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Diagnostic imaging features, cytological examination, and treatment of lymphocytic tenosynovitis of the common digital extensor tendon sheath in an eventing horse

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ABSTRACT

In horses, the structures at the dorsal aspect of the carpus, including the digital extensor tendons, their related tendon sheaths, and bones, are vulnerable to injury because of their superficial location. Injuries to these structures may result in lameness of the affected limb(s) and reduce a horse's athletic performance. A 13-year-old eventing horse that routinely underwent regular exercise exhibited dorsolateral distension of the right carpus. An effusion insensitive to compression was observed in the affected area. No lameness was detected, and the horse exhibited a negative response to the carpal flexion test. Although radiography revealed no abnormal findings in the carpal bones, ultrasonography depicted anechoic fluid and synovial cell proliferation within the common digital extensor tendon sheath. Cytological analysis of the fluid revealed numerous lymphocytes and increased proteinaceous background, suggesting lymphocytic tenosynovitis. The effusion resolved following administration of two intrathecal injections: one injection of corticosteroid combined with hyaluronic acid (HA), and one injection of HA alone. Two weeks after administration of the second injection, daily under-saddle exercise was initiated, consisting of walking and light trotting with a gradual increase in intensity. The horse returned to its habitual intensive training program six weeks following the final injection. In conclusion, the horse was diagnosed with lymphocytic tenosynovitis of the common digital extensor tendon; successful treatment was achieved with administration of corticosteroid and HA. Diagnostic imaging and cytological examination facilitated clinical interpretation and the selection of an appropriate treatment regimen.

1. Presentation

Several structures on the dorsal aspect of the equine carpus are susceptible to injury due to their superficial locations (Platt & Wright, 1997). The vulnerable structures include the lateral digital extensor tendons, common digital extensor, and extensor carpi radialis, along with their associated synovial sheaths (Kainer, 1987; Platt & Wright, 1997). Injuries to these areas can lead to lameness in the affected limb (Belknap, Baxter, & Nickels, 1993; Booth, Abbot, Clements, Singer & Clegg, 2004).

Tenosynovitis is an inflammatory synovial effusion that presents as a distention over the synovial cavity (Mcilwraith, 1987). There is little information regarding the aetiology of digital sheath tenosynovitis; however, direct trauma (Mason, 1977), longitudinal tearing (Arensburg, Wilderjans, Simon, Dewulf & Boussauw, 2011), penetrating injuries to the tendon (Belknap, Baxter, & Nickels, 1993; Platt & Wright, 1997), and overextension of the tendon sheath (Dik, Dyson & Vail, 1995) can predispose horses to this disease. Common sites of tenosynovitis development include the digital flexor sheath (Arensburg et al., 2011; Taintor, Caldwell, & Almond, 2013; Wilderjans, Boussauw,

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Madder & Simon, 2003) and tarsal sheath (Archer, Clegg & Edwards, 2004; Straticò, Varasano, Suriano, Sciarrini & Petrizzi, 2014). In contrast, digital extensor tenosynovitis is uncommon (Gray, Gutierrez-Nibeyro & LoBato, 2020). Indeed, reported cases are typically caused by either septic digital extensor tenosynovitis (Booth et al., 2004; Platt & Wright, 1997) or a chronic disease state (Gray et al., 2020). In the present case, we report the imaging-based diagnosis, cytological examination, and treatment of acute tenosynovitis of the common digital extensor tendon sheath.

2. History and clinical signs

A professional eventing horse (age: 13 years; weight: 425 kg) demonstrated dorsolateral distension of the right carpus several days before the initial examination (Figs. 1a and 1b). Prior to the presentation of clinical signs, the horse regularly participated in an exercise training program for one to two hours per day, three to five days per week. The initial medical examination revealed a round area of effusion approximately 8 cm in diameter at the site of injury (Figs. 1a and 1b). The lesion was not warm and was insensitive to compression. The horse exhibited neither lameness while trotting nor joint pain during the carpal flexion test. The horse was stabled individually in a 12 m^2 stall. Commercial feed was provided four times per day and the horse had free access to clean water.

3. Diagnostic assessments

We performed imaging analysis of the right carpal region. Radiography demonstrated no abnormalities in the bony structures of the carpal region (Figs. 1c–1h). Ultrasonography of the injured location revealed an accumulation of anechoic fluid (Figs. 2a–2d) and cell proliferation within the synovial sheath (Figs. 2b and 2d). Fibrous thickening of the synovial lining adjacent to the dorsal surface of the common digital extensor tendon was also observed (Figs. 2a–2d). Notably, a small defect in the synovial lining, suggesting an injury to the tendon sheath, was visible proximal to the common digital extensor tendon (Fig. 2d). Approximately 25 ml of synovial fluid (SF) was obtained from the distended area via synoviocentesis. The fluid was pale yellow, slightly turbid (Fig. 3a), and had reduced viscosity (Supplemental file). Cytological examination revealed the presence of 5.5×10^9/l total nucleated cells and 22 g/l total protein. Microscopic examination revealed predominantly lymphocytes with increased proteinaceous background (Fig. 3b). As a result, the horse was diagnosed with lymphocytic tenosynovitis of the right common digital extensor tendon sheath.

4. Treatment and follow-up

After the accumulated fluid was fully drained, an intrathecal injection of 25 mg of hyaluronic acid (HA) combined with 10 mg of triamcinolone acetate was aseptically administered to the lesion. The horse was then placed on stall rest and was hand-walked for 20–30 min each day. Seven weeks after the first injection, the distension was markedly

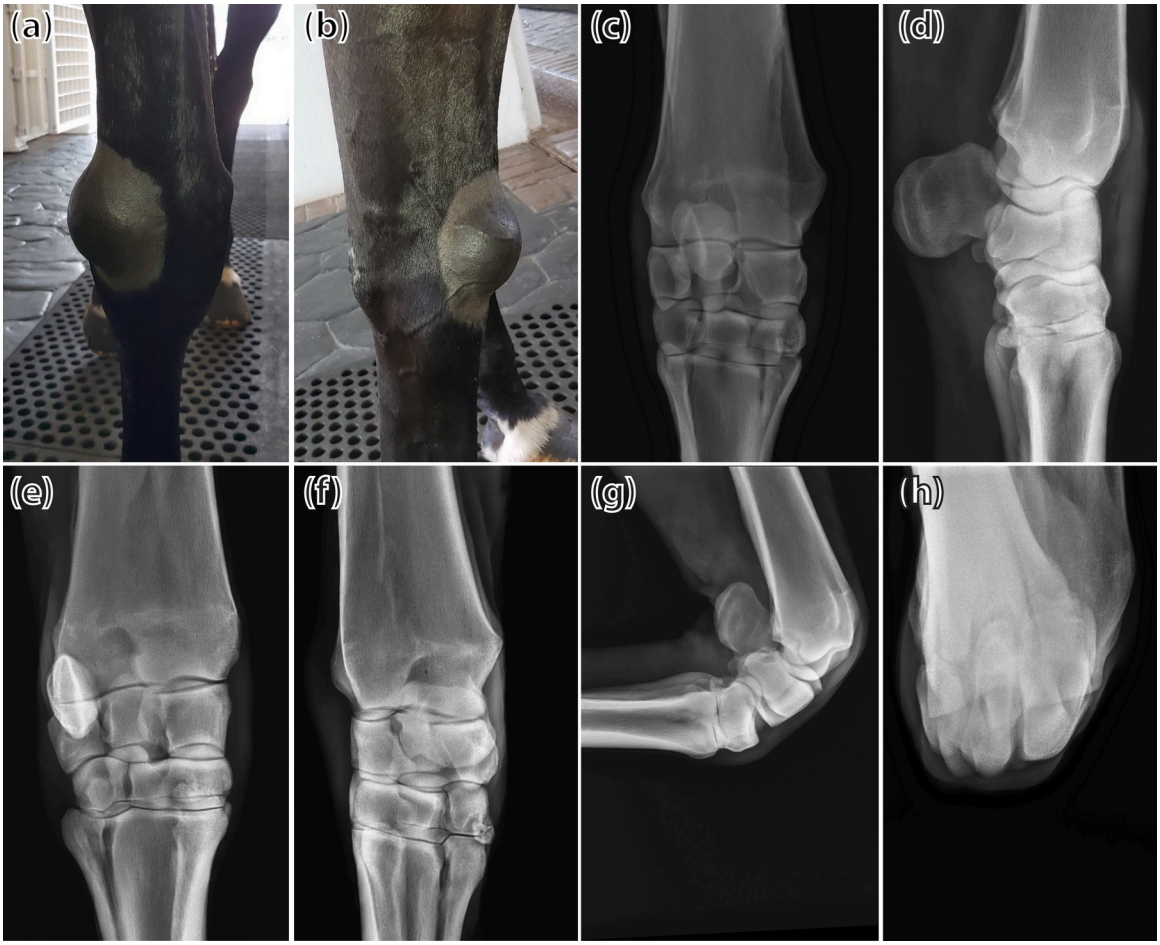

Fig. 1. The injured area and radiographic images of the right carpus. The effusion was visible at the dorsolateral location of the right carpus (a and b). Radiographs were taken of the dorsopalmar (DPa) (c), lateromedial (LM) (d), dorsolateral-palmaromedial oblique (DL-PaMO) (e), dorsomedial-palmarolateral oblique (DM-PaLO) (f), flexed lateromedial (flex-LM) (g), and dorsoproximal-dorsodistal (skyline) (h) views. These images did not reveal any abnormalities in the carpal region.

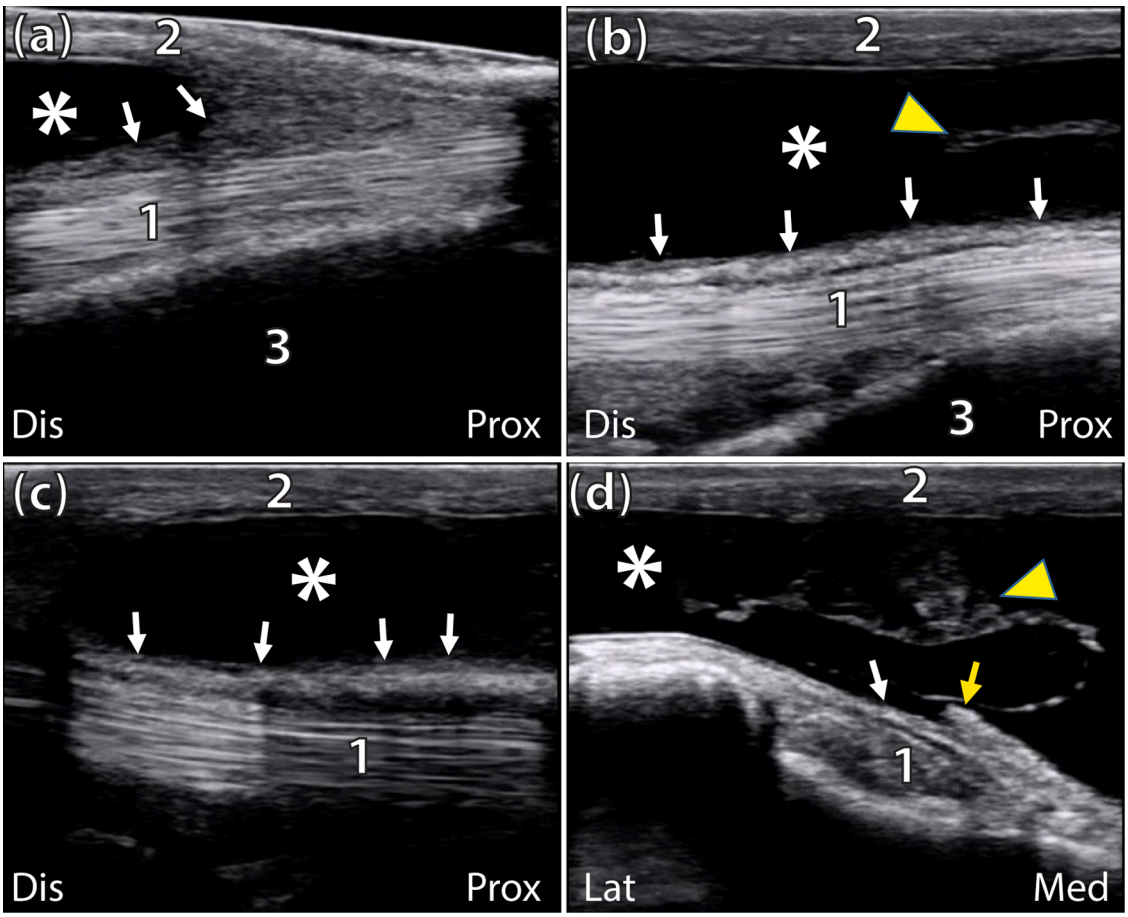

Fig. 2. Ultrasonographic appearance of the dorsolateral aspect of the distension on the right carpus. The proximal, medial, and distal areas of the affected region were imaged on the longitudinal (a, b, and c, respectively) and transverse (d) planes. Ultrasonographic imaging demonstrated several structural defects, including a large area of anechoic fluid accumulation (asterisk); fibrous thickening of the inner lining of the tendon sheath adjacent to the common digital extensor tendon (white arrows); synovial cell proliferation (yellow triangles); and persuasive evidence of a torn tendon sheath (yellow arrow). Prox = proximal; Dis = distal; Med = medial; Lat = lateral; 1 = common digital extensor tendon; 2 = skin; 3 = radius.

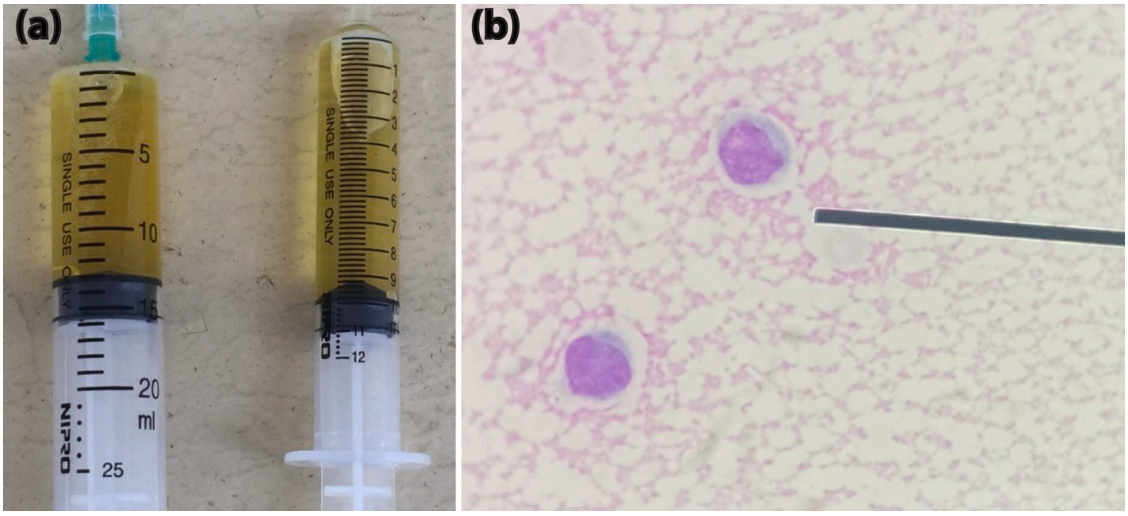

Fig. 3. Macroscopic appearance and cytological analysis of synovial fluid (SF). Pale yellow SF exhibiting slight turbidity was obtained from the affected tendon sheath (a). Cytological analysis of the SF revealed the presence of lymphocytes and increased proteinaceous background (b).

reduced but still visible (Fig. 4a). In addition, ultrasonography revealed persistent synovial fluid accumulation, albeit to a lesser degree than before the first injection, as well as synovial cell proliferation in the tendon sheath (Fig. 4b and 4c). A second dose of 25 mg of HA was intrathecally injected eight weeks after administration of the first dose. At this point, the distension resolved, and recurrent synovial fluid accumulation in the affected area was not observed eight weeks later (Fig. 4d). Indeed, ultrasonography revealed that no fluid deposits were

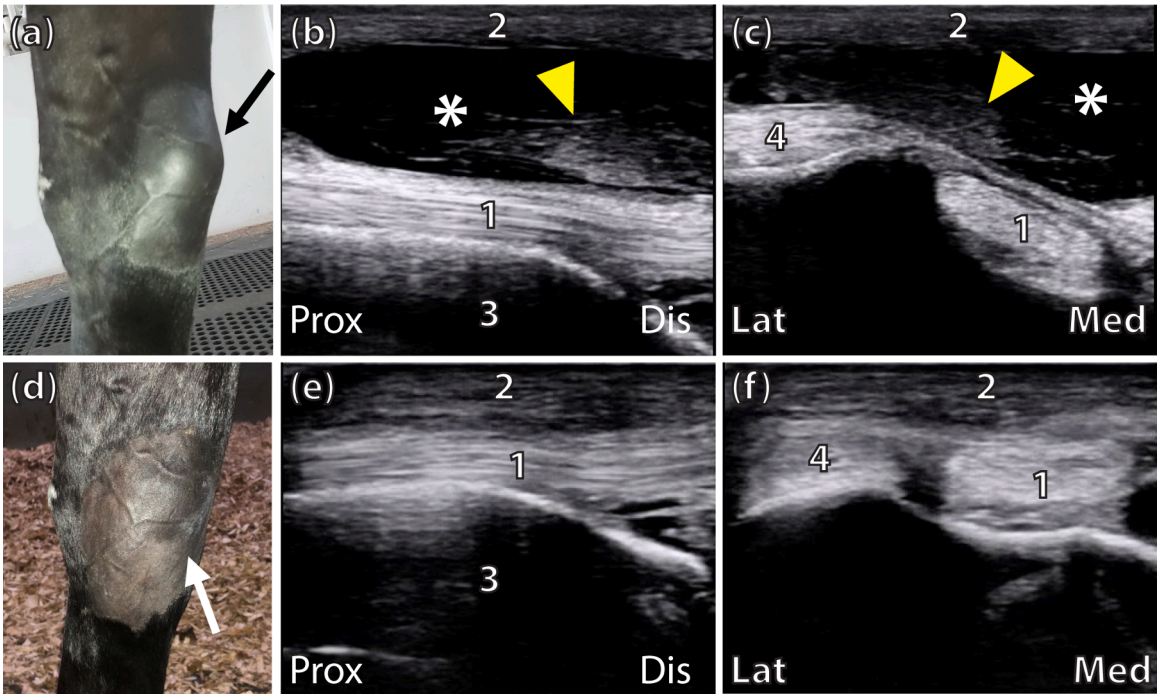

Fig. 4. Physical appearance and ultrasonographic imaging of the right carpus following intrathecal treatment administration. After the first intrathecal injection, the distension on the affected carpus was still visible, albeit smaller than before beginning treatment (black arrow) (a). Ultrasonographic images revealed the presence of an anechoic fluid deposit (asterisk) and synovial cell proliferation (yellow triangles) on the longitudinal (b) and transverse (c) planes. After the second intrathecal injection, the distension resolved (white arrow) (d), and neither fluid deposits nor synovial cell proliferation was observed ultrasonographically (e and f). Prox = proximal; Dis = distal; Med = medial; Lat = lateral; 1 = common digital extensor tendon; 2 = skin; 3 = radius; 4 = lateral digital extensor tendon.

present in the injured area (Figs. 4e and 4f). The horse participated in an under-saddle exercise program two weeks after the final injection. This program consisted of walking and light trotting for approximately 20–30 min per day with a gradual increase in intensity. The horse returned to its full exercise training program six weeks following the second injection.

5. Discussion

Digital sheath tenosynovitis causes lameness in horses and reduces athletic performance (Arensburg et al., 2011; Platt & Wright, 1997; Wright & McMahon, 1999). Despite the paucity of literature concerning the development of common digital extensor tenosynovitis in horses, chronic tenosynovitis of this tendon has been reported in both septic and aseptic contexts and can be ameliorated with surgery (Gray et al., 2020; Platt & Wright, 1997). Notably, in the present case, an eventing horse exhibiting acute laterodorsal distension of the right carpus was diagnosed ultrasonographically with lymphocytic tenosynovitis. Furthermore, the animal did not exhibit lameness after the initial examination or at any point during the 16-week treatment course. Treatment via two intrathecal injections was successful. To the author's knowledge, this is the first report that describes lymphocytic tenosynovitis of the equine common digital extensor tendon sheath.

Diagnostic imaging is usually implemented for cases of suspected tenosynovitis. The presence of osteophyte formation in the injured area, indicating a chronic disease state, can be confirmed with radiography (Gray et al., 2020; Platt & Wright, 1997). Indeed, radiographically detected bony defects were recently reported to cause digital sheath tenosynovitis in horses (Nixon, Schachter & Pool, 2004; Russell, Hall & Kelly, 2017). Therefore, radiography can facilitate the diagnosis of coincident bone injuries in horses with this condition. In the present case, radiography did not detect any carpal bone abnormalities. This result implied that observed acute tenosynovitis did not impact the carpal bones. In addition, ultrasonography was selected as a complement to radiography, enabling a precise diagnosis (Arensburg et al., 2011; Beccati et al., 2015). Specifically, the visualization of a synovial fluid deposit, together with synovial cell proliferation, clearly indicated the presence of inflammation in the common digital extensor tendon sheath.

A cytological examination was performed after radiography to provide insight into the composition and characteristics of the SF. In general, SF is normally transparent, clear to pale yellow, and highly viscous (Steel, 2008). Although the SF from the horse in the present case was pale yellow in colour, it was also slightly turbid and exhibited reduced viscosity; these latter characteristics often indicate the presence of inflammation (Pascual & Jovaní, 2005; Persson, 1971). Similarly, a total protein content of greater than the upper limit of normal, 20 g/l, may also be associated with inflammation (Mcllwraith, 1980). Therefore, cytological analysis of the SF indicated tenosynovitis of the common digital extensor tendon. Even though the total nucleated cell count (TNCC) of the horse in the present case (5.5×10^9/l) was greater than the upper limit of normal (normal range: 0.2–3.5 $\times$ 10^9/l) (Malark, Nixon, Skinner & Mohammed, 1991), the presence of a slightly elevated TNCC with predominantly mononuclear cells indicates idiopathic tenosynovitis (Mcllwraith, 1980; Steel, 2008). Furthermore, the presence of increased proteinaceous background is believed to be associated with inflammatory processes and modulation of immune responses (Jain, Gautam, & Naseem, 2011). As a result, the horse in the present case was diagnosed with lymphocytic tenosynovitis of the common digital extensor tendon.

Given the limited bacterial content, the TNCC of less than 10×10^9/l, and the clear appearance of the SF, it is reasonable to assume that the tenosynovitis in the present case was non-septic in aetiology (Steel, 2008). Intrathecal administration of a short-acting corticosteroid and HA for the treatment of non-septic tenosynovitis has been reported in both humans (Callegari et al., 2011) and horses (Minshall & Wright, 2015). Accordingly, the horse in the present case was initially administered an injection of HA and corticosteroid; distension at the injured

site was markedly reduced but still visible seven weeks later. As a result, ultrasonography was performed to further evaluate the efficacy of treatment. The ultrasonographic images demonstrated attenuated fluid accumulation and a reduction in the fibrous thickening of the synovial lining of the common digital extensor tendon. These findings indicated that the initial injection of corticosteroid and HA had improved the horse's condition. Therefore, a second injection of HA alone was administrated to avoid previously reported complications of steroid use (Harkins, Carney & Tobin, 1993). The lesion on the right carpus subsequently resolved; thereafter, the horse participated in a full exercise regimen without developing recurrent tenosynovitis.

In conclusion, lymphocytic tenosynovitis of the synovial tendon sheath can occur unpredictably in the sport horse. Diagnostic imaging and cytological examination are sophisticated tools for characterising the associated structural defect and implementing a proper treatment plan.

Ethics statement

No ethical approval from national bodies of animal welfare was required as this is the case report

Declaration of Competing Interest

No conflict of interest has been declared.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.vas.2021.100209.

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