Blind Splint Complex and Suspensory Desmitis

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Introduction

Suspensory desmitis should be classified according to the affected limb (forelimb, hind limb), duration of injury (acute, chronic-recurrent), level of injury (origin, body, branch or branches, insertion), coexistent (concurrent) injury to the distal sesamoidean ligaments, and if there is complex injury, suspensory desmitis and involvement of adjacent bony structures. In order to understand and compare various methods to manage simple suspensory desmitis you are compelled to consider these important classification criteria.

For instance, horses with hind limb proximal suspensory prognosis have a much worse prognosis than those with a similar degree of injury in the forelimb. Horses, with recurrent suspensory desmitis cannot be expected to respond as those with acute injury. Horses in which the body of the suspensory ligament (SL) is injured as a result of extension either from initial injury at the origin or by incremental injury originally involving only a branch but subsequently the body of the SL, have a guarded to poor prognosis. Complex suspensory injury includes the blind splint complex and occurs at the origin (avulsion fracture of the palmar cortex of the third metacarpal [McIII] or third metatarsal bone [MtIII]), longitudinal fracture of the proximal palmar/plantar cortex of the McIII/MtIII, chronic insertional osteitis (increased radiopacity indicating chronic bony change), body (adhesions between the second and fourth metacarpal [McII/MtIV] and metatarsal [MtII/MtIV] bones), at the level of the branches (chronic recurrent branch desmitis with or without involvement of the distal aspects of the Mc/Mt II/IV bones), and at the insertion of the branches to the proximal sesamoid bones (PSBs) (chronic sesamoiditis, abaxial avulsion fragments, apical fractures of the PSBs).

Clinical characteristics and management of complex suspensory injury are detailed below. Many other important factors such as the horse’s use and level of competition, conformation and breed play important roles in determining prognosis.

Accurate Diagnosis

An in-depth discussion of diagnosis of complex suspensory injury is beyond the scope of these notes, but to determine the authentic source of pain causing lameness is paramount.

A few comments regarding diagnostic analgesia of this important area are in order. The high plantar/palmar periarticular block should be used to localize pain to the metatarsal/metacarpal region. For the metatarsal region, the medial and lateral plantar nerves and medial and lateral plantar metatarsal nerves are blocked just distal (approximately 1.5 cm) to the tarsometatarsal joint. Variations of this block are often used, but it is important to recognize that sub-tarsal analgesic techniques targeting the lateral plantar nerve, or its deep branch, will not block the medial plantar nerve and false negative results could be obtained. More importantly, false positive results incriminating the proximal aspect of the SL as a source of pain can occur. Sub-tarsal analgesia should be performed only after results of low plantar analgesia are observed, since most injection techniques in the sub-tarsal region are likely to desensitize the plantar metatarsal nerves, important contributors to innervation to the metatarsophalangeal joint.

A recent injection technique was described and has become popular in the diagnosis of proximal suspensory desmitis; the deep branch of the lateral plantar nerve (DBLPN) is blocked approximately 15 mm distal to the head of MtIV, just axial to MtIV, at a depth of 25 mm. While, in theory, this block is done in close proximity to the DBLPN, it is within the same fascial compartment as the parent branch leading to the possibility of blocking this important contributor to distal limb innervation. However, from the DBLPN arise the important medial and lateral plantar metatarsal nerves which descend to innervate the fetlock joint (see below). If performed as a stand-alone technique without first performing low plantar analgesia, sub-tarsal analgesia may lead the clinician to the erroneous impression pain is emanating from the proximal SL.

In a recent study, horses were managed for desmitis of the origin of the SL with desmoplasty and fasciotomy; but criteria for inclusion of cases suggested that pain was localized to the proximal metacarpal/metatarsal regions by use of only sub-carpal or sub-tarsal analgesia without first blocking the distal limb.

In the forelimb distal palmar outpouchings of the carpometacarpal joint complicating interpretation of diagnostic analgesic techniques. In the hind limb, distal plantar outpouchings of the tarsometatarsal joint can potentially be penetrated when high plantar analgesic techniques are performed. However, outpouchings of the joint were not seen in magnetic resonance images in a recent study comparing imaging modalities in the plantar metatarsus. In only 5% of limbs was the tarsometatarsal joint inadvertently penetrated when high plantar analgesic techniques are performed. However, outpouchings of the joint were not seen in magnetic resonance images in a recent study comparing imaging modalities in the plantar metatarsus. In only 5% of limbs was the tarsometatarsal joint inadvertently penetrated when high plantar analgesic techniques are performed. However, outpouchings of the joint were not seen in magnetic resonance images in a recent study comparing imaging modalities in the plantar metatarsus. In only 5% of limbs was the tarsometatarsal joint inadvertently penetrated when high plantar analgesic techniques are performed. However, outpouchings of the joint were not seen in magnetic resonance images in a recent study comparing imaging modalities in the plantar metatarsus.
distally as the lateral medial plantar metabaphyseal nerves that course on the axial aspects of each respective splint bone. Blocking the DLBLN provides analgesia of the origin of the SL, the plantar cortex of the MtIII and partial analgesia of sites more distal to the level of and including the metatarsophalangeal joint.

Accurate interpretation of diagnostic analgesia is critical when planning the surgical procedure, neurectomy of the DLBLN (NDBLPN), which has received considerable attention recently as a surgical approach to management of proximal suspensory desmitis (see below). Histological changes consistent with nerve compression were identified in horses undergoing NDBLPN and nerve compression was proposed as a possible cause for residual pain in horses even after desmitis resolved.9

In that study, 62% of horses returned to soundness after neurectomy8, whereas 19 of 20 horses with neurectomy and laminar fasciotomy were reported to have returned to the previous level of performance.8 The DLBLN that is resected and was studied lies within the dense metatarsal, but outside the laminar fascial planes. Recognition of neuritis in this segment indicates compression of the deep branch may be occurring within this fascial compartment.

**Longitudinal Fracture of the Palmar Cortex of the McIII and the MtIII**

This fracture involves, most commonly, the palmar cortex of the McIII, but occasionally occurs in the hind limb affecting the MtIII.10 This fracture occurs most commonly in young horses, 2- and 3-year-olds in race training, but can occur in non-race horses and in older horses. Horses often have mild undiagnosed forelimb lameness that becomes acute and pronounced, are painful to palpation along the proximal, palmar metacarpal region; and lameness is abolished or substantially improved with both sub-carpal and middle carpal diagnostic analgesic techniques. Occasionally, mild improvement is seen using low palmar analgesia. In general, affected horses have a simple fracture near the origin of the SL on the McIII without concurrent suspensory desmitis. This fracture can only be seen reliably in a dorso-plantar (DP) radiographic image and courses roughly in a longitudinal direction, medial to the axis of the McIII. Fractures can easily be misconstrued as coarse trabeculae because of surrounding increased radiopacity and lack of a crisp fracture line. In a lateromedial or flexed lateromedial radiographic image, increased radiopacity of the endosteal surface and medullary cavity of the McIII is often seen. Scintigraphic examination is quite useful and most often reveals focal mild-to-intense increased radiopharmaceutical uptake (IRU), roughly in a triangular pattern in lateral scintigraphic images and often in a linear pattern in dorsal images. Incongruity of the palmar cortex of the McIII can be seen ultrasonographically; and if associated suspensory desmitis is present, the situation becomes complex suspensory injury. Fractures occur distal to the origin of the SL, but it is compelling to assume the presence of this important structure concentrates forces in this general area predisposing to fracture. The presence of proximal suspensory desmitis worsens prognosis considerably. Palpation to determine the presence of swelling associated with the proximal aspect of the SL and ultrasonographic examination to confirm the diagnosis is important.

Magnetic resonance imaging (MRI) can be useful if horses have stress reaction or stress fracture of the McIII or the MtIII without obvious radiological evidence of fracture. Fractures heal with 4-6 months rest and it does not appear necessary to combine surgical management such as forage or internal fixation with proper rest. What is proper rest? A minimum of 4 months of rehabilitation without early race training and without turn out exercise is recommended – 4 weeks stall rest, 4 weeks stall rest with hand walking, 4 weeks walking in a mechanical walker or with a rider up, and 4 weeks walking and light trotting in a mechanical walker, with a rider up, in a jog cart or some other suitable step up in exercise program without rigorous training. Turn out exercise is avoided in particular in horses with surrounding suspensory desmitis and to limit the possibility of recurrence or aggravation of suspensory injury.

**Avulsion Fracture of the Palmar Cortex of the McIII/MtIII**

The clinical characteristics, diagnosis and management of horses with this injury are quite similar to that described for longitudinal fracture. This injury occurs more frequently in the forelimbs, and while occurring in the hind limbs, radiological identification of an actual fragment is more difficult in the hind limbs. Fragmentation occurs at the distal aspect of the origin of the SL and horses with this injury more often have concurrent suspensory desmitis. Horses with chronic suspensory desmitis can become suddenly, acutely lame and radiographic images reveal obvious increased radiopacity reflective of chronic injury. Small avulsion fractures occur in already weakened bone. The separation between horses with chronic recurrent suspensory desmitis and associated osteitis of the palmar/plantar cortex of the McIII/MtIII without fracture and those with a radiological identifiable fracture fragment is likely arbitrary. Prognosis is good in horses with fracture without surrounding suspensory desmitis and guarded to poor in those with complex suspensory injury. Some consideration should be given to aggressive management such as fasciotomy, bone marrow injection, NDBLPN, or a combination of various surgical and conservative approaches in horses with chronic, recurrent hind limb suspensory desmitis and avulsion injury of the MtIII (see below).

**Adhesions of the SL to the McII/MtII and McIV/MtIV and Associated Suspensory Desmitis – Blind Splint Complex?**

Without using MRI, the diagnosis of a “blind splint” can remain a mystery, and even using this modality there are sources of pain that remain undiscovered. However, MRI is useful in the diagnosis of adhesions between the SL and the associated small metacarpal bones.11 Horses most often have chronic, recurrent lameness and have been managed using local injections, rest, anti-inflammatory agents, extracorporeal shock wave therapy, and therapeutic ultrasound among other modalities. Pain causing lameness is localized to the metacarpal region using sub-carpal analgesia. A unilateral 2-point block, blocking the palmar metacarpal and palmar nerve on the affected side of the limb above the painful region of the suspected adhesion, provides more comprehensive analgesia than does simply locally infiltrating the suspected region. Infiltration of local anesthetic solution along the abaxial surface of a splint exostosis will not resolve pain resulting from...
adhesions on the axial surface of the splint bone. Radiographs usually reveal an abaxially located exostosis that may be smooth or mildly proliferative; but there is often subtle evidence of extension, axially. Axial extension of a splint exostosis could encroach on the nearby SL and cause pain or localized suspensory desmitis without adhesions. Ultrasonographic examination can reveal suspensory body desmitis and dynamic imaging with the limb elevated from the ground will often show the ligament is adhered to the axial aspect of the affected small metacarpal bone. Exostoses can be seen in longitudinal images and focal suspensory desmitis is confirmed. MRI can be quite useful in defining the lesion; however, given lack of clinical response, chronic pain refractory to therapy and pain causing lameness localized to the site, surgery can be recommended without the use of MRI. Surgical exploration of painful splints suspected of causing complex suspensory injury should be reserved for horses with chronic, refractory pain, in which conventional methods have failed.

The horse is placed with the affected side of the affected limb uppermost and a dorsal-based curvilinear incision is used to approach the affected region. Most often extensive adhesions among all tissue planes are encountered, and may involve other nearby soft tissue structures such as the accessory ligament of the deep digital flexor tendon, or perilaminar fascia surrounding the SL, which is adhered. Perhaps it makes little difference since it appears there is constriction of the SL and restriction of movement. Adhesions often involve the axial aspect of the involved splint bone at an actual exostosis, which is removed using an osteotome, and smoothed using a bone rasp. A liberal amount of the adhered superficial and deep fascia is removed (fasciectomy) and adhesions are sharply incised (adhesiolysis). The portion of splint bone is left intact (neither is the distal aspect removed nor is segmental ostectomy performed). Some consideration could be given to segmental ostectomy, but removing the splint bone from the site, distally, potentially causes additional adhesions and pain after surgery. Local injections into the SL, if desmitis exists (bone marrow, bone marrow concentrate, platelet-rich plasma), can be performed. If bone marrow derived mesenchymal stem cells were cultured, the cells can be injected at the time of surgery, or injected under ultrasonographic guidance after surgery. Hylan G-F is injected between the SL and smoothed axial aspect of the involved splint bone. Only the subcutaneous tissues and skin are closed; no attempt is made to suture the metacarpal/metatarsal, since this tissue was removed (fasciectomy) and is the very tissue causing compartment syndrome and contributing to adhesions. The horse is given 2 weeks of stall rest and then 4 weeks of stall rest with deliberate hand walking program, followed by 4-6 weeks of walking with a rider up. Length of rest is determined by the degree of suspensory desmitis and preoperative lameness grade. Therapeutic ultrasound may help during rehabilitation. Shock wave therapy is delayed for a minimum of 45 days after surgery. The surgery site is always thickened and undoubtedly fibrous tissue forms in the deep portion of the incision; whether or not adhesions form is questionable, but they are likely. While the cosmetic appearance at the site is often questionable (firm fibrous swelling, smooth proliferative changes along the abaxial aspect of the involved splint bone form), outcome has been favorable in a limited number of horses. (All of 4 horses became sound and went back into full work, but in one horse a similar condition developed in the contralateral limb 1 year after requiring surgery. In an elite event horse, recurrent lameness prompted re-operation in the original surgery site 14 months later. Her horse returned to eventing after both surgical procedures). Inflammation and lameness do not resolve quickly, but prognosis is likely 75%.

Suspenory Branch Desmitis

Chronic, recurrent branch desmitis can be a frustrating clinical problem. Be aware that pain associated with a branch desmitis can be abolished with intra-articular analgesia of the nearby metacarpal/meta-tarsophalangeal (fetlock) joint and commonly there is concurrent osteoarthritides of the fetlock joint. It is important to evaluate the distal aspects of the splint bones and the PSBs for the presence of fractures or small fragmentation. Ligament splitting (modified Asheim procedure), a time-honored technique, has value in horses with branch desmitis and avulsion injury at the distal attachment to the PSBs and can be combined with ostectomy of the small metacarpal/metatarsal bones and of apical and abaxial fractures of the PSBs. Branch desmitis can be chronic or recurrent and in some horses non-healing core lesions are found. These horses are prime candidates for ligament splitting, bone marrow injection or potentially debrideing using palmar/plantar fetlock arthroscopic approaches. Pain can originate from the suspensory branch without the presence of an actual core lesion; enlarged painful branches may not appear to be active, ultrasonographically, but are painful to palpation and pain-causing lameness can be localized using diagnostic analgesia. In a limited number of STB racehorses with chronic recurrent branch desmitis, I have combined ligament splitting with bone marrow injection with fair success. In sports horses splint bone fractures are unusual but these horses are prone to the development of chronic, recurrent branch desmitis. To split the suspensory ligament I prefer to use numerous linear incisions made in fan-like fashion with a double-edged tenotome. Needle decompression of core lesions in the suspensory ligament lacks merit in my experience since many horses with suspensory desmitis lack distinct core lesions; the ultrasonographic and healing characteristics of horses with suspensory desmitis differs from those with superficial digital flexor tendonitis.

Surgical Management of Suspenory Desmitis

I have used the combination of fasciectomy and bone marrow injection (fresh liquid bone marrow or bone marrow concentrate) in jumpers, dressage horses and STB racehorses with chronic, recurrent suspensory desmitis with fair to good results. Most horses have severe, chronic, recurrent hind limb lameness with large cross-sectional area measurements, involvement of the origin and body of the ligament, have fetlock drop, straight hock conformation and are upper-level horses. Fasciectomy is done to reduce the potential for compartment syndrome in the proximal metatarsal (metacarpal) region, to reduce compression on nearby nerves and to improve gliding function of the enlarged suspensory ligament. Bone
Lateral plantar neurectomy is performed using a 6-8 cm incision along the dorsolateral edge of the superficial digital flexor tendon (SDFT), centered at the level of the tarsometatarsal joint. The DBLPN can be found between the SDFT and long plantar ligament, coursing parallel to the parent lateral plantar nerve. The DBLPN courses abruptly dorsally and enters a small depression in the proximal aspect of the SL. A 2-cm segment is removed. Occasionally the DBLPN is surprisingly hard to find. After NDBLPN horses do not immediately become sound and it takes 2-4 months for substantial improvement, in particular in those horses managed for chronic, recurrent suspensory desmitis in which cross sectional areas are greatly enlarged. While catastrophic breakdown of the suspensory has not been reported, experience is lacking.

References

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