it walks toward (evaluating from the front). The sound horse should bear weight equally on each individual limb as it ambulates. Foot flight pattern is best observed from the front, and most horses will have a slight lateral-to-medial foot flight pattern.¹¹ The horse's limb movement should also be observed while considering the effects of conformation on limb flight patterns. Perfectly straight limbs travel even in all planes, whereas conformational abnormalities result in uneven limb flight patterns. Front limbs that are toed in or toed out may wing in or wing out when exercising. Foot placement relative to midline should also be assessed. Does one limb or foot consistently land closer to or farther away (placed laterally) of midline? Does the horse drift? If the horse drifts, does it drift with the front

end or the hind end and to which direction? For the expert lameness diagnostician, these observations are performed quickly and instinctively as the horse walks down and back. For the inexperienced clinician, the horse may be walked several times down and back to target their visual acuity on specific regions of the moving parts (eg, the feet, front feet, back end).

Next, the horse is evaluated at the trot, the most useful gait for lameness evaluation. The horse is trotted away and then toward the clinician. The trotting horse should also be evaluated from the side. Again, gait characteristics should be noted. Sound horses move with a symmetric trotting gait, each limb bearing equal weight with a uniform limb flight pattern, and the horse travels freely forward without hesitation. Lamenesses have asymmetrical gait patterns, which is commonly classified as weight-bearing or non-weight-bearing (swinging leg) lameness. Weight-bearing lameness is used to describe when the horse reduces the amount of time (decreases the force) applied to the weight-bearing phase of stride. Swinging leg lameness is described as lameness that affects the way the horse carries the painful limb. However, most horses with painful lameness conditions will alter *both* the weight-bearing and non-weight-bearing phases of stride with distinction between the 2 all but impossible to the human eye. Lamenesses consistently shorten the cranial phase of stride, a reliable gait characteristic that is best observed from the side. Other gait alternations include the degree of fetlock drop or full extension during weight-bearing. Bear in mind that all limb movement is somewhat dependent on conformation, anatomy, and function. In limbs with abnormal function, for instance, suspensory desmitis with associated loss of functional support to the fetlock, the affected horse may have increased full extension (increased fetlock drop) because of underlying pathologic condition and therefore the opposite occurs (more fetlock drop with lameness). The lame horse will exhibit some or all abnormal (asymmetrical) gait characteristics, which highlights the importance of comprehensive, consistent, and repeatable lameness examination.

After determining the presence of lameness, the examiner moves onto the second question, "In which leg is the lameness?" Recognition of asymmetric body motion patterns is the first and basic way to allocate lameness to a specific limb. The lame horse shifts their center of body mass away from the painful limb. Forelimb lameness is usually easier to recognize as a head nod. The lame horse's head and neck nod consists of elevation during the weight-bearing stance of the lame leg; the head goes up and back (caudally directed). In addition, the horse's head and neck nods downward when the sound leg hits the ground, down and cranially directed. Hence, the phase "down on the sound" is commonly used. Being very mobile, head and neck nod is a consistent gait asymmetry noted. This head and neck nod is best observed from the side but can also be observed from the front/behind evaluation position. Hind limb lameness is more difficult to identify. Affected horses will exhibit an alteration in movement of the pelvis. During the weight-bearing stance of the lame hind limb, the affected side moves upward, a "hip hike" or preferably "pelvic hike." Alternatively, "pelvic drop" can be observed during the non-weight-bearing phase of the lame leg. Another tendency for hind limb lameness is drifting away from the lameness. The horse with left hind limb lameness often travels with haunches to the right. These head nods and pelvic movements are unconscious, occurring when the horse unloads the lame leg and loads the sound leg. Identification of these shifts in body mass is the basis for determining if the lameness is in a front or hind limb, right or left.

The severity of the lameness is determined next; question number 3. Ideally, a lameness grading system should be consistent, applicable to all types of lameness, and universally accepted; no such scale exists. In North America, the most common lameness scoring system is the 0 to 5 American Association of Equine Practitioners

lameness scale¹² (Table 1). Although useful, this system has limitations because it grades lameness at *both* the walk and trot and does not account for the horse that is lame at the walk and sound at the trot, or vice versa. In addition, horses that are only lame when trotting in a circle are commonly scored grade 1 lameness when by definition, should be grade 2 lameness. An alternative scoring system has been described by Dr Mike Ross¹³ (Table 2) based on observations of the horse when trotting. The system can be used for lameness in the front and hind limbs. However, this system also has limitations, and differentiation between grades 2 and 3 is not straightforward. In the United Kingdom, a subjective scoring system from 0 to 10 is regularly used,¹⁴ where 0 indicates the horse is sound and 10 indicates complete inability to use the limb. This grading system is reasonably reliable among clinicians, but less consistent with inexperienced examiners.¹⁵ Dr Sue Dyson describes a 0 to 8 grading system,¹⁶ which is independently applied to the walk and trot and under different circumstances, such as straight lines, circles, and while ridden. Whichever scoring system the clinician uses, it is important for the examiner to be as consistent as possible when grading lameness.

If the answer to the fourth question, “Is the lameness complicated?,” is yes, accurate lameness is even more challenging. Horses that are lame in more than 1 limb, lame only under certain circumstances, and/or have bilateral lameness are difficult to evaluate. As previously discussed, the horse shifts its weight away from the lame limb, in a side-to-side and front-to-back fashion. As a result, horses with a pelvic hike may also exhibit a head nod, and vice versa. In these horses, distinction between primary and compensatory “false” lameness is not easy. The “law of sides”¹⁷ would suggest that horses with ipsilateral concurrent front and hind limb lameness are predominantly lame in the hind end. Explanation for this phenomenon includes the following. A horse with right hind limb lameness transfers load to the left hind limb but also cranially to the contralateral left front limb resulting in a horse that appears to have ipsilateral right hind *and* right front limb lameness. Compensatory body movement is not restricted to a caudal to cranial direction, and some horses with front limb lameness also have concurrent pelvic movement that mimics contralateral hind limb lameness. Other conditions that complicate the lameness evaluation are horses with bilateral lameness, horses appearing symmetric (sound) in a straight line, and horses with subtle lameness observed only under certain conditions. Observation of gait while circling may be helpful in these horses, and in most instances, mild low-grade lameness is accentuated when circling. However, lunging can induce

Grade 0	Lameness is not perceptible under any circumstances
Grade 1	Lameness is difficult to observe and is not consistently apparent, regardless of circumstances (eg, under saddle, circling, inclines, hard surfaces)
Grade 2	Lameness is difficult to observe at a walk or when trotting in a straight line but consistently apparent under certain circumstances (eg, weight-carrying, circling, inclines, hard surfaces)
Grade 3	Lameness is consistently observable at a trot under all circumstances
Grade 4	Lameness is obvious at the walk
Grade 5	Lameness produces minimal weight-bearing in motion and/or at rest or complete inability to move

From Anonymous. Guide to veterinary services for horse shows. 7th edition. Lexington (KY): American Association of Equine Practitioners; 1999; with permission.

Table 2 Alternative lameness scoring system	
Grade 0	Sound
Grade 1	Mild lameness observed while the horse is trotted in a straight line. When the lame forelimb strikes, a subtle head nod is observed; when the lame hind limb strikes, a subtle pelvic hike occurs. The head nod and pelvic hike may be inconsistent at times.
Grade 2	Obvious lameness is observed. The head nod and pelvic hike are seen consistently, and excursion is several centimeters.
Grade 3	Pronounced head nod and pelvic hike of several centimeters are noted. If the horse has unilateral singular hind limb lameness, a head and neck nod is seen when the diagonal forelimb strikes the ground (mimicking ipsilateral forelimb lameness).
Grade 4	Severe lameness with extreme head nod and pelvic hike is present. The horse can still be trotted, however.
Grade 5	The horse does not bear weight on the limb. If trotted, the horse carries the limb. Horses that are non-weight-bearing at the walk or while standing should not be trotted.

Lameness grades based on trotting in a straight line, in hand, on a firm surface.

From Ross MW. Movement. In: Ross MW, Dyson SJ, editors. *Diagnosis and management of lameness in the horse*. 2nd edition. St Louis (MO): Elsevier; 2011. p. 64–80; with permission.

movement asymmetries in sound horses¹⁸; mild inside hip hike and outside head nod-down occurs. These “normal” body movement adaptations on the lunge may therefore result in lameness to be more or less visible depending on circle direction and location of pain. Because correct identification of the lame limb is prerequisite, both circle-dependent and compensatory front/hind limb movement mechanisms must be taken into account when evaluating lame horses.

LAMENESS EXAMINATION IN THE RIDDEN HORSE

For some horses, lameness is only apparent when ridden, whereby certain movements, sport-specific gaits, changes of pace such as canter-to-trot transitions, can be reliably reproduced. In the lame riding horse, abnormal gait characteristics are highly variable, such as overt limping, reluctance to go forward, resistance in the bridle, bucking, and rearing.¹⁹ The addition of a rider’s weight causes increased limb loading²⁰ affecting both sound and lame horses. Posting trot causes uneven loading of the left and right limbs with peak forces on the sitting trot diagonal higher than the rising trot diagonal.²¹ On the left diagonal, the rider sits when the left front and right hind limbs are bearing weight. This uneven weight distribution during rising trot may enhance detection of lameness; hind limb lameness is often worse when the rider sits on the diagonal of the lame leg.¹⁹ In addition to changes in limb forces, sitting trot also exerts greater stress on the horse’s spine resulting in increased back extension.²² Like limb-loading patterns, rising trot creates uneven stresses on the back. Maximal back flexion occurs during unloaded rising trot stride and maximal extension during loaded sitting trot stride. However, changes in back movement are not strictly limited to rider positions. Lame horses adapt their gaits by stiffening the thoracolumbar-sacral region.²³ The resultant trunk stiffness is often perceived as back pain by the rider even when the underlying pain and decreased back flexibility are due to limb lameness. Although the mere presence of a rider can influence the incidence of lameness, rider effects in individual horse cannot be predicted.²⁴ Some horses will be lame in hand and sound with a rider, and vice

versa, and the prevalence of may be related to the rider's skill level.²⁴ Professional riders may mask underlying gait abnormalities, whereas unbalanced beginners may exaggerate asymmetrical gait conditions. For all riders, accurate identification of lameness and localization of the lame limb are often difficult, and a high proportion of "owner-sound" is lame when assessed comprehensively by a skilled lameness diagnostician.²⁵ Although ridden evaluation is not a substitute for in-hand lameness assessment, it can enhance the clinician's ability to detect and localize lameness. Keen observations in the horse moving with or without a rider are paramount for the lameness diagnostician.

FLEXION TESTS

Flexion tests have been an integral part of the gait assessment and are routinely used in the lameness examination. This longstanding clinical tool often highlights the presence of lameness. Although common practice, subjective flexion testing is not standardized, and evidence-based support for its specificity in lameness localization is lacking. In fact, only 1 of 57 horses had both a positive flexion test and lameness in the same limb.²⁵ Numerous factors, such as variations in technique, degree of flexion, and amount of force applied to the flexed limb, prevail among clinicians and influence posttesting response. Duration of limb flexion period before trotting off varies from 15 to 90 seconds and may account for variable results. In one study,²⁶ a 60-second proximal hind limb flexion test was more likely than a 5-second flexion test to produce a positive response. With all these variables, the reproducibility of testing between examiners is unreliable, although individual repeatability is reportedly good.²⁷ Most sound^{28,29} and lame horses²⁵ will be positive to limb flexion, which emphasizes the lack of sensitivity with limb flexion tests to detect authentic sites of pain. Reasons flexion testing is not a precision diagnostic tool may be due to the inability to stress a single joint without also exerted force to other joints and nearby tissues. The terms lower limb flexion test and upper limb flexion test are more appropriate than fetlock and hock flexion tests, respectively, because they more accurately describe flexion mechanics. Subjectivity of hind limb flexions is further hindered by the reciprocal apparatus, which ensures unison movement of upper hind limb joints. Two different research teams investigated which structures may be responsible for a positive distal limb flexion test, and both concluded that the metacarpophalangeal joint pain is the primary cause of a positive response.^{30,31} Although these findings are interesting, debate continues regarding limb flexion testing and its inherent value in the lameness examination.

DIAGNOSTIC ANALGESIA

With careful and comprehensive gait assessment, a skilled clinician may be able to formulate a reasonable list of potential pain sources during the lameness examination. However, in most horses, diagnostic analgesia will be required to truly authenticate and localize the lameness site. With few exceptions, gait abnormalities are not specific to injury type, and examination findings can be misleading. A horse with foot pain may be lame when trotting in a straight line and/or while lunging and/or when ridden, exhibiting lameness gait characteristics in any or all of these conditions. Severity of front limb lameness may be exacerbated when circling to the right or the left or both. Lame horses also may have pain in more than one site and/or more than one limb, further complicating identification of pain by observation alone. Therefore, diagnostic analgesia is essential, perhaps the most essential, diagnostic tool for the lameness detective.

Perineural and joint blocks should be performed in a systematic and thoughtful manner. Diagnostic analgesia is time consuming but extremely rewarding because “best guesses” frequently result in improper treatment, return to training before adequate healing, and chronicity of injury in the lame horse. Albeit extremely important, interpretation of lameness severity changes after diagnostic analgesia is not always straightforward. When the same clinician performs the lameness examination and the diagnostic analgesia, there may be interpretation bias; the attending clinician expects improvement in lameness severity after blocking. Arkell and colleagues¹⁵ demonstrated that unblinded observers allocated larger changes in lameness grades, increased effect of a nerve block, compared with blinded observers. It is also important to recognize that the intended region to desensitize may differ from what structures are actually desensitized. This sequel may be due to inadvertent penetration of a synovial structure during perineural injections and/or incorrect placement of anesthetic solution. Adequate patient restraint and a solid working knowledge of neuroanatomy can minimize but not completely abolish these complications. Even with good technique, anesthesia of adjacent structures occurs after intra-articular analgesia due to diffusion of anesthetic solution across anatomic borders and/or blockade of peripheral nerves that course through or near joint outpouchings. For example, intra-articular anesthesia of the distal interphalangeal joint improves pain not only in the joint but also in the navicular bursa, the navicular bone and associated soft tissue structures, and the toe region of the sole.³² Diffusion also occurs after perineural injections with significant proximal dissemination occurring within 10 minutes of the procedure.³³ This rapid proximal distribution may also contribute to desensitization of unintentional structures. Small volumes of anesthetic solution and time-sensitive lameness reevaluation may diminish these untoward complications. Diagnostic analgesia is not an exact science, and high specificity within anatomic regions may not be possible. Despite these pitfalls, nerve and joint blocks combined with thorough gait assessment remain the best approach to localize pain and lameness.

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