Treatment of Suspensory Ligament Desmopathy

Nathaniel A. White II, DVM, MS, Diplomate ACVS; and Christina A. Hewes, DVM, MS, Diplomate ACVS

Suspensory ligament desmopathy is a significant cause of lameness in performance and racehorses. Although injuries to the branches and body can normally be treated successfully with supportive care and rest, injuries at the origin and insertion can become chronic non-healing injuries, which require stimulation of healing to resolve the lameness. Authors’ addresses: Marion duPont Scott Equine Medical Center, PO Box 1938, Leesburg, VA 20177 (White); and PO Box 620930, Woodside, CA 94062 (Hewes); e-mail: nawhite2@vt.edu. © 2008 AAEP.

1. Introduction

Suspensory desmopathy or desmitis has been reported to be more common in Thoroughbred racehorses and horses used as hunters, jumpers, or for dressage. Suspensory desmopathy is also observed frequently in western performance horses.1–4 The site of injury in Thoroughbred and Standardbred racehorses is predominantly in the suspensory body and branches.5 Recent reports suggest that lesions at the origin of the suspensory ligament are prevalent in horses used for performance.6

Suspensory desmopathy causes a mild to moderate lameness in the affected limbs. Acute desmitis can cause localized heat, slight edematous swelling, pain on palpation of the ligament, and rounded borders and enlargement seen on ultrasonograms of the suspensory ligament. The clinical signs are more obvious with injuries of the suspensory body and branches versus injuries at the origin of the ligament.7 Front limb lameness caused by proximal suspensory desmitis is often observed in the outside limb when the horse is trotted in a circle on a hard surface or soft ground. Bilateral lesions are also common and may result in changes in stride rather than overt lameness. Proximal suspensory injury can cause mild and intermittent lameness in front and rear limbs and may be initially missed by riders. Suspensory ligaments affected by chronic desmopathy may have no palpable abnormalities.

Local anesthesia in the region of the suspensory injury or perineural analgesia of the lateral and medial palmar/plantar nerves and/or combined with metacarpal or metatarsal nerves is used to localize pain from the suspensory ligament.5 In the front limb, anesthesia of the middle carpal joint will frequently anesthetize the origin of the suspensory ligament near the palmar joint pouch.8 In the rear limb, local anesthesia of the lateral plantar nerve seems to be specific for pain from the proximal suspensory ligament.6,9 Definitive diagnosis of suspensory desmitis is made with ultrasonography, which is used to evaluate the size of the affected ligament and the length and area with fibers with abnormal echogenicity. Scintigraphy can be used to identify involvement of the proximal third metacarpal/metatarsal bone and the suspensory attachment, but radiographs are needed to diagnose avulsion fractures, which are suspected on ultrasonograms or scintigraphs.10
Ultrasonographic abnormalities associated with suspensory ligament injury include enlargement of the cross-sectional area, poor demarcation of suspensory ligament borders, focal or diffuse areas of decreased echogenicity, focal anechoic core lesions, reduced regularity in fiber pattern, and focal mineralization. The degree of the ultrasonographic abnormality often reflects the severity of the lameness. Magnetic resonance imaging has even greater lesion sensitivity with evidence of size and fiber change, which was not evident on ultrasound in some horses.

2. Suspensory Ligament Pathology

There are few reports of the histological lesion of suspensory ligament desmitis. Most injuries heal successfully and horses return to the same or lesser level of activity. Although suspected to be similar to tendon injuries, the chronic nature of some suspensory ligament injuries suggests an alternative tissue response. Normal suspensory ligament microscopic appearance is similar to tendon with linear alignment of the fibers with neurovascular entry in the fascia around the fascicles (Fig. 1). Specimens from horses with severe desmopathy diagnosed by ultrasound (Fig. 2) and failure of the suspensory apparatus exhibited by excessive fetlock extension and a straight leg conformation had marked fiber disruption with focal acellular foci interspersed with hypercellular accumulations of disorganized fibroblasts (granulation tissue; Fig. 3). There is evidence of attempted regeneration by fibroplasia, but lack of healing is apparent in distinct focal areas with no vascular supply and disorganized collagen, which appears immature (Fig. 3). Nerve damage is also evident, with loss of axons in nerves associated with the periligamentous fascia.

Proximal rear suspensory ligament core lesions diagnosed by ultrasonography in chronically lame horses with excessive fetlock extension usually do not respond to rest or conservative treatments. Although these horses have excessive fetlock extension representing loss of suspensory ligament support, the ultrasonograms appear similar to both acute and chronic injuries of the proximal suspensory ligament in horses with normal conformation. Based on the concurrent histological findings in horses with loss
of suspensory support evident at its origin, the lesion is best termed a desmopathy.

Injured ligaments heal by the normal reparative processes including inflammation with removal of injured tissue, proliferation and migration of fibroblasts, which produce collagenous tissue, and liga-

ment remodeling. The collagen fibrils remodel as healing progresses until there is an increase in the number of cross-links between collagen molecules and realignment of the fibrils. In horses with chronic progressive suspensory desmitis with failure of fetlock support, the reparative process is abnormal, with isolation of collagen bundles from the blood supply and death of desmocytes or transformation into chondrocytes. Cartilage-like tissue is produced, resulting in an inelastic ligament that is at higher risk for re-injury. Treatment for the non-healing suspensory injury therefore needs to address chronic inflammation, vascular insufficiency, and ground substance abnormalities.

### 3. Treatment for Suspensory Ligament Desmopathy

Recommended treatments for acute suspensory desmitis include rest, support bandages, anti-in-
flammatory therapy, and a slow return to controlled exercise. For severe or chronic desmopathy, ancil-

lary treatments have been recommended including local and/or systemic administration of glycosaminoglycans, administration of systemic corticoste-

roids, internal blister, injection of bone marrow or porcine bladder submucosa, injection with stem cells, injection with platelet rich plasma, shock wave of the lesion, fasciotomy with neurectomy of the deep branch lateral plantar nerve, and surgical splitting (desmoplasty) of core lesions in the injured portion of the ligament.

The majority of suspensory ligament injuries involving the branches or the body will heal with suf-

ficient rest. Similarly, 90% of proximal suspensory injuries in the front limb respond to rest with rehabilitation, although larger lesions have a higher rate of re-injury.

Shockwave therapy seems to be beneficial, particularly for lesions at the origin of the suspensory ligament. In two studies, ~60% of horses with fore-

limb and 40% of hind limb suspensory injuries, which did not heal with rest, returned to full work within 6 mo, although a high rate of recurrence was reported for the rear limb suspensory injuries, and injuries with a severe grade were less likely to re-

solve. Based on ultrasonographic evaluation, collagenase-induced desmits healed faster with shockwave treatment. Shockwave protocols vary with treatment every 2 wk using 1000–2000 shocks being recommended. Weekly treatment by the authors has also been used successfully on individual cases.

Injection with a variety of biological devices as a stimulus for healing seems to provide improved res-

olution of lameness. ACell is reported to provide an ~80% success rate for both front and rear sus-

pensory injuries. Injection of bone marrow aspiration or cultured stem cells has been used in suspensory ligaments with an ~80% success. Hypothetically bone marrow provides both stem cells and growth factors that stimulate ligament healing. A commercial company, which offers stem cell extraction and culture, reported a 76% success with intralesion injection of suspensory injuries. Intralesional injection of platelet-rich plasma, which also provides growth factors, was reported successful in nine of nine horses with severe mid-suspen-

sory body lesions with horses returning to racing.

Bathe reported ~79% success with horses returning to performance using the combination of lateral plantar neurectomy and fasciotomy to treat proximal rear limb suspensory ligaments with core lesions. It is not clear if the fasciostomy or neurec-

tomy is the reason for the success, but report of desmoplasty (surgical splitting) with fasciotomy suggest that the opening of the fascia is important.
for healing and the reason for the success of these combined techniques.\textsuperscript{23}

Suspensory desmoplasty (ligament splitting) has been used for several decades and is similar to tendon splitting. Tendon splitting was first developed in the 1960s and was reported in the 1970s to help with local regeneration of injured tendon tissue.\textsuperscript{24–26} One previous report of suspensory branch splitting describes a percutaneous incision with a tendon-splitting knife to produce a fan-like split in the ligament to open the ligament in Standardbred trotters. Fifty-nine percent of cases raced >10 races and 29% raced 1–10 races. Most horses raced 6–7 mo post-operatively. Because only 59% of horses raced >10 races, co-existent involvement of the proximal sesamoid bone was thought to have limited performance.\textsuperscript{25}

The desmoplasty with fasciotomy completed using ultrasound guidance opens both the core lesion and the palmar/plantar fascia. The technique is similar to tendon splitting and likely stimulates healing by decompression, neovascularization, and fibroplasias in areas lacking collagen replacement.\textsuperscript{26} The surgery is completed with horses under general anesthesia in lateral recumbency with the affected leg uppermost or in dorsal recumbency if bilateral lesions are present. The procedure is completed using ultrasound to guide a no. 11 scalpel blade or a ligament knife\textsuperscript{4} through stab incisions just lateral to the superficial flexor tendon.\textsuperscript{8} At the origin of the suspensory, the blade is advanced through the suspensory ligament lesion to the bone surface, which was scored with the blade at the suspensory origin (Fig. 4). Stab incisions are spaced at 2-cm divisions for decompression of the entire core lesion, which simultaneously opens the deep metatarsal fascia. The skin incisions (4–5 mm) are left open. A similar procedure can be performed on the forelimb proximal suspensory ligaments that do not heal with initial rest or shockwave treatment.

Recommended post-operative care for ultrasound guided desmoplasty consists of treatment with phenylbutazone (2.2 mg/kg, PO, q 12 h) for 5–7 days post-operatively and 30 days of absolute stall rest followed by 30 days of stall rest with 5–10 min of hand walking daily. After 60 days, an ultrasound examination is completed to make sure the core lesion has increased density from growth of new fibers. If improvement is detected on ultrasonograms and no lameness is detected, exercise is gradually increased (Table 1).\textsuperscript{23} The increase in exercise is dependent on improved fiber density on ultrasound at each subsequent ultrasound examination and stabilization or decrease in the cross-sectional area. Turn out is not recommended until horses are ridden at the walk, trot, and canter, indicating adequate ligament strength.

Ultrasound-guided desmoplasty can also be successful in stimulating healing in non-healing injuries at the insertion of the suspensory branches on the sesamoid bones and in the straight and oblique distal sesamoidean ligaments.\textsuperscript{i}

The technique has resulted in resolution of lameness with return to work in ~85% of horses that had long-term follow-up.\textsuperscript{23} The suspensory ligament ultrasonographic structure does not always return to normal, with some ligaments retaining hypoechoic areas or an increased cross-sectional area in

<table>
<thead>
<tr>
<th>Table 1. Typical Protocol for Exercise After Suspensory Ligament Desmoplasty</th>
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<td><strong>Weeks 1–4</strong></td>
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<td><strong>Weeks 5–8</strong></td>
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<td><strong>Walking in hand for 15 min twice daily or under saddle for 15 min once daily</strong></td>
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<td><strong>Walking under saddle for 30 min and trotting if allowed by healing of the suspensory ligament</strong></td>
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<td><strong>Walking and trotting under saddle with increasing trotting time weekly</strong></td>
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<td><strong>Walking, trotting, cantering and possible turn out dependent on ultrasonogram and absence of lameness</strong></td>
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<td><strong>Gradually increasing exercise progressing to regular work</strong></td>
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Fig. 4. Cross-section of a cadaver limb with a desmoplasty knife (arrow) guided by ultrasound through the metatarsal fascia and into the suspensory ligament. The blade is rotated longitudinally to open core lesions and the deep fascia. (Reprinted with permission from Hewes CA, White NA. Outcome of desmoplasty and fasciotomy for desmitis involving the origin of the suspensory ligament in horses: 27 cases (1995–2004). \textit{J Am Vet Med Assoc} 2006;229:407–412.)
sound horses. Failure seems to be related to the horse conformation. Horses with excess extension (dorsiflexion) of the fetlock are anecdotally slower to heal or never completely heal. These horses are more likely to be re-injured or never heal sufficiently to resolve the lameness.25 This may be related to the excess suspensory ligament tension likely present with this conformation. In two cases, a fetlock support shoe allowed for healing of the suspensory ligament with resolution of lameness albeit for light exercise and effective in decreasing the fetlock extension after the support shoe was removed.

Horses with forelimb injuries are usually able to return to full work 6–12 mo after surgery depending on the rate of healing. Horses with hind limb proximal suspensory injuries can take up to 18 mo before being in full work. In the authors’ experience, suspensory ligament injuries that are resistant to healing or that cause continued lameness may respond to repeat shockwave therapy after the surgery. Shockwave treatment is applied after the inflammation from the surgery has decreased (after 60 days), and to date, this has only been used for horses that stay lame after the surgery.

4. Discussion

New treatments have resulted in improved outcomes for suspensory ligament desmopathy. All the invasive techniques likely stimulate healing by physical stimulation and improved circulation and mobilization of local mesenchymal cells. Monitoring the rehabilitation with serial ultrasound examination is just as important as treatment used to stimulate healing. Experience suggests that exercise, applied to healing suspensory ligaments where healing has become static, can help stimulate new fiber growth or maturity resulting in increased echogenicity. The improved ultrasonographic character of the lesion normally corresponded with resolution of the lameness.

Fasciotomy combined with lateral plantar neurectomy for rear limb proximal suspensory desmitis resolved lameness in ~80% of horses.6 These results suggest that relief of the compartment pressure is a key to the success in healing this type of injury. This was also supported by the results of intralesional injection of porcine bladder submucosa b (urinary bladder matrix powder) for suspensory desmitis, in which 36 of 38 of the hind limb suspensory ligament desmopathies were also treated with a fasciotomy in addition to the porcine bladder submucosa b injection.17

The prognosis after desmoplasty is improved compared with a rest and rehabilitation program or shockwave therapy and should be considered as an alternative or in combination with other treatments. Careful monitoring of healing with a gradually increasing exercise program seems to be important in the rehabilitation program.

References and Footnotes


bACell Vet Urinary Bladder Matrix Powder, ACell, Jessup, MD 20794.

cVet Stem, Poway, CA 92064.

dSontec, Englewood, CO 80112.