Intra-thecal (tendon sheath and bursa) tendon disease

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Introduction

Pathology of tendon sheaths (and the similar structures, bursae) are common, with the most commonly affected being the digital flexor tendon sheath (DFTS). Asymmetric synovial effusion, accompanied by lameness and frequently pain on palpation, are significant findings. Before the advent of new ultrasonographic techniques, MRI, and tenoscopy, the primary cause of the DFTS effusion often remained unrecognised. However, with the development of these imaging techniques and tenoscopy, tenosynovitis is more frequently found to be secondary to injuries of specific structures within or adjacent to the digital sheath which can now be recognized with confidence.

Consequences of intra-thecal tendon injury

Intra-thecal tendons lie within a synovial environment and are usually under compression, of which additionally restrict healing. Within a tendon sheath or bursa, the tendon lacks a paratenon, the layer surrounding extra-thecal tendons which is believed to supply vascular and cellular elements that contribute significantly to healing. The synovial environment is damaging to the internal tenocytes and prevents normal debridement of damaged tissue (Garvican *et al*. 2016). Furthermore, the release of tendon matrix components and bleeding into the tendon sheath drives inflammation, further compromising limb and tendon function and inducing lameness.

Diagnosis of intra-thecal tendon injury in horses

Diagnostic analgesia by the instillation of local anaesthetic solution into the tendon sheath or bursa will provide evidence that the site of lameness is situated in the digital sheath but this does not always eliminate the lameness completely and still does not indicate the exact nature of the pathology within the tendon sheath (although it is more effective at eliminating lameness associated with deep digital flexor tendon tears than manica flexoria tears (Fiske-Jackson *et al*. 2013). Diagnostic analgesia of the DFTS is best accessed via the distal palmar pouch of the sheath, which extends between the two distal branches of the SDFT and between the two digital annular ligaments, along the palmar surface of the DDFT. The needle can be introduced through the skin to one side of the midline and, to avoid iatrogenic damage to the deep digital flexor tendon, gently and slowly advanced at approximately 45 degrees to the skin surface until synovial fluid is seen at the needle hub. 7-10ml of local anaesthetic solution is injected for adequate desensitization of the DFTS.

Contrast tenography (Fiske-Jackson *et al*. 2013) is proving a useful addition to the diagnostic armoury. 5mls of a water-soluble iodine-containing contrast agent can be injected at the same time as diagnostic analgesia and a lateromedial radiography obtained. This enables a reliable identification of manica flexoria tears (sensitivity of 96% and specificity of 80%) but less reliable for DDFT tears (sensitivity of 57% and specificity of 84%).

Ultrasonography is effective at identifying mid-substance pathology within a tendon sheath. However, intra-thecal DDFT tears are difficult to identify and it can also be challenging to determine whether mid-substance injuries communicate with the synovial environment.

Improvement in identifying tendon tears is achieved by using non-weight-bearing views and assessing the DDFT in oblique images obtained just distal to the proximal sesamoid bones for DDFT marginal tears, and displacement and thickening of the manica flexoria in longitudinal (and transverse) mid-line scans at the level of the apices of the proximal sesamoid bones. Movement of the tendons can also be assessed in non-weight bearing views where gapping between the tendons can signify adhesion formation or a fully torn manica flexoria.

Magnetic resonance imaging has superior soft tissue contrast and may be of use to identify occult lesions not seen radiographically or ultrasonographically, especially within the foot. However, the standing MRI images may have inferior quality, especially in hindlimbs, because of greater movement artefacts which makes the diagnosis of intra-thecal tendon tears difficult. Tenoscopy provides excellent evaluation of the internal structures of tendon sheaths and bursae and can identify the primary cause of an inflammatory tenosynovitis and offer the prospect of surgical debridement to augment the limited natural debridement occurring in this location. The ability in introduce an arthroscope into the tendon sheath of the horse has revolutionized both our ability to diagnose intra-thecal tendon pathology but also provides an opportunity for therapy. Many lesions remain unaltered, including the clinical signs of lameness and distension, with conservative management of rest and controlled exercise. Consequently, for damage that is in communication with a synovial cavity, tenoscopic debridement provides a means to reduce irritation and permit second intention healing.

Specific conditions and treatments

Tendon tears

Deep digital flexor tendon tears

The deep digital flexor tendon can be injured throughout the length of the digital sheath and within the navicular bursa. These injuries can be either mid-substance tears where only hyperaemia may be evident tenoscopically or have marginal tears which are usually where the tendon is under maximal compression, within the digital sheath at the level of the metacarpophalangeal joint.

Treatment of these injuries involves debridement of the tear and removal of the torn fibres using a synovial resector and/or arthroscopic scissors or suction punch rongeurs. However, it is rarely possible to leave the defect completely free of prolapsed tendon fibres because of the nature of the tissue. Some surgeons have used coblation techniques although there is a concern that this will result in tenocyte death which may inhibit healing, similar to that found when coblation is used on cartilage, and some evidence of a poorer outcome when this has been used has been presented (Arensburg *et al*. 2011).

The prognosis of these injuries after surgical debridement is still relatively guarded for a return to the previous level of work, varying from 18%-40% depending on extent (Smith and Wright 2006, Arensburg *et al*. 2011).

Manica Flexoria tears

The manica flexoria is a thin loop of tendon tissue that is attached to both medial and lateral borders of the superficial digital flexor tendon and surrounds the deep digital flexor tendon within the proximal digital sheath. With the advent of tenoscopy, tearing of one (usually medial) or both of the attachments of this structure to the superficial digital flexor tendon has been found to be a common cause of digital sheath tenosynovitis and lameness, most commonly in the hindlimb. The degree of tearing varies between cases and can, in some cases, result in complete severance of the attachments and reflection of the manica flexoria proximally to becomes adhered to the proximal digital sheath synovium. In these cases, lameness may resolve

at this time. However, complete disruption of both attachments is unusual and most commonly the horse remains lame until the manica flexoria is removed in its entirety. This is done tenoscopically which enables the two tendon and the proximal synovial attachments to be transected. In contrast to the deep digital flexor tendon tears, these cases carry a good prognosis of approximately 80% returning to the same level of performance after surgery (Smith and Wright 2006, Findley *et al*. 2012).

Ligament tears into the digital sheath

These are a rare variant of desmitis affecting most commonly the straight, but also the oblique, distal sesamoidean ligament. The lesions are characterised ultrasonographically by anechoic lesions adjacent to the digital sheath cavity. These lesions can be debrided as for DDFFT tears. The proximal scutum can also tear into the sheath and be managed in the same way tenoscopically.

Tendon sheath wall tears/Synoviocoeles

These are usually the result of tears in the wall of the tendon sheath (Crawford *et al*. 2011). They are not always significant but can cause pain and lameness, especially if the opening develops into one that acts as a 'one-way' valve. Treatment, if deemed significant, is by either removal (Crawford *et al*. 2011) or more appropriately, enlargement of the opening, where the synoviocoele can resolve as has been described for those associated with the tarsal sheath (Minshall and Wright 2012).

Palmar/Plantar annular ligament syndrome

The passage of the arthroscope through the fetlock canal is, in the author's opinion, the best way of determining the degree of constriction by the palmar/plantar annular ligament. Constriction of the PAL is usually secondary to other pathology within the digital sheath and hence transection should only be performed with concurrent tenoscopic evaluation of the sheath. Transection of the ligament is performed using a hook knife introduced through a proximal ipsilateral portal.

Mid-substance tendon lesions

The presence of a central disruption leading to a 'core' lesion lends itself to intra-tendinous drug administration. Most recently, biological treatments such as mesenchymal stem cells or platelet-rich plasma has gained popularity for the treatment of many tendon and ligament injuries. Implantation of autologous mesenchymal stem cells or PRP may be appropriate for intra-thecal injuries because healing is hampered in this location by a reduced cellular supply. In this location, such intra-tendinous treatments should be performed under combined tenoscopic and ultrasonographic control because of the difficulty in identifying any surface defects pre-operatively through which the cells could leak, thereby reducing the potential benefits of delivering high numbers of cells into the lesion.

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