



# The suspensory ligament injuries in horses: most common etiologies and possible diagnostic procedures

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## Abstract

Diseases of the muscular-skeletal system in horses concerning the tendons, especially the suspensory ligament (interosseous muscle), have a significant impact on the possibility of subsequent use of sporting horses in recreation and sport. Therefore, accurate diagnosis

and proper treatment is a key to solve this issue. The article describes the causes, clinical symptoms, treatment and diagnostic possibilities of interosseous muscle injuries in horses.

**Keywords:** interosseous muscle; suspensory ligament injuries; etiology; clinical symptoms; tendons lameness; horses.

## Introduction

Horses used in sports are exposed to a number of injuries. The most frequent injuries include the damage to soft tissues and tendons involving the suspensory ligament (SL). Consequently, the SL injuries may lead to the movement disorders in horses, thus temporarily or permanently limiting the use value of the animal. The most common predisposing factors of such injuries are the muscle fatigue, posture defects, too light or too hard training, as well as poor ground conditions [1–4]. The SL begins at the palmar ligament of the carpal joint and at the distal end of III metacarpal bone, as a thick tendon plate, placed between the splints bones. At one third of the lower metacarpal bone, the muscle splits into two arms that reach the proximal sesamoid bones. These branches on both sides send strengthening bands to the tendon of the common extensor muscle of the digit [5–6]. The tendon, being an elastic structure in nature, can be stretched by 3–5% and then return to its original state without any visible consequences in the histological picture. The stretching by 8–12% leads to discontinuity of collagen fiber bundles [7], causing various types of musculoskeletal dysfunction.

## Etiologies of SL injuries

Damage to the SL is one of the most common disease problems in horses used in sports. According to Dyson and Genovese, it accounts for 2 to 11% of horses. Damage can occur in three areas. At the site of a proximal bone insertion, body, or branches. This damage occurs most often

at the site of the medial lobe proximal insertion. The SL has its proximal attachment in the form of two lobes attached to the bones of the proximal third metacarpus. Each of them has a characteristic shape. The medial lobe shape is similar to a triangle, and the outer one is more rounded. If there is a suspicion of damage to the interosseous muscle, all the above-mentioned structures should be examined in order to make an accurate diagnosis. Ultrasonography is a completely non-invasive method and usually does not require pharmacological preparation in animals. The advantage of echography is that the animal can be examined while maintaining its natural body posture and in natural stress-free conditions [8]. The most common damage to SL occurs when the tendon is overstretched above its ultimate strength. Then, inflammation occurs with partial or complete disruption of collagen fibers. The inflammation may be acute or, if it lasts longer, it may be chronic. The accurate diagnosis of SL injury is of particular importance for the prognosis and possible treatment options. In all sporting equestrian disciplines, the ground condition is an injurious factor, not resulting from the horse's build or use [9–10]. The quality of ground condition is of great importance in diseases of both soft and hard tissues. Moreover, another important factor causing suspensory ligament injury is the lack of hoof balance and the hoof-pastern axis [11–12]. In the case of dressage horses, excessive work in extended trot is also a predisposing factor to muscle and tendon damages. The risk increases with the advancement of training, especially when we include passages or pirouettes in the range of exercises [9]. In jumping horses, traction (borium spots, ice nails, calks) should be used bilaterally, as if screwed into only one arm of the horseshoe, this may cause imbalance and the possibility of non-physiological rotation even torque of the limb. It also disturbed the balance when the ground is hard. Therefore, during landing, it concentrated on the shock forces [9].

## Diagnosis and clinical symptoms of SL injuries

In the first stage, the diagnostic procedure is based on animal history by conducting the meticulous interview with the trainers, riders and owners in order to obtain as many details of the injury as possible. The horse should then be inspected at rest and movement to determine which leg the horse is lame and what is the degree of lameness. The next step is to look at the outline of the limbs and identify soreness. Depending on the situation, the examination may include flexion tests and perineural anesthesia. However, the final answer to the question of whether and how severe the damage to the tendon is, can only be given after echographic examination. It is an excellent method for this purpose, non-invasive, relatively inexpensive and well-tolerated by the patient. Echographic examination is also a useful tool for introducing a gradual increase in training loads. Thanks to it, we can track the progressive healing of the tendon or, what happens when introduced to training too early, the deterioration of the condition.

Injury can occur in three places from the anatomical and topographic point of view. At the (origin) upper attachment to the third metacarpal / metatarsal bone (PSD – proximal suspensory desmitis) (**Figure 1**), halfway up, *i.e.* the body (**Figure 2**), and the attachment to the proximal sesamoid bones – the branches (**Figure 3**). Injury of SL in the proximal zone most often occurs in dressage horses [13]. The SL damage may also affect the site of attachment to the third metacarpal bone, which is why it is also worth performing a radiographic examination of this area. The radiographs show degenerative changes in the form of filamentous dark circles radiating outward (radiolucency), and caused the enthesopathy. Most of the symptoms of attachment damage to the thoracic limbs are 2/5 lameness, which in this case means that the lameness is clearly visible in the trot. On the other hand, a lower degree of lameness causes the trainer and rider to be overlooked in most cases [10]. The injury tends to last longer in horses with an proximal attachment (PSD) injury than in horses with body or branches injuries because swelling is easier to spot in these cases. In the pelvic limb, trauma is often chronic and takes a long time to recognize it [14].

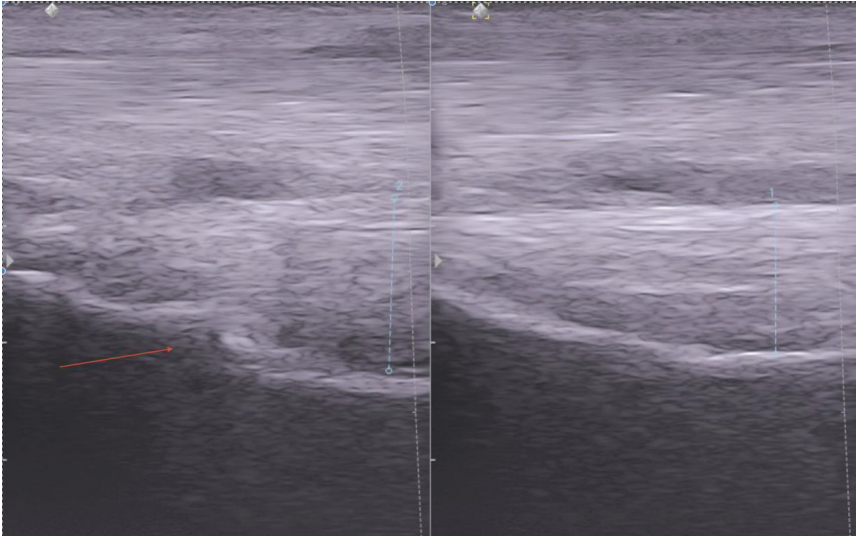


Figure 1. Longitudinal scan of the proximal origin of the SL, left image note irregularity of the bone (arrow), on the right normal bone surface

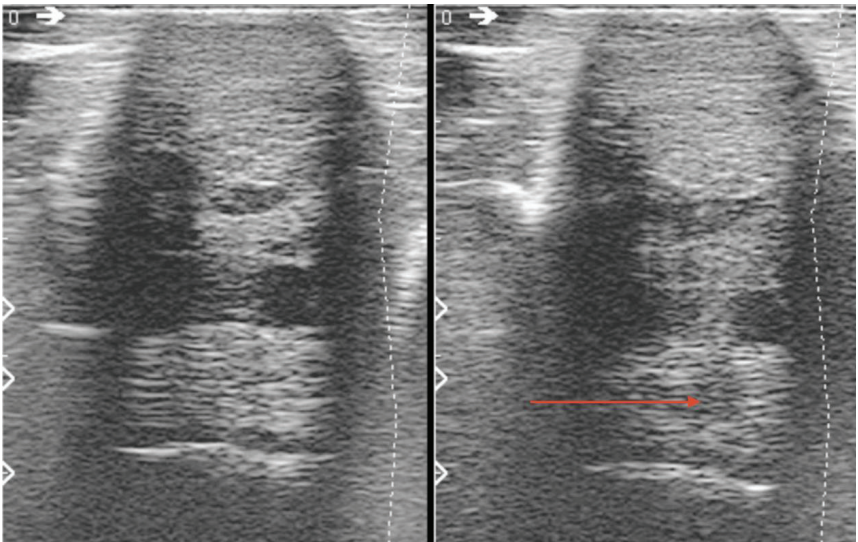


Figure 2. Transverse scan of the proximal origin of the SL, right image injuries, hypoechoic area (arrow), left image normal

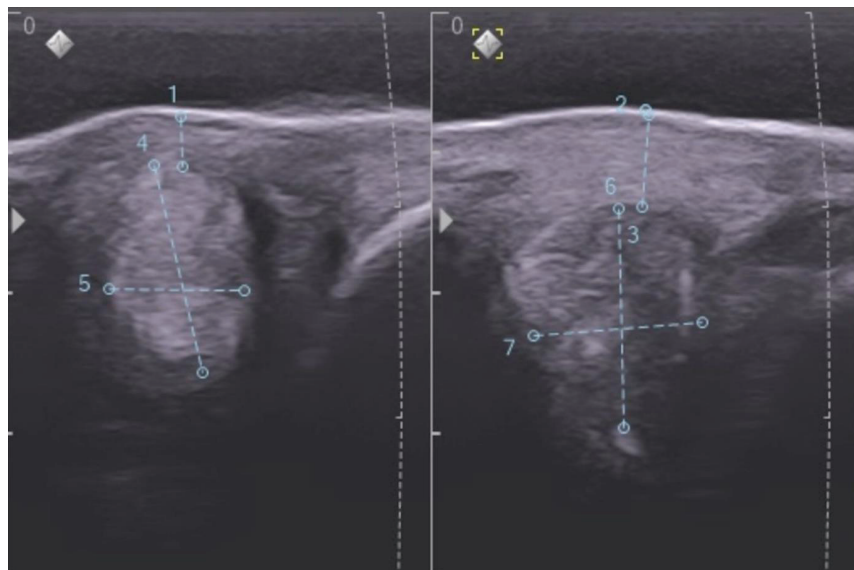


Figure 3. Transverse scan of the SL branches, right image note enlargement of the branch and less echoic areas, left image normal

Trauma to the attachment of SL in the thoracic limb is more often diagnosed than in the pelvic limb and it may result from the hyperextension of the carpal joint, which occurs during extensive movement of the limb. Lameness may not be visible in the working trot and only becomes detectable at the medium or extended trot. It is often stressed briefly after attempts to bend the limb. Presumably, this is because the SL is relaxed during flexion and then stretched when the horse suddenly loads the limb again [11, 15]. Lameness is often one-sided and well-marked in the early stages. Sometimes it affects both limbs. This may be exacerbated when the horse is trotted in a circle with the affected limb on the outside. This examination is also used in the case of an injury to the body and SL branches [14]. Sometimes it occurs after an effort that is disproportionate to the horse's abilities (overtraining) and disappears after rest. The area of the SL proximal attachment is difficult to palpate due to the anatomical structures found there [9, 16]. From the sides the splint bones, and palmar/plantar,

the tendon of the deep and superficial digital flexor tendons. Therefore, diagnostic anesthesia is useful to verify the source of pain [9, 14]. In severe cases, there may be a slight swelling, but it often disappears within 24 hours. Lameness can be short lived if the horse is not introduced to training too early. In this case, it is more noticeable by the rider under the saddle while riding than it is visible on the longer ride during the test [9].

As previously mentioned, the diagnosis should be confirmed by ultrasound, because the cause may be slight changes or previous subclinical tendon injuries. In the ultrasound image, they can take different sizes from a small area with reduced echogenicity to extensive areas with reduced echogenicity, or its complete anechoic, which indicates a partial or complete disruption of collagen fibers, respectively. The comparison between damaged and sound limb structures can be very useful in determining the significance of subtle changes [14]. One should also always pay attention to the periosteum. If damage to the SL attachment is suspected, a radiological examination is recommended to exclude any initial calcification of the SL. Also, fractures with a so-called avulsion fracture can be identified. Avulsion fractures involving the detachment of the tendon from the bone with its fragment at the site of attachment [17–18].

Bone exostosis can also cause inflammation of SL. This is due to the changes taking place in the bone, causing its unnatural growth, which results in a mismatch between the bone and the tendon elements. The result is chronic irritation through pressure, especially in the area where the SL, as already mentioned, is between the two splints bones. As a result, chronic inflammation arises. Trauma within the SL body can be diagnosed based on the presence of clinical symptoms and ultrasound. The SL branches injury is characterized by: metacarpal swelling, an increase in local temperature and pain on palpation, especially in acute cases. The presence of lameness is variable and may not always be evident [14].

The injury to the SL branch is accompanied by a noticeable swelling located in a characteristic place – between the bone of the third metacarpus and the tendon of the deep digital flexor tendon. Pain on palpation occurs in acute cases, and lameness is variable and may be absent [14]. Usually, its degree is proportional to the extent of the injury, and inversely

proportional to the duration of the injury [9]. Diagnostic anesthesia is used when there are doubts about the cause of disorders in this limb area [14]. Our own research showed that in dressage horses the most common injury was damage to the SL – PSD, and then to its also branches. Trauma to the proximal attachment of the SL and branches are common injuries in jumping horses [19].

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