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TITLE OF CASE

Haematogenous synovial sepsis of the digital flexor tendon sheath following contralateral limb foot abscessation in a horse

SUMMARY

A 5-year-old Shire mare was presented for investigation of severe right hindlimb lameness and was diagnosed with extensive right hind subsolar and submural foot abscessation. The mare developed severe contralateral limb lameness 11 days following right hind abscess debridement, with investigation revealing synovial sepsis of the left hind digital flexor tendon sheath. Synovial sepsis persisted despite aggressive surgical and medical treatment, resulting in euthanasia. Microbial culture of synovial fluid isolated *Bacteroides* sp., consistent with haematogenous synovial sepsis. This is the first report to describe haematogenous synovial sepsis as a cause of contralateral limb lameness during the management of foot abscessation in the horse.

BACKGROUND

Foot abscessation is commonly encountered in equine practice and routine management typically results in a rapid resolution of signs¹. Haematogenous spread of bacteria from a foot abscess to a distant synovial structure in the same limb (the infraspinatus and intertubercular bursae) has been described². There are no reports of synovial sepsis affecting the contralateral limb. This report describes the development of contralateral limb digital flexor tendon sheath (DFTS) synovial sepsis of haematogenous origin, following management of an extensive foot abscess in a mare.

CASE PRESENTATION

A 5-year-old 800kg Shire mare was referred with a 10-day history of marked right hindlimb lameness evident at walk. During assessment by the referring veterinarian, no obvious localizing signs were evident on examination of the right hindlimb, though the mare became pyrexia (40.3°C). Initial management consisted of oral NSAID (suxibuzone and flunixin on different occasions) and antimicrobial therapy (trimethoprim potentiated sulfadiazine). Immediately prior to referral, purulent exudate drained from the lateral heel bulb of the right hind foot, which coincided with an improvement in lameness.

INVESTIGATIONS AND INITIAL MANAGEMENT

On arrival at the referral institution the mare was moderately tachypnoeic (48 breaths per minute) with a rectal temperature of 38.5°C. Other vital parameters were within normal limits. Mild grade right hindlimb lameness was evident at walk (AAEP scale grade 4/5). There was a moderate volume of purulent exudate draining from the right hind lateral heel bulb (Figure 1). A second draining sinus tract was present on the lateral coronary band adjacent to the proximal extent of a partial thickness hoof wall crack (Figure 2). Mild pain was evident over the sole of the right hind foot on hoof tester examination. Radiographs of the right hind foot demonstrated radiolucency in the region of the draining sinus tracts and lateral hoof wall crack. Radiographs of the right and left hind feet were otherwise unremarkable. The draining sinus tracts were probed, with the lateral heel bulb subsolar abscess extending approximately 13cm toward the toe. The lateral coronary band sinus tract extended distally, toward the adjacent hoof wall crack. The mare was diagnosed with extensive subsolar and submural abscessation of the right hind foot.

The mare was admitted and commenced on doxycycline (10mg/kg PO q12h; Karidox, Nimrod Veterinary Products Ltd), suxibuzone (3.8 mg/kg PO q12h; Danilon Equidos, Elanco UK AH Ltd) and paracetamol (20mg/kg PO q12h). The abscess cavity and associated tracts were lavaged with dilute povidone-iodine solution and the foot bandaged. Tetanus antitoxin (7500 iu SC; Tetanus Antitoxin Behring, MSD Animal Health) and tetanus toxoid (60 iu IM; Equip T, Zoetis UK Ltd) were administered. Based on the extensive abscessation, surgical intervention was recommended to optimise drainage. The hind feet were shod with heart bar shoes. The mare was sedated with acepromazine (0.01 mg/kg IV; Calmivet, Vetoquinol), detomidine (2.5 µg/kg IV; Domidine, Dechra Veterinary Products) and butorphanol (2.5 µg/kg IV; Dolorex, MSD Animal Health). A right hindlimb abaxial sesamoid nerve block was performed with mepivacaine (100mg SC biaxially; Intra-Epicaine, Dechra Veterinary Products) and the foot aseptically prepared. The lateral hoof wall was trephined at the proximal aspect of the hoof crack using a 3.5cm diameter Galt trephine and an electric drill driver. The underlying laminae appeared healthy but there was communication with the adjacent coronary band sinus tract. The abscess cavities were curetted and lavaged with dilute povidone-iodine solution.

The mare was continued on the perioperative medication and progressed well, without significant lameness at walk. The abscess cavities were lavaged on a further four occasions at intervals of between 1 and 3 days. Subsequent bandage changes demonstrated a gradual decrease in exudate and the trephine site was packed with gauze swabs coated in a sugar and povidone-iodine mixture. Paracetamol and suxibuzone were discontinued 4 days and 10 days postoperatively respectively.

DIFFERENTIAL DIAGNOSIS

Eleven days postoperatively the mare developed acute onset contralateral limb lameness, with a moderate left hindlimb lameness at walk (AAEP scale grade 4/5). There were no overt localizing signs on examination of the limb and the digital pulse was normal. At this stage primary differential diagnoses for contralateral limb lameness were support limb laminitis or foot abscessation.

The left hind shoe was removed and the foot pared. There was no improvement in left hindlimb lameness and no evidence of abscessation despite poulticing of the foot. Placement of an abaxial sesamoid nerve block in the left hindlimb resulted in a significant improvement in lameness. Repeat radiographs of the left hind foot were unremarkable. Phenylbutazone (2.5 mg/kg PO q12h; Chanazone, Chanelle Pharma) and paracetamol (20mg/kg PO q12h) were commenced. Given the satisfactory improvement of the right hindlimb abscessation, doxycycline was discontinued 14 days postoperatively. However, the mare became increasingly left hindlimb lame (AAEP scale grade 5/5), dull, tachycardic and tachypnoeic.

Given the lack of evidence of laminitis or foot abscessation, further investigation was performed. Arthrocentesis of the left hind distal interphalangeal joint and left metatarsophalangeal joint produced grossly normal samples. Synoviocentesis of the left hind digital flexor tendon sheath (DFTS) produced turbid fluid with a total nucleated cell count of 55.1×10^9 cells/L, a neutrophil differential of 85.9% and a total protein concentration of 40 g/L, consistent with synovial sepsis. The DFTS was medicated with amikacin (200mg; Amikin Injection, Bristol-Meyers Squibb Holdings Ltd). Synovial fluid was submitted in blood culture medium for microbial culture. There was no history of previous synoviocentesis or evidence of penetrating trauma. Synovial sepsis of the left hind digital flexor tendon sheath of haematogenous origin was suspected.

TREATMENT

The dose of phenylbutazone was increased (4.4 mg/kg IV q12h; Equipalazone, Dechra Veterinary Products) and a caudal epidural was performed using a standard technique (morphine (0.15 mg/kg) and detomidine (0.05 mg/kg)). An intravenous catheter was placed, and the mare was commenced on procaine penicillin (20 mg/kg IM q12h; Depocillin, MSD Animal Health) and gentamicin (6.6 mg/kg IV q24h; Genta-Equine, Dechra Veterinary Products). Tenoscopic lavage of the left hind DFTS was performed under general anaesthesia. An Esmarch bandage was applied prior to routine aseptic preparation and draping of the left hind distal limb. Tenoscopic examination demonstrated synovitis in the region of the fetlock canal, with evidence of blood clots (secondary to synoviocentesis) and fibrin accumulations (Figure 3). The remainder of the sheath appeared to be within normal limits with no evidence of foreign material, penetrating trauma or structural injury. Fibrinous accumulations were debrided using Ferris-Smith rongeurs and a motorized synovial resector. The tenoscopic portals were closed in a routine fashion. At the end of the procedure the sheath was medicated with amikacin (300mg) and the distal limb was bandaged. Recovery from anaesthesia was uneventful.

Perioperative medications were continued. The day following tenoscopic surgery the left hind DFTS was medicated with amikacin (600 mg). Evaluation of the right hind foot demonstrated continued reduction in exudation and healthy granulation tissue at the trephination site. Two days post-tenoscopy the left hindlimb lameness significantly increased. Repeat synoviocentesis of the left hind DFTS yielded grossly purulent material. Cytological evaluation indicated persistence of synovial sepsis with a neutrophil differential of 99% and variable preservation of neutrophils. Options for further management were discussed, principally consisting of repeat tenoscopic lavage under general anaesthesia, which is required in some cases of synovial sepsis. However, following discussion the owner elected to subject the horse to euthanasia.

OUTCOME AND FOLLOW-UP

Following euthanasia, post-mortem examination of the left hindlimb demonstrated a focus of purulent material adjacent to the proximal tenoscopic portal. The DFTS contained purulent material with the greatest accumulation in the proximal recess. There was generalized synovitis, consistent with the clinical diagnosis of haematogenous synovial sepsis of the left hind DFTS (Figure 4). There was mild, irregular discoloration on cross-section of the left hind deep digital flexor tendon just proximal to the level of the proximal digital annular ligament, which may have represented early secondary tendinitis. Examination of the right hindlimb demonstrated resolving subsolar and submural abscessation.

Aerobic microbial culture of synovial fluid taken from the left hind DFTS prior to surgery was negative. Anaerobic culture isolated *Bacteroides* sp. Routine antimicrobial susceptibility testing demonstrated resistance to gentamicin but susceptibility to all other agents (including doxycycline, penicillin and amikacin).

DISCUSSION

This case report describes haematogenous synovial sepsis of the DFTS following management of a foot abscess in the contralateral limb of a horse. The foot abscess is implicated as the origin of bacteraemia. The initial differential diagnoses for contralateral limb lameness in this case were supporting limb laminitis or a second foot abscess³. However, investigation demonstrated synovial sepsis of the DFTS. Haematogenous synovial sepsis is common in foals but is rare in adult horses with immunological and skeletal maturity⁴. The factors that increase the risk of a particular synovial structure to haematogenous synovial sepsis are unclear. No overt predisposing factors were identified in the DFTS of this case. The vascular supply of the DFTS is complex and includes the

mesotenon vessels that supply the deep digital flexor tendon⁵. This arrangement could facilitate haematogenous localisation of bacteria and subsequent sepsis in a manner that mirrors that of haematogenous septic tendinopathy⁶.

Various origins of bacteraemia have been reported in previous cases of haematogenous synovial sepsis in adult horses, including endocarditis⁷ and peritonitis⁸. A single report documented the development of haematogenous synovial sepsis of the infraspinatus and intertubercular bursae following management of subsolar abscessation in the same limb². Although the horse in our report was receiving systemic antimicrobial therapy, the primary abscessation was more extensive than that reported by O'Sullivan et al.², and may present a greater risk for bacteraemia despite antimicrobial therapy. In addition, the surgical debridement of the abscess performed in this case may have caused transient bacteraemia comparable to that documented to occur during dental procedures in horses⁹.

A variety of pathogens have been isolated from cases of synovial sepsis of haematogenous origin in adult horses. In this case synovial culture was positive despite administration of systemic antimicrobial prior to sampling, which mirrors previous evidence that systemic therapy does not significantly influence synovial culture outcomes¹⁰. Monomicrobial, aerobic infections are the most common isolates in cases of haematogenous synovial sepsis^{11–13}. O'Sullivan et al.² isolated *Staphylococcus intermedius* from synovial fluid, consistent with bacterial species present in pathologic hoof tissue¹⁴. Our report documents the isolation of *Bacteroides* sp., a Gram-negative anaerobic bacteria¹⁵. *Bacteroides* spp. are common isolates from sites of abscessation¹⁶ and have been isolated from cases of equine septic pedal osteitis¹⁷. In human patients, this genus has been associated with bacteraemia¹⁸ and haematogenous spread¹⁵. This supports our hypothesis that the foot abscess acted as the origin of haematogenous synovial sepsis.

LEARNING POINTS/TAKE HOME MESSAGES

- Support limb laminitis is the primary differential diagnosis for contralateral limb lameness in adult horses with excessive unilateral weightbearing.
- Although uncommon, haematogenous synovial sepsis should be considered as a differential diagnosis for development of contralateral limb (i.e. support limb) lameness in adult horses with foot abscesses and other orthopaedic septic foci.
- If haematogenous synovial sepsis is suspected, synoviocentesis for cytology, fluid analysis and bacterial culture is a key step to establish a diagnosis.
- Bacteriological sampling of the primary septic focus (i.e. the suspected origin of bacteraemia) may also be helpful if synovial fluid culture is negative.

CONFLICT OF INTEREST STATEMENT

The author(s) declare they have no conflicts of interest.

ETHICS STATEMENT

The client provided informed consent for use of clinical information for the purpose of publication. No review committee oversight was required for this retrospective review of clinical records and case report preparation.

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FIGURE/VIDEO CAPTIONS

Figure 1: Photograph of the plantarolateral aspect of the right hind foot at admission. A draining sinus tract is evident at the level of the coronary band of the lateral heel with associated purulent exudate.

Figure 2: Photograph of the dorsolateral aspect of the right hind foot at admission. There is a draining sinus tract on the lateral coronary band. A partial thickness, vertical hoof wall crack is also evident on the lateral aspect of the foot adjacent to the draining sinus tract.

Figure 3: Tenoscopic images of the left hind digital flexor tendon sheath. There was minimal synovitis in the proximal aspect of the sheath (A). Significant hyperaemia and synovitis were present in the region of the fetlock canal, consistent with synovial sepsis (B).

Figure 4: Photograph of the left hind digital flexor tendon sheath at the level of the plantar proximal pastern during post-mortem examination. Proximal is toward the top of the image. The deep digital flexor tendon has been transected (black arrowheads indicate the proximal edge) and the distal aspect of the tendon reflected (white arrowheads). There are fibrinous accumulations evident in the digital flexor tendon sheath (white arrows), consistent with synovial sepsis. Photograph kindly provided by G. Chapman, University of Glasgow.