Clinical Evaluation and Diagnosis of Palmar Foot Pain

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1. Introduction
Palmar foot pain accounts for a substantial portion of forelimb foot lameness, and it may have devastating effects on the athletic career of the horse and potential livelihood of the owner. Pain originating from the palmar region of the foot manifests in different ways and is dependent on the occupation of the horse, conformation of the foot, etiology of the condition, accompanying sources of pain, and severity of the pain. This discussion focuses on the clinical evaluation and diagnosis of palmar foot pain from a clinician’s perspective.

In the author’s opinion, there should be nothing mysterious about isolating lameness originating from the heel region. Misdiagnosis often arises because of failure to thoroughly evaluate the horse or failure to recognize and properly diagnose sources of pain elsewhere in the horse that may complicate the evaluation. When pain is isolated to the palmar foot region, the greater challenge is to further define the source of pain to a specific structure. In addition to having implications on the selection of treatment, a specific diagnosis provides prognostic value to aid in directing the athletic career of the patient.

2. History
An accurate history and thorough clinical evaluation are paramount to an accurate diagnosis of palmar foot pain. With recent advancements in imaging techniques, this preliminary component of diagnostics is often not pursued, and therefore, vital information relative to the diagnosis and eventual case management may be missed. Pertinent facts to obtain in the history include occupation of the horse, exercise schedules, and duration of lameness. Prior diagnostic testing and any treatments as well as the response to treatments should be obtained. Changes in intensity of exercise programs or surfaces as well as any shoeing or trimming changes should be noted. A thorough description from the owner regarding specifics about the character of gait or changes in the gait should be obtained.

Some typical historical findings in all types of horses are that a gait has deteriorated in smoothness and lost its suppleness or has become short and choppy, especially on firm surfaces. Horses performing events requiring sharp turns (barrel racing) or concussive actions (jumping) will often be described as losing performance, reluctant to work, or lame. In ranch horses or endurance horses, one of
the earliest complaints is a short, choppy gait first noticed on a decline.

3. Clinical Evaluation

The clinical evaluation cannot be overemphasized in importance when dealing with palmar foot pain. The clinical evaluation typically begins with visual inspection at rest. Special attention is given to conformation of the whole horse as well as a close inspection of the feet. The size and weight of the horse is often overlooked as having a role in lameness. In my opinion, control of obesity and relatively large body mass compared with the frame and the mass of the feet is as germane to management of lameness as is any other form of treatment.

It is a common belief that hoof misbalance, small hoof mass, broken hoof-pastern axis, and poor limb or hoof conformation may result in altered biomechanical load on the navicular apparatus.1-6 Relative long toe and low heel (low angle) have been shown to increase the force on the navicular bone; interestingly, heel collapse (under-run heels) was not associated with increased force on the navicular bone.4 Adverse biomechanical load on the navicular bone has been suggested to result in pathologic changes similar to those seen in navicular disease. There are, however, no controlled clinical studies establishing the incidence of or a correlation between horses with palmar foot pain that have less than ideal feet compared with those with “good feet.” Many horses with palmar foot pain that have “normal” feet and “normal” radiographs present some of the most challenging diagnostic and therapeutic dilemmas. Conversely, there is little to account for the number of sound horses with poor feet that seem to remain free from trouble. This fact aside, common sense and clinical experience in farrier science supports a correlation between palmar foot pain and altered foot conformation through clinical improvement after corrective shoeing and feet balancing.

Variances from the ideal foot are relatively simple to recognize after the clinician is familiar with what is normal. Consistent abnormal stance (pointing, camped out, camped under) and discrepancies in size, shape, length, angle, and balance of the feet should be noted. The condition and integrity of the whole foot should be critically evaluated. If shoes are in place, observe for uneven wear and position relative to the toe and heel and the angle of the foot. It is very uncommon for a horse to have a matched set of feet; however, overt differences in size and contour may be associated with chronic lameness.

Common foot conditions associated with palmar foot pain include broken hoof-pastern axis, under-run heels, sheared heels, and medial to lateral imbalance. The hoof-pastern axis may be broken forward (dorsal) or back (palmar). Broken forward axis may be seen secondary to chronic palmar foot pain and an excessively high hoof angle or with a club-foot condition. An axis that is broken back is often associated with a long toe and low or crushed under-run heels in which the center axis of the foot is positioned more dorsally than normal. This is a common condition of Thoroughbreds in which one foot is generally worse than the other. Horn tubules are often directed in a dorsal distal direction with growth, and generally, the walls are thin, undermined, and integrally poor. This may be recognized on radiographs as a negative palmar angle of the coffin bone, and theoretically, it may cause increased strain on supportive soft-tissue structures of the navicular apparatus or increase pressure against the bone or tendon unit.

Sheared heels are often seen in conjunction with under-run heels. They are believed to result from chronic loading of one heel more than the other, which breaks down the support structures between the heel bulbs. In all likelihood, sheared heels are both a cause and result of palmar foot pain because of the abnormal load applied.

Other morphologic alterations of the feet that the examiner should look for include vertical wall cracks, horizontal cracks associated with abscessation, wall separation, and undermining from lamellar shearing or abscessation. The bars and overlying sole and frog should be pared and cleaned for thorough evaluation and assessed for evidence of bruising or discoloration.

The degree of sole concavity and thickness as well as the size, shape, and orientation of the frog should be observed. It is common for a foot to obtain a distorted appearance with the frog losing its central position after prolonged corrective trimming for various angular limb deviations. This type of foot has an excessive lateral flare and flat medial wall, and it is prone to wall separation and abscessation of the lateral wall.

Palpation of the foot should include assessment of wall temperature, assessment of digital pulse, and thorough palpation of the coronary band around the entire foot and heel bulbs. The coronary band should be examined carefully over the entire circumference, including the heel bulbs, to inspect for areas of increased sensitivity. The symmetry and “fullness” of the coronary band should be uniform over its entire circumference. The examiner should note areas that are flat or swollen as well as areas that have ridges. Hoof-tester evaluation should be performed first with gentle pressure in a non-sensitive region of the foot or on a sound foot to avoid an over-reactive response by the horse. Gradual increases in the degree of pressure on all regions of the foot and across the foot should be performed. Hoof-wall percussion using a hammer along the wall is also useful to detect focal areas of wall pain such as a laminar abscess between the solar junction and coronary band.

Although the jog is used for most of the locomotor evaluation, examination at the walk may also provide useful information. Close attention should be given to hoof contact with the ground. For example, does the foot strike heel to toe or toe to heel, and
does the foot load excessively on the medial versus lateral wall or vice versa? Stride length between the limbs is observed in addition to the flight pattern and degree of flexion of the limb during ambulation. Reluctance to fully load the limb on close turns, alteration in the stance during turns, or abbreviated periods of loading in one direction versus another may be observed. Walking on an decline may exacerbate the lameness in one limb or the other.

Jogging on a flat, firm surface in a straight line and turns to obtain a consistent degree of lameness is important to be able to accurately differentiate the response to nerve blocks. A consistent and reproducible lameness or gait deficit must be established in the examiner’s eye before further evaluation by diagnostic anesthesia is possible. This may require working the horse under tack, working on different surfaces, performing flexion tests, or performing frog-wedge compressions; in a bilateral lameness, blocking one foot to exacerbate the lameness may be required.

4. Diagnostic Anesthesia

Diagnostic anesthesia has been the gold standard for isolating lameness to a given anatomical region such as the heels, and this is not likely to change. However, because of the lack of specificity of local anesthetics, this diagnostic aid has been challenged regarding its usefulness.7–14 As diagnostic imaging modalities have improved our diagnostic capabilities, local anesthetics have been used less often. This is a mistake that leads to erroneous diagnoses, because these tools should be used to compliment one another rather than substitute each other. We must keep in mind that all of the modalities employed in lameness diagnostics have limitations in a given situation.

Over the past decade, attention has been given to the innervation pattern of the foot and the effects of local anesthetics on specific structures.11,15–17 It has been found that anesthesia of the palmar digital nerves not only provide anesthesia to the palmar third of the foot but also to the entire distal interphalangeal (DIP) joint.13 It has also been shown that the dorsal branches of the palmar digital nerves do not innervate the DIP joint, and likely, they only contribute sensory innervation to the coronary band and dorsal laminae. To obtain information that is as accurate as possible, the palmar digital nerve block should be performed as low as possible (at or below the level of the ungular cartilage), and 1.5 ml of local anesthetic deposited subcutaneously should be used.12 This should preclude inadvertent analgesia of the proximal interphalangeal joint.

It is common belief that secondary pain may arise from compensatory gait changes; the most common compensatory lameness associated with heel pain is pain in the dorsal aspect of the foot and the proximal suspensory ligament. If there is a marked improvement in the lameness after palmar-digital nerve block, this should be considered as a primary source of lameness and investigated further unless other signs indicate otherwise.

Further differentiation of the source of heel pain is accomplished by either uniaxial palmar-digital nerve block or by anesthesia of the navicular bursa or the DIP joint. Anesthesia of the navicular bursa includes the bursa, navicular bone and supporting ligaments, solar toe pain, and the deep digital flexor tendon (DDFT) but does not include the DIP joint.8,12,13 Conversely, anesthesia of the DIP joint has repeatedly been shown to anesthetize the bursa and its accompanying structures.11,13 Therefore, to maximize information from diagnostic anesthesia, several sessions of performing blocks may be required, and the sequence may be determined on an individual case basis. In general, it is believed that a positive response to DIP joint anesthesia and a negative response to intrabursal anesthesia incriminate the DIP joint as the source of lameness.

Time of evaluation after intrasynovial anesthesia may have bearing on interpretation of the block.11,12 There is no difference in the time of effect when performing anesthesia of the DIP joint between the DIP joint and navicular bursa. Both have been shown to become anesthetized 5–8 min after injection. Several trials have shown that evaluation should be performed within 10 min of intra-articular or intrabursal injection, because diffusion of anesthetic into surrounding soft tissues results in loss of specificity of the block.11–13

Lesions of the DDFT identified by magnetic resonance imaging (MRI) are consistently blocked by abaxial sesamoid nerve blocks but are inconsistently blocked by palmar-digital nerve blocks, DIP joint, or navicular bursa blocks. It has been suggested that intrathecal anesthesia of the sheath of the DDFT after a negative palmar-digital nerve block but positive abaxial sesamoid block is suggestive of a lesion involving the DDFT, and further investigation is warranted.11

It should be noted that because of variation in innervation patterns in some horses and potential technique problems, there is a real possibility of false-positive and false-negative information. This can be minimized by implementing consistent techniques in the evaluation and when performing the blocks and, if in doubt, repeating the evaluation.

5. Imaging Modalities

Historically, radiography has been at the forefront of imaging after the lameness has been localized to the heel region. Although advancements have been made through the use of high-detail film and digital radiography, very few, if any, “new” lesions have been identified within the osseous structures of the heel. Also, as our knowledge increases regarding heel pain, it is apparent that much of the heel-associated lameness is soft tissue in origin. Radiography will, however, remain an integral and necessary part of the evaluation as long as the cli-
bician recognizes the potential pitfalls of false-positive and false-negative findings.

Digital radiography aids tremendously with efficiency and quality control, but it provides no more information than a good-quality conventional radiograph. To ensure good-quality radiographs, the foot must be clean, and attention should be given to position and technique. Depending on the type of shoe present, it may be necessary to remove the shoe for radiographs. The most salient views are the lateral to medial projection, 65° dorsal-palmar projection, and flexor tangential (skyline or palmar-proximal-palmarodistal oblique) view of the navicular bone. Horizontal-beam dorsal-palmar and oblique views may be necessary to further define some lesions. The lateral to medial projection should be performed with the foot on a standard block for uniformity. The beam should be 1–1.5 cm proximal to the block surface and parallel to a line bisecting the heel bulbs centered on the foot in a dorsal-palmar plane. This will allow accurate assessment of the sole depth, palmar angle, and dorsal-wall alignment of the distal phalanx and shape and size of the navicular bone. Also, laminar thickness and alterations in soft-tissue density within the heel area may be assessed. The 65° dorsal-palmar projection of the navicular bone may be performed with the cassette or imaging panel in a tunnel or with the foot on an elevated block on the toe. The cassette is positioned vertically against the sole of the foot, and the radiograph beam is directed perpendicular to this. This projection gives a less magnified and distorted view of the navicular bone than the conventional tunnel view.

The flexor tangential navicular view may be performed with the cassette positioned caudal to the perpendicular plane of the limb to allow the limb to be positioned ~12–16 in caudal to the perpendicular. The ideal beam projection should be between a line parallel to the angle of the pastern and the angle of the heels. In low-heel horses, a 15° elevation block may be required to obtain the proper angle to view the palmar surface of the navicular bone.

Lesions recognized as significant include loss of corticomedullary demarcation, cortical erosive lesions, cyst-like lesions, remodeled borders of the navicular bone, fractures of the navicular bone, or mineralization of the DDFT. Over the years, there have been recognized exceptions to almost all of these findings, which makes researchers doubtful of the correlation between radiographic findings of the navicular bone and clinical signs of heel pain. The most recent advancement in imaging technology for heel lameness has been the introduction of MRIs.18–22 Several pathological entities have now been recognized including DDFT lesions in areas inaccessible by ultrasound, cartilaginous damage of the DIP joint, and navicular-bone pathology not identified radiographically. Injury to the impar ligament, collateral DIP ligaments, or collateral navicular suspensory ligaments have also been diagnosed with MRI. The major disadvantage for MRI for the general practitioner is affordability and lack of implementation in a field setting. Although systems are readily available in hospital settings, cost will preclude the widespread application on a routine basis for most horse owners.

Nuclear scintigraphy likewise has application in some situations and may aid in differentiation of primary bone pathology, DDFT insertional disease, and disease of the DIP joint.23,24 As with MRI, there is limited application for the general practitioner, and it is restricted to use predominately in referral centers.

Newer techniques in ultrasonography through the frog and heel region allow inspection of a segment of the DDFT and its insertion, impar ligament, and distal border of the center third of the navicular bone.25,26

Diagnosis of heel pain is a clinical exercise and although no single imaging modality is suited to every situation, all have merit in a given setting. As with other aspects of medicine, a joint effort of several diagnostic aids is required to obtain as specific of diagnosis as possible.

References


