Surgical Management of Soft Tissue Injuries – Update
Michael W. Ross, DVM, DACVS

I. SUSPENSORY DESMITIS

Suspensory desmitis, associated avulsion injury of the proximal aspect of the third metacarpal/metatarsal bones (MCIII/MTIII) and insertional injury (branch desmitis) on the proximal sesamoid bones (PSBs) are two of the most important soft tissue injuries in the racehorse and non-racehorse sport horse. In the Standardbred (STB) racehorse suspensory desmitis is a common primary and compensatory injury in both pacers and trotters. In trotters, desmitis of the origin and body of the hind suspensory ligament is debilitating and career limiting. Prognosis is better in pacers and in STBs with branch injuries when compared to those with body desmitis. In Thoroughbred (TB) racehorses, forelimb suspensory desmitis is much more common than hindlimb injury, medial branch desmitis and associated abaxial fracture of the PSBs is common, and a clear relationship between chronic low grade suspensory desmitis and subsequent breakdown injuries exists. Jumpers and dressage horses are particularly predisposed to suspensory desmitis and hindlimb injuries are most important. A relationship with chronic recurrent suspensory desmitis (particularly branch desmitis) and chronic osteoarthritis of the fetlock joint appears to exist. It is important to realize that intra-articular analgesia of the fetlock joint can abolish pain associated with branch desmitis and for that matter oblique sesamoidean desmitis and of course low palmar/plantar analgesia will abolish pain associated with both the fetlock joint and these important soft tissue structures.

Prognosis depends on signalment, performance type and level, level of suspensory injury, limb involved and if the injury is acute or chronic and recurrent. For instance, horses with acute forelimb proximal suspensory desmitis have a good prognosis with rest and controlled exercise alone without any attempt to augment reparative healing or to stimulate regenerative healing. Those with hindlimb lesions have a poor prognosis particularly if injury is recurrent. In order to make sense of the large number of currently in vogue treatment modalities one must ask 2 questions: which limb is involved and is the injury acute or recurrent? Currently both reparative and regenerative healing strategies are being used to manage suspensory desmitis yet conclusive evidence of the benefits of regenerative healing is lacking. Surgical management of suspensory and associated bony injuries is a viable option to augment reparative healing of the ligament.

Ligament splitting, 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 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 splitting, bone marrow injection (fresh bone marrow, bone marrow concentrate [BMC]) or potentially debridement using palmar/plantar fetlock arthroscopic approaches (I have had limited experience, and it has not matched the reported success [13/18 horses returned to work equal or better than before diagnosis.]). I am however, well-aware of the intimate association of the suspensory branches and the metacarpophalangeal/metatarsophalangeal joints (MCPJ/MTPJ) – there are often associated clinical signs such as effusion and early/moderate osteoarthritis coexistent with branch desmitis.

In a limited number of STB racehorses with chronic recurrent branch desmitis I have combined ligament splitting with fresh bone marrow injection with fair success. 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.

Bone marrow injection with or without fasciotomy and lateral plantar neurctomy is useful in management of chronic recurrent proximal suspensory desmitis (I have not performed lateral palmar neurctomy). The technique of bone marrow injection should likely be considered augmentation of reparative healing rather than regenerative healing since transfer of pluripotential stem cells is limited (certainly the potential exists, however). The technique is controversial and lacks substantive support but I have had success in selective cases. Transfer of growth factors and a limited number of stem cells are potential benefits but the technique might simulate acute injury to stimulate reparative healing. In one study, bone...
marrow supernatant (without cells) was superior to growth factors, platelet-rich plasma and fetal calf serum in causing up-regulation of protein production in fibroblast tissue culture.\(^2\)

I have used the combination of fasciotomy and bone marrow injection (fresh liquid bone marrow or BMC) in jumpers, dressage horses and STB racehorses with chronic, recurrent suspensory desmitis with fair to good results. Most horses have severe, chronic, recurrent hindlimb 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. Fasciotomy 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 marrow injection is done to augment reparative healing in combination with fasciotomy. Return to previous level of competition is strict criteria for success given the pre-injury level of these horses but is estimated at 40-50%. Recurrence of desmitis is common, however. Using this technique, fasciotomy is performed most commonly using a medial approach. In the proximal metatarsal (metacarpal) region there is a dense fascia that is confluent with the tarsal and carpal retinaculum. There a loose, thin “lamellar” fascia overlying the suspensory ligament deep to the deep digital flexor tendon (DDFT). The dense and lamellar fasciae attach to the plantar/palmar aspect of MTIV. This surgical procedure is performed using a medial approach as opposed to the more commonly done surgical approach being done currently, which uses a plantarolateral approach. A 6-8 cm incision is made in the proximal medial metatarsal region beginning approximately 3 cm distal to the tarsometatarsal joint (TMTJ). The dense metatarsal fascia is incised first using a \#11 scalpel blade on the plantar aspect of MTIV; the incision is extended both proximally and distally using a straight Mayo scissors from the level of the TMTJ to the distal extent of the lesion (usually mid-body). Since both dense and lamellar fascia attach to MTIV it appears fasciotomy cuts both layers. The origin of the suspensory ligament can be palpated or seen by retracting the deep digital flexor tendon in a plantar direction. The foramen in the proximal aspect of the suspensory ligament into which travels the deep branch of the lateral plantar nerve can be palpated and the nerve could be severed ([neurotomy] not done in any of the clinical cases mentioned); a neurectomy would be difficult to perform with limited exposure. Liquid bone marrow (60-80 ml) is harvested from the sternum using a \#11 Jamshidi needle and 60 ml syringe and injected directly into the suspensory ligament (origin – through the incision) or through pre-placed needles (when there is concomitant branch desmitis). Bone marrow concentrate can be used but volume is usually between 10-12 ml if 60 ml of fresh bone marrow is harvested. Subcutaneous tissues and skin are apposed routinely. Horses are given a minimum of 4 months of controlled exercise WITHOUT TURN OUT EXERCISE that includes 4 weeks of stall rest, followed by 4 weeks of stall rest with hand walking, followed by 4 weeks of walking with a rider-up (or in a jog cart) and followed by 4 weeks of walking a light trotting before beginning into an early training program.

Current recommendation: Fasciotomy and neurectomy of the deep branch of the lateral plantar nerve (DBLPN). Fasciotomy can be performed using a plantarolateral approach and with this approach neurectomy of DBLPN can be performed. Neurectomy of the DBLPN is performed using a 6-8 cm incision, centered at the TMTJ just along the dorsolateral edge of the superficial digital flexor tendon (SDFT). The parent LPN and the DBLPN can be found between the SDFT and long plantar ligament, once the SDFT has been retracted and dissection proceeds in the loose tissue deep to the SDFT. Using this approach the neurectomy is completed as is fasciotomy of both the dense metatarsal and laminar fascia of the suspensory ligament. I close only the subcutaneous tissues and skin leaving both fascial compartments decompressed. My results suggest that approximately 65-70% of horses go back into full work, but some do not become completely sound. Inexplicably, horses take between 2-4 months to become serviceably sound, so a quick turn-around does not occur. Catastrophic breakdown of the suspensory ligament can occur but is rare. In most horses recurrence of pain is the most common complication.

II. SUPERFICIAL DIGITAL FLEXOR TENDONITIS - IS THERE STILL A ROLE FOR SURGERY?

Surgical management continues to play an important role in the management of all horses with injuries to the SDFT, in both racehorses and sport horses. Intra-lesional therapy has certainly progressed and there are numerous options for augmenting repair of damaged SDFT. Regenerative therapy continues to improve and with additional experience healing of SDFT using this approach will likely play an important role in management, singularly or in combination with other forms of management, including surgery. The BEST approach is likely the use of combination therapy, including an intra-lesional option (injection or surgery, or both), a surgical procedure \{superior check desmotomy (SCD) alone or in addition to other surgical procedures\}, rigorously controlled post-injury exercise (see below, without turn out exercise), and careful monitoring of tendon health when the horse returns to training/performance. Surgical management of horses with SDF tendonitis/ tendinopathy satisfies many of the time-honored principles used in tendon healing. Superior check desmotomy increases the bone-ligament-tendon-bone interface length, which protects the healed tendon likely harboring an inelastic scar from incomplete or inadequate repair. While regenerative approaches are being used and continuously refined, I am not convinced healing is occurring without scar tissue formation, given recurrence of injury in many horses undergoing this therapeutic option. Carpal retinaculotomy (incising the carpal retinaculum, both outer and inner lamina, in horses with proximally located SDFT lesions), annular desmotomy (AD, severing the annular ligament in the distal metacarpal/palmar fetlock regions), and metacarpal fasciotomy (severing the dense metacarpal fascia in the region of SDFT enlargement) all improve gliding function, a time-honored theorem used to manage all tendon injuries.
More on Superficial Digital Flexor Tendonitis

Tendonitis of the SDFT is a common and debilitating injury in racehorses; recurrence is common despite aggressive management and ultrasonographic evidence of adequate healing. CONTROLLED EXERCISE WITHOUT TURN OUT may be the most important component in management coupled with a graded return to training and racing and use of frequent clinical and ultrasonographic examinations. In the STB racehorse, tendonitis of the SDFT is not as common as in TBs but can be career limiting in young stakes caliber horses and occurs most commonly in pacers. Surgical management using desmotomy of the accessory ligament of the SDFT (superior check desmotomy) alone or in combination with annular desmotomy is the treatment of choice.

Tendonitis of the SDFT is not nearly as common in non-racehorses as it is in racehorses or event horses. While tendonitis in the mid-metacarpal region is most common, lesions involving the proximal metacarpal region can be problematic. Tendonitis in this region can be difficult to diagnose since swelling is easily missed unless the limb is carefully palpated. Likewise, diagnostic analgesia may be difficult since the lesion is proximal in the metacarpal region and may involve the carpal sheath, so high palmar or other sub-carpal blocks may not provide analgesia. In some horses, carpal tenosynovitis is present; in others there may be extensive swelling of the SDFT from the proximal metacarpal region to the annular ligament. Inexplicable severe tendonitis of the SDFT is seen in middle aged to old horses; horses are often turned out when clinical signs develop. I have seen a surprising number of show ponies with proximal SDFT injuries, clinical signs from which can be difficult to piece together, and often a diagnosis is difficult to make. Beware of a pony with recurrent, severe forelimb lameness with minimal clinical signs, positive to carpal flexion, with or without carpal tenosynovitis!

Prognosis depends on the level and extent of injury as well as the horse’s age. Old horses with severe tendonitis have a poor prognosis. Numerous modalities and methods have been advocated recently, using both reparative and regenerative healing principle. Intra-lesional injections with stem cells (bone marrow derived), acellular urinary bladder matrix, growth factors, platelet rich plasma, and bone marrow; use of shock wave therapy and combinations of these approaches are currently being used. I have used liquid bone marrow injections in numerous horses, but have largely discontinued this approach since tendons appear clinically “active” for longer than with superior check desmotomy alone. I have used cultured, bone marrow derived stem cells in several horses to date, and remain unconvinced of efficacy. I still prefer surgical management using SCD, sometimes in combination with intra-lesional injections. I have had reasonable success combining SCD with tenon splitting in TB racehorses but rarely elect to split a tendon in a STB racehorse. In the author’s opinion, the SCD is the cat’s meow in the STB racehorse used alone. In a “first do no harm” approach to tendon healing I now commonly combine SCD with intra-lesional injection of platelet rich plasma if an injection is requested by a trainer or owner. I remain dubious regarding efficacy of stem cell therapy as currently available.

Prognosis for non-racehorses with tendonitis of the SDFT is somewhere in between that for the Thoroughbred (TB) racehorse (guarded to poor prognosis) and the Standardbred (STB) racehorse (good prognosis). SCD combined with fasciotomy and desmotomy of the carpal retinaculum (carpal retinaculotomy) and/or AD are recommended. In a limited number of older field hunters, all 3 surgical procedures have been used successfully.

SCD can be performed using a medial approach and conventional surgical techniques (flexor carpi radialis transthecal approach) or by carpal tenoscopy. I still prefer the conventional approach since it allows easy, complete transection of the entire ligament and ability to avoid hemorrhage from the nutrient vessel or control hemorrhage if the vessel is inadvertently severed. The horse is placed in lateral recumbency with the unaffected limb uppermost and repositioned if the procedure is done bilaterally. The procedure can and often is combined with annular desmotomy if tendonitis involves the distal metacarpal region. I avoid tendon splitting (tenoplasty) procedures if possible, particularly in STB racehorses, but have had my absolute best results in the TB racehorse using superior check desmotomy in combination with tenoplasty. If done, I prefer to perform tenoplasty using a double-edge tenotome.

In horses with severe tendonitis extending from the carpal canal to the distal metacarpal region, I have used SCD, carpal retinaculotomy, metacarpal fasciotomy and annular desmotomy as an aggressive surgical approach with reasonable success for salvage. I do not hesitate to recommend SCD, carpal retinaculotomy and metacarpal fasciotomy in horses with proximally located tendonitis of the SDFT that extends into the carpal canal. I prefer the conventional surgical approach rather than carpal tenoscopy but this requires dedication and time during surgery to ensure the inner lamina of the carpal canal is completely severed and the major vessels such as the radial artery and vein are avoided.

III. DIGITAL FLEXOR TENOSYNOVITIS

Tenosynovitis of the digital flexor tendon sheath (DFTS) is a common problem in jumpers and dressage horses, particularly older horses, Warmbloods and in the hindlimbs. Many horses normally have thickening and effusion in the hindlimb DFTS’s but are not lame. Horses with lameness should be blocked (intrathecal analgesia – may not completely alleviate clinical signs but horses should improve considerably) and undergo careful ultrasonographic evaluation to diagnose adhesions, annular desmitis and lesions of the DDFT. Beware that intrathecal analgesia is not specific for pain associated with the DFTS since pain from nearby structures can be abolished using this technique. Horses with DDFT lesions are often quite lame, more so than expected and often have lesions on the lateral (most common) or deep surface of the DDFT. Annular desmitis does occur but usually the annular ligament causes secondary compression from distension and thickening of the DFTS. Annular desmotomy is successful in approximately 50% of
horses but tenosynovitis persists. When to do annular desmotomy? I usually judge how easy it is to slide the endoscope through the fetlock canal (5.0 mm endoscope) – if it is easily maneuvered through the canal and the surgical procedure can be completed without transaction, then I proceed conservatively. If it is difficult to maneuver, I need extra room to complete the procedure, there is enlargement of the SDFT, DDFT or both, or if requested by the referring veterinarian then I do the transaction.

Surgery is most successful in horses without lesions of the DDFT and in those without adhesions. Early surgical intervention before extensive adhesions develop is key and may explain my early reticence to recommend tenoscopy; I now feel it is of value particularly if done early. Horses with lesions such as tears in the manica flexoria, lateral tears of the SDFT and DDFT can be managed successfully if operated early. As with most surgical procedures, case selection and early surgical intervention may be the keys to success.

IV. CARPAL TENOSYNOVITIS

Carpal tenosynovitis can be differentiated from effusion of the antebrachio-carpal joint by careful palpation and ultrasonographic examination. Supra-carpal exostosis and proliferation of the distal caudal radius (“caudal radial spikes”) can cause irritation to the carpal sheath or deep digital flexor tendon and tenosynovitis. Effusion is often hemorrhagic. Scintigraphy can be useful to differentiate lesions of the ABC joint from those of the carpal sheath, particularly in horses with intermittent severe lameness as a result of hemorrhagic synovitis, but without obvious effusion. Focal increased radiopharmaceutical uptake is often seen along the distal caudal aspect of the radius and in the ABC joint in horses with hemarthrosis of that joint. Surgical management using tenoscopic approaches is recommended. A rare cause of carpal tenosynovitis is tearing of the superior check ligament (see below). I have seen only one horse, a graded-stakes winning TB sprinter with acute carpal tenosynovitis and a tear in the radial head of the DDFT. I debrided the torn tendon/muscle. The horse developed lameness and recurrence of carpal tenosynovitis when it returned to race training and has not raced 9 months after surgery.

V. DISTAL SESAMOIDIAN DESMITS

Injury of the distal sesamoidean ligaments needs to be differentiated from SDFT branch tendonitis and careful ultrasonographic examination is critical. Distal sesamoidean desmitis is most common in the forelimb but does occur in the hindlimb. Injury of the oblique distal sesamoidean ligament is most common. Rest is most important but I have had limited success using a reparative healing approach in jumpers with intrasional bone marrow injection. Acute, traumatic disruption of this ligament can cause palmar/plantar subluxation of the proximal interphalangeal joint and may occur in combination with injury of the branches of the SDFT.