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Abstract: Proximal suspensory desmitis of the hindlimbs commonly affects performance horses. Definitive diagnosis is usually achieved by the combination of clinical signs, diagnostic analgesia, and medical imaging. Conservative treatment, including stall rest followed by an incrementally increasing exercise regimen, with or without radial pressure-wave therapy, is often unrewarding. However, surgical intervention to interrupt the innervation of the suspensory ligament, with or without transection of the restricting fascia plantar to the suspensory ligament, may provide the best prognosis for return of full athletic function.

Proximal suspensory desmitis (i.e., inflammation of the proximal aspect of the suspensory ligament) of the hindlimb is a cause of acute or chronic lameness in horses.1,2 It is most frequently diagnosed in horses 4 to 10 years of age that are used for dressage, general purpose competition, and eventing.3–5 Horses with excessively straight hocks or with hyper-extended metatarsophalangeal joints seem to be predisposed to proximal suspensory desmitis of the hindlimbs.1 Thoroughbreds and Thoroughbred crosses appear to be more commonly affected.4

The proximal aspect of the suspensory ligament is rigidly confined by the plantar aspect of the third metatarsal bone, the axial borders of the second and fourth metatarsal bones, and the deep fascia covering the suspensory ligament.1 These unique anatomic features likely contribute to the development of proximal suspensory desmitis. Sensory and motor innervation of the suspensory ligament is provided by the deep branch of the lateral plantar nerve (DBLPN) and its branches—the medial and lateral plantar metatarsal nerves6 (Figures 1 AND 2). The tibial nerve supplies the lateral plantar nerve, from which the DBLPN originates.7 The DBLPN and plantar metatarsal nerves may be damaged when they are compressed due to an inflamed suspensory ligament. Compression of these nerves may explain the poor response to treatment with rest alone of horses that are lame because of hindlimb proximal suspensory desmitis.8

Diagnosis
Diagnosis of proximal suspensory desmitis of the hindlimbs is based on clinical signs, physical examination, regional analgesia of the proximal aspect of the suspensory ligament, ultrasonographic examination of the suspensory ligament and other structures on the plantar aspect of the metatarsus, and radiographic examination of the proximal aspect of the third metatarsal bone.3–6,9 Nuclear scintigraphy is unreli-
able in establishing a diagnosis of proximal suspensory desmitis.1

Hindlimb lameness caused by proximal suspensory desmitis is often characterized by a decreased arc of foot flight with a shortened cranial phase. Lameness is usually most obvious when the horse is ridden and is usually exacerbated in 85% of affected horses by flexion of the affected limb.8,9 Lameness improves substantially after anesthesia of the DBLPN, or lateral and medial plantar metatarsal nerves at the proximal aspect of the metatarsus or can improve after instillation of local anesthetic solution at the site of insertion of the suspensory ligament.1,3 Analgesia of the DBLPN is best achieved by inserting a needle 15 mm distal to the head of the fourth metatarsal bone and axial to the bone to a depth of 25 mm and injecting 2 to 4 mL of local anesthetic solution.7,8 Inadvertent injection of the tarsal sheath or the tarsometatarsal joint may cause false-negative results.8 However, intraarticular analgesia of the tarsometatarsal joint occasionally alleviates lameness caused by proximal suspensory desmitis. Therefore, proximal suspensory desmitis should be considered as a cause of lameness if a horse suspected to be lame from osteoarthritis of the tarsometatarsal or distal intertarsal joint responds to diagnostic analgesia administered in the location described above but fails to respond to intraarticular medication, especially if radiographic examination reveals minimal changes in these joints.8

High-quality ultrasonographic images are helpful in the diagnosis of proximal suspensory desmitis of the hindlimbs.6 The most common ultrasonographic abnormalities recorded in a study of 42 horses included diffuse reduction in echogenicity involving the dorsal border of the ligament in 23 horses, enlargement of the ligament in the median or transverse plane in 12 horses, and poor definition of the dorsal border in five horses.3,4 Other ultrasonographic changes associated with proximal suspensory desmitis include the presence of one or more hypoechoic areas, either centrally or peripherally, hyperechogenic foci, and irregularity of the plantar cortex of the third metatarsal bone.5,4 Combinations of these lesions are often seen. In addition, ectopic mineralization is more common in hindlimb suspensory ligaments than in the forelimbs; focal, anechoic areas are more commonly observed in the forelimbs.5 Recently, however, the value of ultrasonography in establishing the cross-sectional area of the proximal aspect of the suspensory ligament has been questioned by demonstration of its poor correlation with measurements obtained using magnetic resonance imaging (MRI) and histology.10 When MRI was used as the gold standard to establish

Critical Point

Proximal suspensory desmitis of the hindlimbs is sometimes difficult to confirm by ultrasonographic examination of the ligament because of the surrounding bony structures.
Proximal Suspensory Desmitis of the Hindlimbs

A diagnosis of proximal suspensory desmitis, ultrasonography was found to have 90% sensitivity but only 8% specificity in diagnosing proximal suspensory desmitis. Radiographic abnormalities involving the proximal aspect of the third metatarsal bone are often associated with proximal suspensory desmitis. Common abnormalities observed in the lateromedial projection include alteration of trabecular orientation and new periosteal bone formation on the proximoplantar aspect of the third metatarsal bone. Trabecular sclerosis is frequently seen in the dorsoplantar projection. MRI was used successfully to identify proximal suspensory desmitis in the forelimbs of horses, and a recent report described MRI results evaluating the hindlimbs of 25 horses with proximal plantar metatarsal pain. Primary desmitis without osseous abnormalities was identified in six of the horses, primary desmitis with osseous abnormalities was identified in seven, and primary osseous abnormalities without desmitis were identified in eight. Four of the 25 horses had no obvious abnormalities. Lesions of the suspensory ligament identified during MRI included focal or generalized areas of signal hyperintensity, with or without enlargement of the cross-sectional area of the suspensory ligament, and adhesions between the plantar aspect of the third metatarsal bone and the dorsal surface of the suspensory ligament. These findings suggest that proximal suspensory desmitis is often associated with osseous disease, which may influence response to treatment and prognosis. Equine patients with pathologic changes at the interface of the suspensory ligament and the plantar aspect of the third metatarsal bone may have a worse prognosis for return to

Critical Point

Radiographic abnormalities involving the proximal aspect of the third metatarsal bone are often associated with proximal suspensory desmitis.

The hindlimb of an equine cadaver showing the ramification of the lateral plantar nerve in the proximal plantar region of the metatarsus. The superficial and deep digital flexor tendons (1) have been transected and folded proximally and distally. The structures include the lateral plantar nerve (2), the deep branch of the lateral plantar nerve (DBLPN; 3), fibers of the DBLPN entering the suspensory ligament (4), the medial plantar metatarsal nerve (5), and the lateral plantar metatarsal nerve (6). (The distal portion of the limb is at the top of the photograph.)

Cross-section of the left hindlimb, approximately 5 cm distal to the tarsometatarsal joint, of an equine cadaver showing the fascia (7) plantar to the suspensory ligament. (MTII, MTIII, MTIV = second, third, and fourth metatarsal bones, respectively; DDFT = deep digital flexor tendon; SDFT = superficial digital flexor tendon; SL = suspensory ligament; 5 and 6 = medial and lateral plantar metatarsal nerves, respectively)
soundness than patients with disease involving only the suspensory ligament.13

Treatment

Treatment of equine lameness due to proximal suspensory desmitis of the hindlimbs has included restriction of exercise followed by a regimen of gradually increasing exercise.2,4 Although approximately 90% of horses with proximal suspensory desmitis of one or both forelimbs return to soundness with this treatment,15 most horses with proximal suspensory desmitis of one or both hindlimbs remain lame.2,4 In one study, only 6 of 42 horses with proximal suspensory desmitis of one or both hindlimbs treated with confinement followed by a regimen of controlled, gradually increasing exercise were able to return to their previous level of activity, without recurrent lameness, for more than a year.4 Compartment syndrome and associated neuropathy persist despite prolonged rest and may explain chronic pain and lameness associated with proximal suspensory desmitis. In people, abnormalities of the median nerve caused by entrapment may be permanent, adversely affecting the functional outcome of human patients undergoing surgical decompression of this nerve.15 Postmortem examination demonstrated evidence of peripheral nerve compression in 12 of 14 horses with proximal suspensory desmitis.8 These findings suggest that excision of a portion of the DBLPN, rather than decompression of the nerve alone, may be necessary to resolve lameness.

Treating horses with proximal suspensory desmitis of the hindlimbs with radial pressure-wave therapy in addition to exercise restriction, improves their prognosis for return to soundness.5 In one study, 18 of 44 horses with proximal suspensory desmitis of one or both hindlimbs that received radial pressure-wave therapy in addition to restriction of exercise for 12 weeks were able to return to their previous level of activity for at least 6 months without recurrence of lameness.5

Hewes and White2 reported that 85% of horses with lameness due to proximal suspensory desmitis of the hindlimbs characterized by core lesions and treated with desmotomy, fasciotomy, and exercise restriction for 30 days were able to return to full work. Other treatments for proximal suspensory desmitis include infiltration of a glucocorticoid around the insertion of the affected suspensory ligament of acutely affected horses,6 injection of bone marrow16 or bioscaffold material12 into the ligament, and systemic or local administration of glycosaminoglycans.2

Excision of a segment of the DBLPN to desensitize the suspensory ligament, either alone or combined with resection of the fascia plantar to the suspensory ligament to decompress the ligament, has been used by us and others7 to treat horses for lameness of one or both hindlimbs caused by proximal suspensory desmitis.

Surgical Technique

The horse is anesthetized and positioned in dorsol recumbency with its hindlimbs flexed, and the area between the metatarsophalangeal joint and the crural region is aseptically prepared for surgery. A 6- to 8-cm longitudinal skin incision, centered at the level of the tarsometatarsal joint, is made at the lateral border of the superficial digital flexor tendon (Figure 3). A small stab incision is made through the flexor retinaculum and extended to the length of the cutaneous incision using scissors. The incision in the flexor retinaculum should be located 3 to 4 mm axial to the fourth metatarsal bone to provide sufficient tissue to easily suture the retinaculum.

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Critical Point

Nonsurgical treatments (e.g., confinement, shock-wave therapy) are often ineffective in resolving lameness due to proximal suspensory desmitis of one or both hindlimbs.

Compartment syndrome results in ischemic neuropathy from compression of capillaries among the bundles of nerve fibers. The condition persists despite prolonged rest and may explain chronic pain and lameness associated with proximal suspensory desmitis.
Proximal Suspensory Desmitis of the Hindlimbs

and the subcutis are closed separately using 2-0 absorbable suture material in a continuous pattern. The skin is apposed using skin staples or nonabsorbable, 0-nylon or polypropylene suture in a vertical mattress suture pattern. The affected area is protected with a bandage.

**Aftercare**

The affected limb should be rebandaged every 3 to 4 days until the sutures or staples are removed 14 days after surgery. An NSAID, usually phenylbutazone (2.2 mg/kg PO) or flunixin meglumine (1.1 mg/kg PO), is administered once or twice daily for 4 to 7 days. The patient is confined to a stall for 3 weeks but walked daily. After 3 weeks, the patient can be placed in a small paddock. Four to 8 weeks after surgery, the patient should be reexamined for lameness and the suspensory ligaments of the hindlimbs examined ultrasonographically. The patient can gradually resume training 4 to 8 weeks after surgery if ultrasonographic examination of the suspensory ligaments demonstrates no evidence of fiber disruption.

**Prognosis**

Neurectomy, with or without plantar fasciotomy, appears to result in a better prognosis for return to soundness compared with treatment by confinement with gradual return to full exercise or treatment with radial pressure-wave therapy combined with restriction of exercise. In our practices, 102 horses underwent excision of the DBLPN without transection of the fascia plantar to the suspensory ligament without severe complications. Follow-up data obtained at least 3 months after surgery revealed that 91 (89%) of these horses were able to return to their previous level of exercise without recurrence of lameness (unpublished data). In another study of horses with proximal suspensory desmitis of one or both hindlimbs, 214 of 271 horses (79%) that underwent both resection of a portion of the DBLPN and plantar fasciotomy of one or both hindlimbs were able to return to their previous level of exercise.13 Horses that had severe lameness of one or both hindlimbs due to proximal suspensory desmitis can be returned to soundness by resecting a portion of the deep branch of the lateral plantar nerve of the lame limb.

**Critical Point**

Most horses with lameness of one or both hindlimbs due to proximal suspensory desmitis can be returned to soundness by resecting a portion of the deep branch of the lateral plantar nerve of the lame limb.

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**Figure 3**

The hindlimb of an equine cadaver showing the skin incision over the lateral border of the superficial digital flexor tendon. A small nick (arrow) is present in the flexor retinaculum. The needle is placed into the tarsometatarsal joint to show the relationship of this joint to the incision. (The distal portion of the limb is at the top of the photograph.)

**Figure 4**

A hindlimb of an equine cadaver showing the location of the lateral plantar nerve (2) below the flexor retinaculum. (The distal portion of the limb is at the top of the photograph.)
Proximal Suspensory Desmitis of the Hindlimbs

Blunt dissection between the deep digital flexor tendon (1) and the suspensory ligament of a cadaver using a curved mosquito forceps exposes the deep branch of the lateral plantar nerve (arrow). This nerve is elevated with the forceps and resected using a scalpel. The lateral plantar nerve is retracted laterally with a Penrose drain. (The distal portion of the limb is at the top of the photograph.)

The hindlimb of an equine cadaver showing transection of the fascia (7) plantar to the suspensory ligament. The lateral plantar nerve is retracted laterally using a Penrose drain, and the deep branch of the lateral plantar nerve is elevated using a mosquito forceps. The superficial and deep digital flexor tendons are held medially with a handheld retractor. (The distal portion of the limb is at the top of the photograph.)

ultrasonographic lesions of the suspensory ligament received an injection of bone marrow or xenogenic extracellular matrix (ACell Inc., Jessup, MD) into the lesions and underwent plantar fasciotomy and resection of a segment of the DBLPN. Of the 25 horses treated in this manner, 84% became sound. Horses with pain thought to be caused by insertional desmopathy (diagnosed when the lameness was not substantially affected by anesthesia of the DBLPN but was dramatically ameliorated after the origin of the suspensory ligament was infiltrated with local anesthetic solution) were treated by resection of a segment of DBLPN, plantar fasciotomy, and osteostixis of the proximal plantar aspect of the metatarsus. Only 55% of these 35 horses returned to their previous level of exercise after receiving this combination of treatments.

The primary complication associated with the procedure is the failure to resolve lameness. This may be due to either the presence of an additional DBLPN contributing to the innerva- tion of the suspensory ligament or other conditions that may coexist before surgery or develop after surgery. Other complications of the surgery include incisional infection (our observation) and complete breakdown of the suspensory ligament (anecdotal reports). We have observed neither clinically appreciable changes in cutaneous sensation nor development of a painful neuroma after excision of a portion of the DBLPN, although the latter is a common complication of palmar digital neurectomy.

References
Proximal Suspensory Desmitis of the Hindlimbs

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3 CE CREDITS

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1. What conformational hindlimb abnormality(ies) predispose(s) horses to proximal suspensory desmitis?
   a. excessively straight hocks
   b. sickle hocks
   c. hyperextended metatarsophalangeal joints
   d. a and c

2. Which imaging modality is the least reliable in confirming a diagnosis of proximal suspensory desmitis of the hindlimbs?
   a. ultrasonography
   b. radiography
   c. nuclear scintigraphy
   d. MRI

3. What is the most common ultrasonographic change associated with proximal suspensory desmitis of the hindlimbs?
   a. enlargement of the ligament on the median or transverse plane
   b. diffuse reduction in echogenicity
   c. poor definition of the dorsal border of the suspensory ligament
   d. diffuse mineralization of the ligament

4. Which radiographic abnormality is not seen with proximal suspensory desmitis of the hindlimbs?
   a. alteration of the orientation of trabeculae on the proximal aspect of the third metatarsal bone
   b. new periosteal bone formation on the proximoplantar aspect of the third metatarsal bone
   c. trabecular sclerosis affecting the proximal aspect of the third metatarsal bone
   d. subchondral bone lysis affecting the proximal aspect of the third metatarsal bone

5. MRI has been used successfully to establish a diagnosis of proximal suspensory desmitis in
   a. forelimbs only
   b. hindlimbs only
   c. forelimbs and hindlimbs
   d. none of the above

6. In one study, ____ of 44 horses with proximal suspensory desmitis of one or both hindlimbs that received radial pressure-wave therapy in addition to restriction of exercise for 12 weeks were able to return to their previous level of activity for at least 6 months without recurrence of lameness.
   a. 12
   b. 18
   c. 21
   d. 28

7. The suspensory ligament of the hindlimb is innervated by the
   a. DLBLN
   b. medial plantar metatarsal nerve
   c. lateral plantar metatarsal nerve
   d. all of the above

8. The lateral plantar nerve is a branch of the ______ nerve.
   a. tibial
   b. deep peroneal
   c. superficial peroneal
   d. lateral metatarsal

9. To resect a portion of the DLBLN, the clinician should center the skin incision
   a. 6 to 8 cm proximal to the tarsometatarsal joint
   b. at the level of the tarsometatarsal joint at the lateral border of the superficial flexor tendon
   c. 6 to 8 cm distal to the tarsometatarsal joint
   d. close to the level of the tarsometatarsal joint at the medial border of the superficial flexor tendon

10. In horses with lameness due to proximal suspensory desmitis of the hindlimbs, _____% returned to soundness after resection of a portion of the DLBLN without fasciectomy.
    a. 89
    b. 60
    c. 55
    d. 41