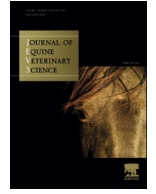




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Original Research

# Incomplete Tears of the Medial Calcaneal Insertion of the Superficial Digital Flexor Tendon of a Hind Limb in Three Horses

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## ARTICLE INFO

## Article history:

Received 13 June 2014

Received in revised form 7 July 2014

Accepted 9 July 2014

Available online 17 July 2014

## Keywords:

Lameness

Hock

Ultrasonography

Calcaneal bursa

Luxation

## ABSTRACT

Twelve tarsi from six horses humanely destroyed for reasons unrelated to the study were dissected and measurements of the calcaneal insertions of the superficial digital flexor tendon (SDFT) were acquired. The medial calcaneal insertions of the SDFT ranged in length and thickness from 4.0 to 5.4 cm and 0.3 to 0.5 cm, respectively, and the lateral calcaneal insertions ranged in length and width from 4.0 to 6.3 cm and 0.3 to 0.5 cm, respectively. The calcaneal insertions of the SDFT of both hind limbs of six horses with no history or clinical signs of hind limb lameness and no palpable abnormality of the tarsi were examined ultrasonographically. The medial calcaneal insertion of the SDFT was of uniform echogenicity, thickest at the attachment to the SDFT, and smoothly tapering to its insertion on the plantaromedial aspects of the calcaneus. The lateral calcaneal insertion was less echogenic adjacent to the SDFT than the tendon itself but was of similar echogenicity toward the insertion on the plantarolateral aspect of the calcaneus. Three horses with full-thickness incomplete tears of the medial calcaneal insertion of the SDFT had variable enlargement of the calcaneal bursa, an unstable ( $n = 2$ ) or stable ( $n = 1$ ) SDFT and lameness. The presence of an extensive but incomplete full-thickness tear of the medial calcaneal insertion of the SDFT was determined ultrasonographically in all horses.

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## 1. Introduction

The superficial digital flexor tendon (SDFT) in hind limbs has two broad, thick, ligamentous-like attachments to the calcaneus, medially and laterally, respectively. These have been variously described as bands [1,2], the medial and lateral edges of the cap of the SDFT [3], or retinacula [4].

Luxation of the SDFT from the tuber calcanei is a well-recognized cause of acute-onset severe lameness and is the result of a complete tear of one of the calcaneal insertions [4–12]. In most horses, there are no premonitory clinical signs, although occasionally an astute owner may

observe low-grade lameness and mild soft tissue swelling on the plantaromedial aspect of the hock, before luxation occurring (Dyson unpublished data). Lateral luxation occurs more commonly than medial luxation. There is usually rapid development of extensive soft tissue swelling, involving, among other structures, the calcaneal bursa. The condition may occur unilaterally or, more rarely, bilaterally. Many horses with lateral luxation of the SDFT are able to return to full work, although the hind limb gait may be altered. However, with medial luxation, chronic lameness often ensues [10].

Progressive lateral luxation of one or both of the SDFTs has also been recognized in association with degeneration of the suspensory apparatus in horses with straight hock conformation and abnormal extension of the metatarsophalangeal joints [10,13].

Acute onset of intermittent instability of the SDFT has also been recognized, usually progressing to complete

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luxation [10]. However, a recent report describes chronic instability of the SDFT associated with both partial disruption of one of the calcaneal insertions and a longitudinal tear in the fibrocartilaginous cap of the SDFT [12]. These horses were managed by transecting the residual attachments of the fibrocartilaginous cap to the calcaneus and removal of the torn side of the cap opposite to the side of subluxation, effectively allowing the tendon to luxate to a stable position. Four of seven horses returned to full athletic function.

There is also a recent description of 12 horses with fluid distension of the calcaneal bursa associated with “partial tearing” of the calcaneal attachments of the SDFT [12]; however, the SDFT was stable in its normal position. Based on ultrasonography, five tears were lateral, three were medial, and one was both medial and lateral. Surgical debridement was performed endoscopically, with removal of “disrupted tendon fibrils and granulomata.” Six lateral tears and six medial tears were identified, which were mostly partial thickness. The proximodistal extent of the injuries was not documented. Only two tears were full thickness and resulted in communication between the calcaneal bursa and an acquired subcutaneous bursa. Nine of the 12 horses returned to athletic function.

With the exception of Wright and Minshall [12], there has been little detailed description of the clinical features or ultrasonographic findings of a syndrome, which clearly has a variety of clinical manifestations, depending on the severity of injury and the anatomic structures involved. A rather simplistic brief review of the types of injury has been documented in an ultrasonographic review of injuries of the tarsus, but there was no description of their ultrasonographic appearance [14].

The objectives of this article were to (1) illustrate normal anatomic features of the calcaneal insertions of the SDFT and their ultrasonographic appearance and (2) describe the variable clinical and ultrasonographic features of severe full-thickness incomplete tears of the medial calcaneal insertion of the SDFT in three mature sports horses and the pathologic findings in one horse.

## 2. Materials and Methods

### 2.1. Normal Anatomic and Ultrasonographic Features

Twelve tarsi from six horses (Warmblood or Thoroughbred; height, 160–172 cm; body weight, 540–630 kg) humanely destroyed for reasons unrelated to the study were dissected, and measurements and photographs of the calcaneal insertions of the SDFT were acquired. The calcaneal insertions of the SDFT of both hind limbs of six horses (Warmblood or Thoroughbred; height, 152–167 cm; body weight, 520–658 kg) with no history or clinical signs of hind limb lameness and no palpable of the tarsi were examined ultrasonographically. Examination was performed using a 10-MHz virtual convex or linear transducer, with and without a standoff pad.

### 2.2. Clinical Study

Three horses were examined at the Animal Health Trust between 2012 and 2014, with clinical and ultrasonographic

features of an incomplete full-thickness tear of the medial calcaneal insertion of the SDFT in one hind limb. Horses were examined at rest, moving in hand on a hard surface and on the lunge on both soft and firm surfaces. Lameness was graded under each circumstance on a scale of 0–8 [15,16]. Horse 3 underwent a nuclear scintigraphic examination of the pelvic region and hind limbs at the request of the referring veterinary surgeon. Bone phase images were acquired dynamically using a 53 × 39 cm field of view gamma camera and general purpose collimator, using a 128 × 128 matrix, 2.5 hours after injection of <sup>99m</sup>technetium–methylene diphosphonate (1 GBq/100 kg body weight). A motion correction program was used to obtain static images. Subsequently local analgesia was performed. Horses 2 and 3 underwent radiographic examination of the tarsus including lateromedial, dorsomedial–plantarolateral oblique, dorsolateral–plantaromedial oblique, and dorsal 5° proximal–plantarodistal oblique views and dorsoplantar (flexed) images of the calcaneus. All horses underwent a comprehensive ultrasonographic examination of the distal aspect of the crus and the tarsus; the metatarsus was also examined in horse 1.

## 3. Results

### 3.1. Anatomy and Normal Ultrasonographic Features

The medial and lateral calcaneal insertions of the SDFT ranged in proximodistal length close to the insertion on the calcaneus from 4.0 to 5.4 cm (mean, 4.7 cm) and 4.0 to 6.3 cm (mean, 5 cm), respectively. Thickness close to the insertion on the calcaneus ranged from 0.3 to 0.5 cm medially and laterally (mean, 0.4 cm) (Figs. 1A and 1B). The calcaneal insertions were relatively uniform in thickness from proximal to distal. They were in close apposition to the wall of the calcaneal bursa. The relative medial and lateral lengths and widths of the calcaneal insertions varied among horses; in six limbs, the lateral insertion was longer than the medial insertion; in two limbs, the medial insertion was the longest; and in four limbs, the medial and lateral lengths were similar. In four limbs, the medial insertion started proximal to the lateral insertion (Fig. 1B). Ultrasonographically, the medial calcaneal insertions were of uniform echogenicity, thickest at the attachment to the SDFT, and smoothly tapering to their insertions on the plantaromedial aspects of the calcaneus (Fig. 1C). The lateral calcaneal insertion was more variable in thickness and echogenicity immediately adjacent to the SDFT (Fig. 1D) but was consistently uniform in echogenicity closer to its insertion on the plantarolateral aspect of the calcaneus.

### 3.2. Clinical Study

#### 3.2.1. Horse 1

Horse 1 was a 15-year-old Warmblood Prix St. Georges level dressage horse gelding (height, 178 cm; body weight, 630 kg).

**3.2.1.1. History.** The horse had been purchased from a veterinarian 1 year previously. A prepurchase examination

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