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Lecture title: lameness

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Summary:

Signs of lameness

Manifestations of lameness include any alteration in gait from what is normal for the horse. In general, it is harder to detect hind limb lameness when compared to lameness in a front limb when using visual cues .

1- Identifying a front limb lameness: The classic sign of lameness in a front leg is a prominent "head bob." Viewed from the side, the horse raises its head and neck when the lame leg hits the ground, which helps to unload the lame leg. A horse may also try to reduce impact on a lame front leg by tensing of the muscles of the shoulder.

2- Identifying a hind limb lameness: Evaluation of hind limb lameness can be difficult. Generally, the viewer watches the hip, sacrum, gluteal muscles, or hemi-pelvis (pelvis of one side of the body) when examining lameness in the hind end. Examination should be performed both watching the horse from behind while trotting away from the examiner, and from the side as the horse passes. Additionally, horses with a hind limb lameness will tend to reduce the degree of leg use. The statements ("hip hike" vs "hip drop" on the lame leg) can be explained by when the horse perceives pain during the stride. If the pain is perceived during the early stance phase of the stride, the horse will try to unweight the leg and produce a "hip hike." If the pain is perceived during the pushoff phase of the stride, the horse does not push with as much force, subsequently reducing the height the pelvis is raised, and leading to a "dipping" motion during the swing phase of the stride as the horse brings the limb forward.

3-A normal horse with have a cranial phase and a caudal phase of equal length. The horse will bring the leg as far forward as it does backward. In a lame horse, the cranial phase will be shorter when compared to the caudal phase, so it appears to spend more time with the leg backward than it does forward. A shortened cranial phase is most commonly seen in cases of bilateral lameness, lameness of the upper limb (such as shoulder or hip pain), and osteoarthritis of the hocks

4-Decreased fetlock drop during the stance phase of the stride may be seen in cases of lameness, with the lamer leg producing less drop than the sound leg as the horse tries to relieve weight on the painful limb.

5-Lastly, behavioral changes and decreased performance, holding a foot up, inability to turn smoothly, dragging a toe, not lifting hooves, standing imbalanced may indicate pain, even if obvious clinical lameness is not evident.

lameness evaluation

A lameness exam is used to try to pinpoint the cause of lameness in the horse, which subsequently guides treatment. It is the first step to evaluate decreased performance in an equine athlete, even if the horse does not appear overtly lame, to rule out any pain-associated cause.

1-History

-Age: Foals are more likely to have infectious causes of lameness (septic arthritis). Horses just starting training may be lame due to a developmental orthopedic disease, such as osteochondrosis. Older animals are more likely to experience such as osteoarthritis.
-Breed: Breed-specific diseases, such as hyperkalemic periodic paralysis(HYPP), can be ruled out.
-Discipline: Certain lamenesses are associated with certain uses. For example, racehorses are more likely to have fatigue-related injuries such as stress fractures and injury to the flexor tendons, while western show horses are more likely to suffer from navicular syndrome and English sport horses are more likely to have osteoarthritis or injury to the suspensory ligament.
-Past history of lameness: An old injury may be re-injured. In the case of progressive disease, such as osteoarthritis, a horse will often experience recurrent lameness that must be managed.
-Duration and progression the lameness: Acute injury is more common with soft tissue injury. Chronic, progressive disease is more common in cases such as osteoarthritis and navicular disease.
-Recent changes in management: such as exercise level, diet, or shoeing.
-Effect of exercise on degree of lameness.
-Any treatment implemented, including rest.

2-Physical examination and palpation

-One of the first steps of the lameness examination is to evaluate the horse at rest. A good evaluation of conformation, including overall body type, can help the practitioner determine the potential cause of lameness.
-The horse's stance is also evaluated. Frequently resting a particular leg, "pointing" a foot (holding a leg out in front of the body), or standing in an abnormal position can indicate compensation for an injury. It is normal in the hind legs, but frequent shifting of weight in the front legs, or placing both front feet in front of the body, can indicate bilateral forelimb lameness Stifle pain sometimes causes a horse to stand with the stifles rotated out. Hip and pelvic pain can produce a toe-out, stifle out, hock-in stance and that remains present at the walk.
-Asymmetry of the muscular structure, due to muscle atrophy, usually occurs on the side of the lame limb. Hind limb lameness or pelvic fracture can cause unilateral atrophy of the middle gluteal or gracilis muscles. Damage to the suprascapular nerve can lead to atrophy of the muscles of the shoulder (supraspinatus and infraspinatus). Neck muscle atrophy can be seen with cervical vertebral malformation (Wobbler's disease).

-After a visual exam, the practitioner palpates the horse, feeling for heat, swelling, and

sensitivity to pressure indicating pain. Palpation is usually most thoroughly performed in the lower limb, but a comprehensive exam will include palpation of the back, pelvis, and neck. Joints should be palpated for pain, effusion of joint pouches, thickening of the joint capsule, and checked for range of motion. Major ligaments and tendons, such as the superficial and deep digital flexor tendons, inferior check ligament, suspensory ligament, and distal sesamoidean ligaments, should also be palpated along their entire length. Individual bones may be palpated if injury is suspected, such as a fracture.

Specialized manipulative tests can be used to help identify specific areas of pain:
1- The Churchill test: pressure is applied to the plantar surface of the head of the medial splint bone. A painful horse will flex and abduct the limb, indicating hock pain.
2-Peroneus tertius rupture: The hock is pulled into extension while the stifle is flexed. A positive test (the ability to extend the hock) indicates a ruptured peroneus tertius muscle.
3-Patella displacement: the patella is pushed laterally and proximally, to test for upward fixation of the patella.
4-Cruciate test: the examiner moves the tibia sharply caudally, to feel for movement away from the femur or crepitus. Excessive movement can indicate cruciate rupture.
5-Test for stifle collateral ligament damage: the stifle is held still, while the distal limb is abducted (to test for damage to the medial collateral ligament) or adducted (to test for lateral collateral ligament damage). Excessive movement by the distal limb relative to the stifle suggests rupture of the collateral ligament. Sprain of these ligaments can be evaluated by repeating this test multiple times, before trotting the horse off an looking for lameness.

3-Evaluation of the hoof

The majority of lameness originates in the hoof. For this reason, the hoof is closely scrutinized in shape, balance, shoeing, wear pattern, and for the presence of cracks, and contracted or sheared heels.
-Chronic lameness will change the shape of the hoof capsule, since the lame limb is not weighted as much as its partner, making the capsule more upright, narrow, with a higher heel on the lame limb and more flattened on the sound one. Founder rings or thickened concentric rings in the hoof wall, indicate a past episode of laminitis. Concavity of the dorsal (front) surface of the hoof can indicate chronic laminitis. The sole may become convex if the coffin bone begins to push through the bottom of the hoof.
-Correct hoof balance allows for even distribution of forces through the leg and hoof. Poor hoof balance, due to conformational flaws or poor trimming, can cause lameness from musculoskeletal injury and poor hoof balance has been associated with increased risk of catastrophic injury in racehorses. Long toes force the horse to pivot (break over) further forward over the toe. The toe acts as a lever arm, and its increased length makes it harder for the heels to rotate off the ground. This increases strain on the deep digital flexor tendon and the ligaments of the navicular bone.
-The shape of the sole, size of the frog, and shape of the bars can indicate overall health of the hoof. Holes in heel bulb usually indicate a hoof abscess that has ruptured. The horse's shoeing

can also provide clues to the examiner. The application of corrective shoes or pads may indicate past problems requiring special shoeing.

-Digital pulse evaluation is important when addressing the hoof. An increased digital pulse often indicates that the lesion is in the foot, and are usually most significantly increased in horses with laminitis. The coronary band may also be palpated. Cool swelling can indicate coffin joint effusion, swelling with an increase in temperature can indicate laminitis, firm swelling can occur with ringbone and a localized swelling with pain can indicate an abscess.

-Examiners will also "hoof test" each foot by applying a metal instrument that squeezes the foot to test for deep pain. Diffuse sensitivity occurs with fracture or infection of the coffin bone, and laminitis. More localized sensitivity can be found with sole bruises, puncture wounds, hoof abscesses, and hot nails. Sensitivity over the middle third of the frog is consistent with navicular syndrome, but can also occur with sheared heels. To distinguish these two, the hoof testers may be applied over the heels, which will be sensitive in the case of any heel-related pain, such as sheared, contracted, or bruised heels.

4-Evaluation in motion

-The horse is evaluated in motion, usually at the walk and trot, but occasionally also in the canter. The walk is often the best gait to evaluate foot placement.The trot is generally the best gait to localize the lameness to a particular leg, because it is a symmetrical gait where the front half of the horse and the back half move in unison. The canter may also be used for lameness evaluation. Resistance to picking up the canter or to engage the hind end can suggest pain in the sacro-iliac joint, pelvis, or hind leg.

-Lameness may be accentuated under certain conditions. Therefore, the moving examination is often performed both in a straight line and on a circle, and may be repeated on different footings. Hard footing tends to make joint and bone injury more apparent, while soft, deep footings tend to accentuate soft tissue injury. Circles may accentuate a lameness when the lame leg is on the inside or outside of the circle.

-At times, it may be helpful to evaluate the horse under saddle, since the weight of the rider can accentuate lameness. Gait is evaluated for symmetry. This includes the overall fluidity of the horse's motion, length of stride, loading of a leg, how the hoof lands on the ground (flat, toe, or heel-first), range of motion of the joints, deviations in body position, and position of the head and neck.

The first evaluation of the horse is used to determine the severity of lameness and to help pinpoint which part of the body may be affected. The process of watching a horse move is repeated after each additional flexion test or nerve block to determine its effect on the animal

A-Flexion tests: Flexion tests are a diagnostic tool involving the application of sustained pressure on a particular set of joints. The limb is forcibly flexed for between 30 seconds and 3 minutes, depending on the joint and practitioner preference, and the horse is immediately trotted off. Flexion tests help narrow down the source of lameness to a certain part of the leg, but they are non-specific because they almost always affect more than one joint and because they also affect the soft tissue structures around the joint, not just the joint itself.Additionally, they must be interpreted carefully due to the risk of false negatives and false positives.
B- Regional limb anesthesia (nerve blocks):Nerve blocks involve injecting a small amount of local anesthetic around a nerve or into a synovial structure (such as a joint or tendon sheath) in order to block the perception of pain in a specific area. After the substance is injected, it is given a few minutes to take effect. The block is then tested by pushing a blunt object, such as a ballpoint pen, into the area that is supposed to be desensitized. If the horse does not react to this pressure, the area is desensitized, and the horse is trotted to see if the lameness has improved. Improvement indicates that the cause of lameness was from a structure desensitized by the nerve block. Although nerve blocks are very important to the lameness examination, they are not foolproof. If the anesthetic migrates to the structure that is causing the horse pain, the horse will have a positive block, and the examiner will conclude that the lameness originates in an area that is not actually causing the horse discomfort. False results can also be secondary to practitioner error if the anesthetic is accidentally administered into a location that was unintended, such as a synovial structure rather than around a nerve.

5-Diagnostic tests

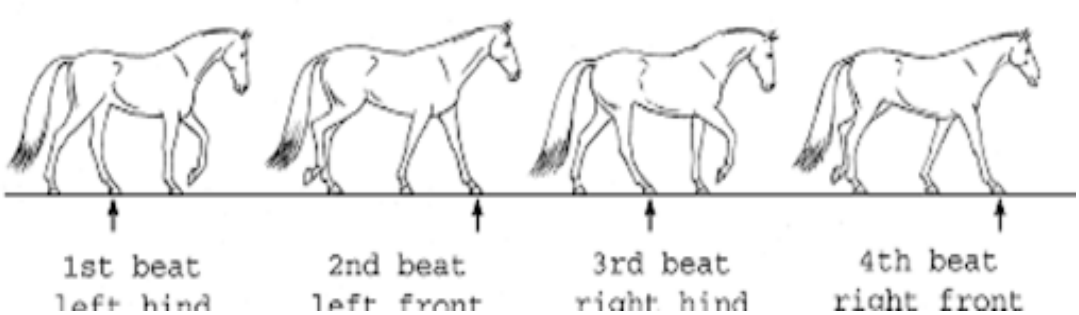
A- Radiographs are commonly used to evaluate lameness in the lower limb.The most common forms of diagnostic imaging for use during a lameness exam are X- ray to evaluate bone and joint lesions, and ultrasound to evaluate soft tissue lesions.
B- Nuclear Scintigraphy (bone scan): its mean injecting a radioactive substance, often technetium-99 into the horse and then measuring uptake, which is strongest in the areas of rapid bone remodeling. The bone scan is often useful for lameness that can't be easily localized to one area, that affects multiple limbs, or lameness that is thought to originate in areas not easily imaged by other means, such as the vertebral column.
C-Computed Tomography (CT) is an imaging modality that produces a 3-dimensional radiograph. A series of plain radiographs are taken in a spiral around the site of interest, and the individual 2-D radiographs are converted into a 3-D image by a computer. The image may be manipulated to view in different planes, such as cross-section, making it possible to see an injury from multiple perspectives and improving diagnostic capabilities when compared to plain radiographs.
D-Magnetic Resonance Imaging (MRI) produces a 3-dimensional image that allows for exceptional evaluation of soft tissue structures, as well as the detection of boney change and the presence of excessive fluid accumulation associated with inflammation.

E-Thermography or thermal imaging, measures the heat gradient of skin by detection of infrared radiation. F- Blood or synovial fluid testing
G- Arthroscopy: it mean involves placing a small camera through a hole into a joint or other synovial structure. It requires general anesthesia, but allows thorough visualization of the synovial membrane and articular cartilage.
H- Body-Mounted Inertial Sensor Systems (ISS) generally refer to wireless inertial sensors (accelerometers and gyroscopes) transmitting precision movement data back to a computer.

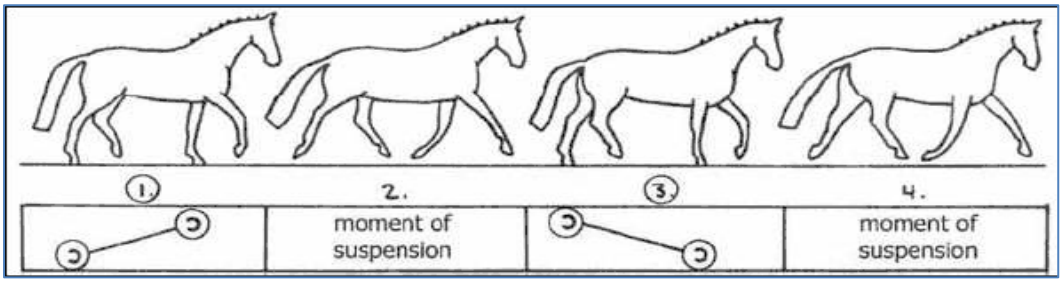
Horse gait: It's a pattern of movement , a manner of walking on foot or sequence of steps by which equines move forward . Different breeds can be perform a varity of gaits depending on their ability and level of training
Natural Gaits : gallop, trot, walk, back, and canter are the basic movements that can be carried out by horses.
1- Walk: This movement comprises of four legs moving in equal intervals of time. It is the gait of four-beat thus four different footstep sounds can be easily recognized when a horse is walking on the ground. The footfall order is left hind, left fore , right hind, right fore.

2- Trot: Trot is a two-beat gait where the movements of the diagonal legs are harmonized. It is a gait that is in between a walk and a run. The sequence of the footfall is right hind with left fore and left hind with right fore.
3- Canter: Based on the three-beat gait, it is a controlled movement which begins with a foreleg leading and another foreleg following with the diagonal hind leg. The order of the footfall is right hind, then left hind with right fore , after which the left front follows.

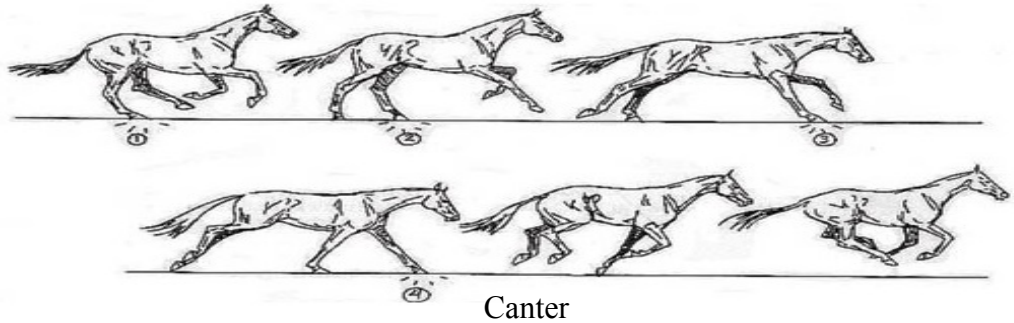
4- Gallop: In this movement, there is an increase in the length of strides and suspension period. It is a four-beat gait, where foreleg or inner leg leads, depending on whether the movement is in a straight line or not. Since there is a greater weight on the leading leg, the horses change legs in between the gallop.
5-Back: This two beat diagonal gait is performed by the horses themselves, with no involvement of the rider. The pattern in this movement is somewhat similar to the trot, but in a backward direction. Which means the back footfall is right front with left hind and right hind with left front. you can see the gait of horse (footfall gait in horse)



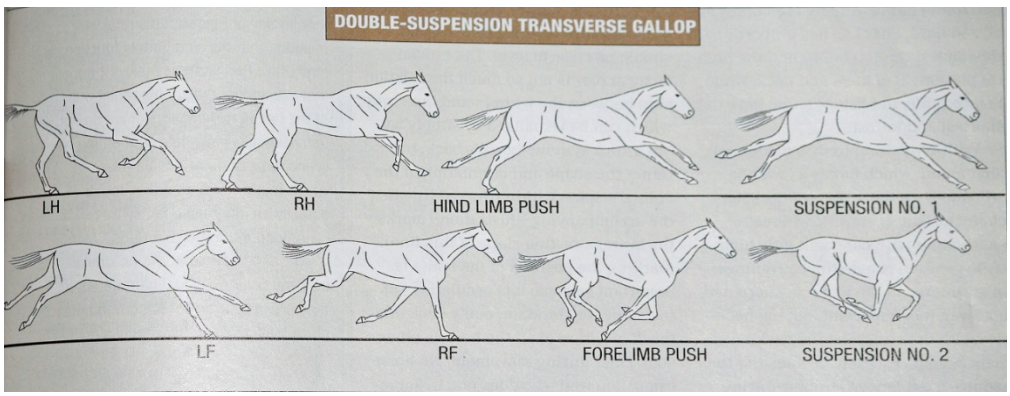
walk



Trot



Canter



Gallop