Osteomyelitis of the sustentaculum tali in horses: 10 cases (1992–1998)

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Objective—To determine outcome of horses with osteomyelitis of the sustentaculum tali (ST), with or without associated tarsal sheath tenosynovitis, following surgical débridement and lavage.

Design—Retrospective study.

Animals—10 horses in which a diagnosis of osteomyelitis of the ST had been made on the basis of history, physical examination findings, and results of radiography.

Procedure—Information on results of diagnostic testing, surgical findings, postoperative treatment, and short-term outcome was obtained from the medical records. Long-term follow-up information was obtained through reevaluation of horses at the teaching hospital and telephone conversations with referring veterinarians, owners, and trainers.

Results—Treatment consisted of surgical débridement, intra- and postoperative lavage, and long-term antimicrobial and anti-inflammatory treatment. Eight horses had evidence of involvement of the tarsal sheath. One horse was euthanized after surgery because of a lack of response to treatment; the other 9 were discharged from the hospital. Severity of lameness had improved, but all still had grade-1 or -2 lameness at the time of discharge. One horse was euthanized after discharge because of contralateral hind limb laminitis, and another horse was lost to follow-up. Of the remaining 7 horses, 6 returned to their previous use, and 1 was sound but retired for breeding for unrelated reasons.

Conclusions and Clinical Relevance—Results suggest that horses with osteomyelitis of the ST, with or without concomitant tarsal sheath tenosynovitis, can have an excellent to good outcome and may return to their previous use after surgical débridement of affected tissues and lavage of the tarsal sheath. (*J Am Vet Med Assoc* 2001;219:341–345)

The **sustentaculum tali (ST)** is the enlargement of the distal aspect of the medial surface of the calcaneus and forms a groove for passage of the tendon of the **lateral digital flexor (LDF)** muscle.[1] This tendon has also been called the **deep digital flexor (DDF)** tendon; however, it more properly should be called the LDF tendon at this level, because the tendons of the medial and lateral digital flexor muscles do not join, forming the common tendon of the DDF muscle, until distal to the tarsal joint.[2] The LDF tendon is enveloped by the tarsal sheath, which extends 12 to 16 cm proximal and 4 to 6 cm distal to the tarsocrural joint, ending in the proximal third of the metatarsus.[3] At the level of the tarsocrural joint, the dorsal and lateral aspects of the tarsal sheath are bound by a smooth fibrocartilaginous groove formed by the plantar tarsal ligament. The medial and plantar aspects of the tarsal sheath are covered by a thick retinaculum, so that the sheath is enclosed in an inelastic canal from the proximal border of the ST to the proximal third of the metatarsus.[3]

Horses with osteomyelitis of the ST and tarsal sheath tenosynovitis have historically been considered to have a guarded prognosis for surviving and a poor prognosis for returning to their previous use.[3-9] Typical clinical abnormalities in affected horses include swelling of the soft tissues of the tarsus, severe lameness, distension of the tarsal sheath, and effusion of the tarsocrural joint. Between 1976 and 1988, reports[3,4,6-9] of 19 horses with lesions of the ST, tarsal sheath sepsis, or both were published. Only 3 horses were sufficiently sound to return to work after treatment; 8 horses were persistently lame, and 8 were euthanized.[3,4,6-9] In most of these horses, treatment consisted only of antimicrobial administration, although in a few horses, fragment removal and tarsal sheath lavage were also performed. A more recent report[10] described 5 horses that were treated surgically, all of which survived, and indicated that 3 were sufficiently sound for riding and 2 were used for light riding. Another report[2] described the use of tenoscopy to assess and treat 5 horses with tarsal sheath sepsis, fragmentation of the ST, or both. Two of the 5 horses had fragments involving the ST with nonseptic tenosynovitis, 2 had fragments of the ST and septic tenosynovitis, and 1 had no fragments involving the ST but had septic tenosynovitis. Follow-up times for horses in that report were short, but all had returned to use. Therefore, the purpose of the study reported here was to document long-term outcome of horses with osteomyelitis of the ST and tarsal sheath sepsis that undergo surgical treatment and, in particular, to determine whether these horses were able to return to their previous use.

Criteria for Selection of Cases

Medical records of all horses admitted to the Texas A&M University Veterinary Teaching Hospital between April 1992 and December 1998 because of lesions involving the ST were reviewed. Horses were included in the study if a diagnosis of osteomyelitis of the ST had been made on the basis of history, physical examination findings, and results of radiography.

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Procedures

Information obtained from the medical records included history, signalment, treatment, outcome, surgical and cytologic findings, and results of microbial culture, physical and lameness examinations, radiography, and ultrasonography. Long-term follow-up information was obtained through reevaluation of horses at the teaching hospital and telephone conversations with referring veterinarians, owners, and trainers.

Outcome was classified as excellent if the horse returned to its previous use at the same level; good if the horse returned to its previous use but at a lower level; fair if the infection resolved, but the horse remained lame; or poor if the infection did not resolve or the horse was euthanatized.

For all horses, lateromedial, dorsoplantar, dorsolateral-plantaromedial (45° lateral to the dorsoplantar line) oblique, plantarolateral-dorsomedial (45° lateral to the dorsoplantar line) oblique, and plantaroproximal-plantarodistal (skyline) radiographic views of the affected tarsus were obtained. In some horses, ultrasonography was used to evaluate the LDF tendon and the associated tarsal sheath for evidence of tenosynovitis. Tarsal sheath fluid from some horses was submitted for cytologic evaluation.

Surgical débridement was recommended for all horses. Horses were treated with potassium penicillin G (10,000 to 20,000 U/kg [4,500 to 9,000 U/lb] of body weight, IV, q 6 h) and gentamicin sulfate (6.6 mg/kg [3 mg/lb], IV, q 24 h), beginning before surgery or after samples were obtained for microbial culture. All horses were treated with phenylbutazone (2.2 to 4.4 mg/kg [1 to 2 mg/lb], IV, q 12 h), beginning before surgery.

Surgical technique—Horses were anesthetized and placed in lateral recumbency with the affected limb down. A 10-cm-long incision centered over the ST was made on the plantaromedial aspect of the hock. If tenosynovitis was not present, the tarsal sheath was not opened surgically, and dissection through soft tissues on the medial aspect of the ST provided access for débridement of diseased bone and infected soft tissue. If tenosynovitis was present, the tarsal sheath was opened, and the LDF tendon was retracted so that the fibrocartilaginous surface of the ST could be examined. All diseased fibrocartilage and bone were removed from the ST along with devitalized or necrotic tissue of the LDF tendon and the tarsal sheath. Portals were created by making 2-cm-long incisions in the proximal and distal aspects of the tarsal sheath. Teat cannulas[a] were introduced through the portals and used to lavage the tarsal sheath. The tarsal sheath and ST were lavaged with 5 to 8 L of polyionic fluids; a 10% solution of dimethyl sulfoxide was added to the last liter of lavage fluid. Drains were placed as needed, and the incision was closed in a routine fashion. The tarsal sheath and subcutaneous tissues were closed with 2-0 absorbable suture in a continuous pattern; the skin was closed with size 0 or size 1 absorbable suture in an inverted cruciate pattern. The 2 portals in the tarsal sheath were left open so that the sheath could be lavaged after surgery. All drains were removed 5 days after surgery.

Results

Signalment and history—Ten horses met the criteria for inclusion in the study. Median age was 7 years (range, 3 to 16 years). Eight were Quarter Horses, 1 was a Thoroughbred, and 1 was an American Paint horse. There were 7 females and 3 males (2 geldings and 1 stallion). Nine horses had a history of trauma prior to the onset of lameness; 8 had an external wound on the plantaromedial aspect of the tarsus at the time of admission. An inciting cause was not identified for the remaining horse. Horses had been lame for at least 10 days, and possibly as long as 90 days, before examination. Five of the horses had been treated with procaine penicillin G and phenylbutazone, and 3 had been treated with trimethoprim-sulfonamide and phenylbutazone; the other 2 horses had not been given any medications prior to examination at the teaching hospital.

Physical examination findings—All horses were lame at the time of admission. Five had grade-4 lameness, and the other 5 had grade-3 lameness. Eight horses had obvious effusion involving the tarsal sheath, and 6 horses had effusion of the tarsocrural joint.

Radiographic and ultrasonographic abnormalities—In all horses, radiography revealed an irregular contour to the ST with osteolysis and mild to moderate bony proliferation, sclerosis, and fracture, fragmentation, or sequestration of the ST. There were also irregular areas of decreased opacity within the ST. Substantial swelling of soft tissues on the medial aspect of the tarsus was also apparent radiographically. Lesions were best seen on the plantarolateral-dorsomedial oblique and plantaroproximal-plantarodistal radiographic views (**Fig 1**).

Ultrasonography was performed in only 3 horses. None of these 3 had lesions involving the LDF tendon. However, all 3 had fibrinous effusion within the tarsal sheath.

Cytologic abnormalities—In 6 horses, synovial fluid aspirated from the tarsal sheath was submitted for cytologic evaluation. Total protein concentration ranged from 1.5 to 6.1 g/dl (median, 4.0 g/dl) and WBC count ranged from 1,703 to 105,100 cells/µl (median, 22,000 cells/µl). The WBC consisted predominantly of nondegenerative neutrophils; no bacteria were seen.

In 1 additional horse, fluid was aspirated from the tarsal sheath at the time of surgical debridement of the ST. Total protein concentration was 1.5 g/dl, but other tests were not performed. The attending surgeon decided that the tarsal sheath was not involved, and the tarsal sheath was not opened surgically.

Results of bacterial culture—Bone specimens from 7 horses were submitted for bacterial culture, and bacterial growth was obtained from all 7. Samples of tarsal sheath synovial fluid from 6 horses were submitted for bacterial culture, and only 1 yielded bacterial growth. For 5 of the 7 horses for which results of bacterial culture were positive, only a single organism was identified (*Streptococcus zooepidemicus* [2 horses],

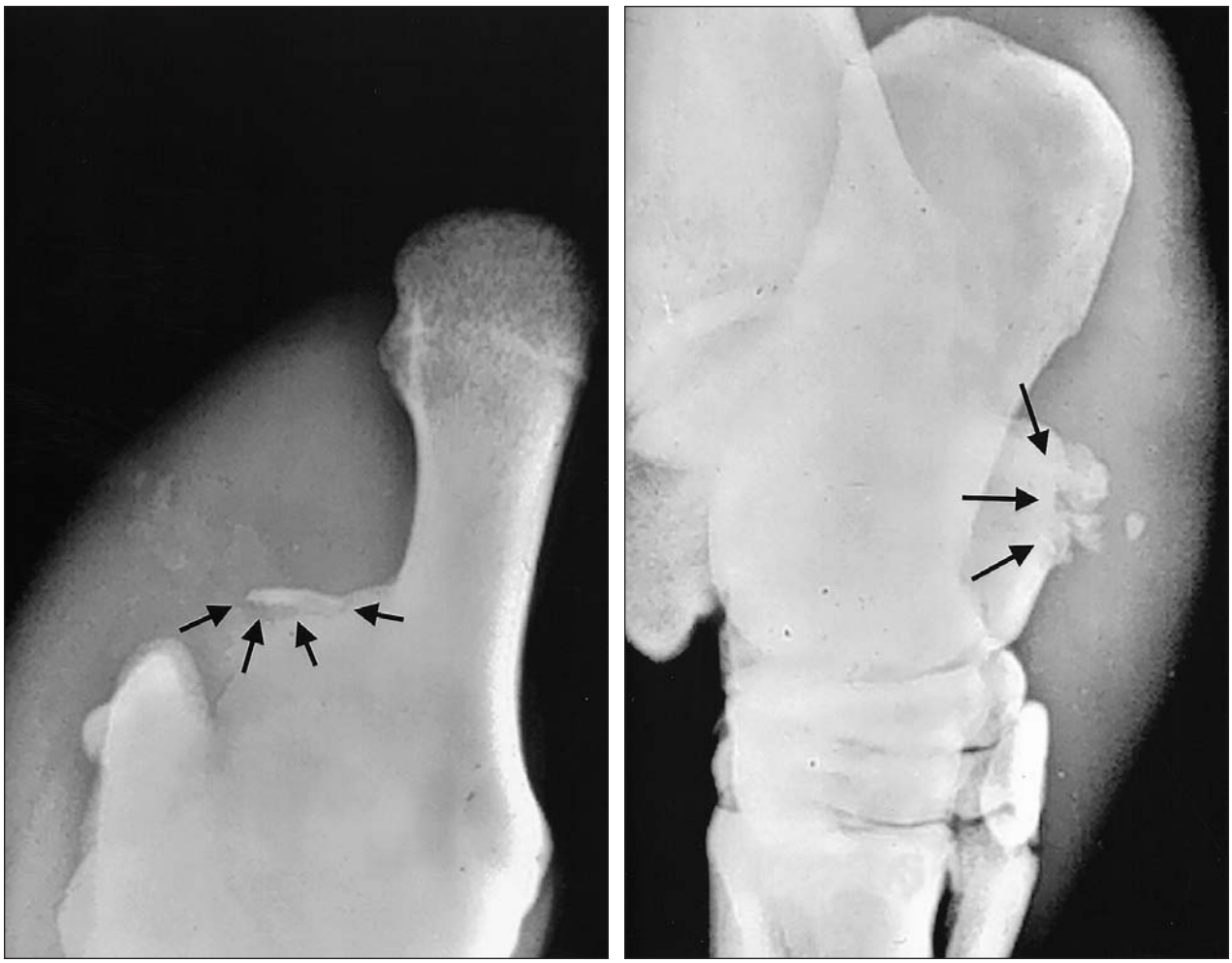

Figure 1—Plantaroproximal-plantarodistal (left) and plantarolateral-dorsomedial oblique (right) radiographic views of the tarsus in a horse with osteomyelitis of the sustentaculum tali. Notice the osteolysis and evidence of a sequestrum (arrows).

Corynebacterium spp, *Escherichia coli*, and *Enterobacter cloacae* [1 horse each]). Three organisms were cultured from the bone specimen from 1 horse (*Proteus* spp, *E coli*, and *Pseudomonas* spp). In the remaining horse, *Aeromonas salmonicida* was cultured from the bone specimen, and *Staphylococcus epidermidis* was cultured from the synovial fluid sample.

Surgical findings—Two horses were considered to not have tarsal sheath involvement. In 1 horse, this was determined on the basis of results of cytologic examination and bacterial culture of tarsal sheath synovial fluid. In the other, it was determined on the basis of total protein concentration of the tarsal sheath synovial fluid. In these horses, the ST was exposed and débrided by dissecting soft tissues medial to the tarsal sheath, and the tarsal sheath was not opened or lavaged. Bacterial culture of bone specimens from both horses confirmed the diagnosis of osteomyelitis. In 1 horse, a drain was placed to allow postoperative lavage of the surgical site.

The remaining 8 horses all had tarsal sheath involvement in conjunction with osteomyelitis of the ST, and fibrin and fibrous tissue were seen within the tarsal sheath. In these horses, necrotic bone was débrided, and the tarsal sheath was lavaged.

In 1 horse, a communication between the ST and the tarsocrural joint was identified during surgery; however, it was unclear whether this communication was a result of débridement of the ST, inadvertent entry into the plantar pouch of the tarsocrural joint during surgery, or preexisting infection and inflammation. After débridement of the ST and lavage of the tarsal sheath, the tarsocrural joint was lavaged.

Postoperative management—In 8 horses, antibiotics were administered IV at the same dosages as before surgery for 7 to 14 days after surgery. In 1 horse, enrofloxacin (7.5 mg/kg [3.4 mg/lb], PO, q 24 h) was administered for 21 days after surgery, and in the remaining horse, procaine penicillin G (20,000 U/kg, IM, q 12 h) was administered, instead of potassium penicillin G, in conjunction with gentamicin for 7 days after surgery. Administration of phenylbutazone was continued in all horses; the dosage was gradually decreased according to the degree of lameness and swelling. When parenteral antibiotic administration was discontinued, 9 horses were treated with trimethoprim-sulfamethoxazole (30 mg/kg [13.6 mg/lb], PO, q 12 h) for an additional 7 to 21 days. The remaining horse was euthanatized.

The tarsal sheath was lavaged daily after surgery in the 8 horses with tarsal sheath involvement, and the surgical site was lavaged in 1 horse without tarsal sheath involvement. Horses remained standing during the lavage procedure. On average, 5 L of a polyionic solution was used for the lavage procedure; the last liter of lavage fluid contained 10% dimethyl sulfoxide. The tarsal sheath was infused with 1 g of amikacin sulfate following lavage. Portals were protected by sterile bandages between lavage procedures. The decision to discontinue lavage treatment was made on the basis of the appearance of the wound, character of the discharge, and response to treatment. Mean duration of daily lavage was 5 days; 2 or 3 additional lavages were performed every other day after daily lavages were discontinued. The tarsocrural joint was also lavaged in the horse with evidence of a communication between the tarsal sheath and the tarsocrural joint.

Outcome—One horse was euthanatized 14 days after surgery because of a failure to respond to treatment, and outcome was classified as poor. The remaining 9 horses were all discharged from the hospital. Severity of lameness had improved in all 9, but all still had grade-1 or -2 lameness at the time of discharge. Duration of hospitalization ranged from 6 to 40 days (median, 21 days). Owners were instructed to confine the horses to a stall with daily hand walking for 4 weeks followed by pasture turn-out for 2 to 3 months and reexamination before light riding was resumed. One horse was euthanatized several months after discharge because of laminitis in the contralateral hind limb. Follow-up information was available for 7 of the remaining 8 horses (median follow-up time, 53 months; range, 12 to 96 months). Six horses were considered to have an excellent outcome and returned to their previous level of performance within 6 to 8 months after discharge (2, barrel racing; 1, cutting; 3, pleasure riding). The remaining horse was considered to have a good outcome, and the owner reported that the horse did not have any visible abnormalities and was sound at pasture. However, for reasons unrelated to tarsal joint problems, the owner had decided to retire the horse from performance and use it for breeding.

Discussion

Results of the present study suggest that horses with osteomyelitis of the ST, with or without concomitant tarsal sheath tenosynovitis, can have an excellent to good outcome and may return to their previous use after surgical débridement of affected tissues and lavage of the tarsal sheath. Six of the 10 horses in this study returned to their previous use, and 1 additional horse was sound but was retired for unrelated reasons. Two other horses improved after surgery, but 1 was lost to follow-up, and 1 was euthanatized because of laminitis. Results of this study were better than those reported in previous studies[2,10] and in contrast to those of reports[3-9] in which horses with osteomyelitis of the ST were considered to have a good to fair chance of surviving but only a fair to poor chance of returning to their previous use.

In the present study, lesions of the ST were best seen on the plantarolateral-dorsomedial oblique and plantaroproximal-plantarodistal radiographic views. In particular, the plantaroproximal-plantarodistal view allows examination of the ST and calcaneus without overlying bony shadows and may be the most useful view for detecting lesions of the ST.[11] Ultrasonography may be useful in the diagnosis of tenosynovitis in horses and in determining whether the tendon itself is involved. In 3 horses in the present study, ultrasonography provided information as to the character of the tarsal sheath synovial fluid and suggested that the LDF tendon itself did not contain any lesions.

White blood cell counts > 30,000 cells/µl of synovial fluid are suggestive of infection,[12] and counts > 100,000 cells/µl are pathognomonic. Mean ± SD total protein concentration in synovial fluid from healthy horses is 1.81 ± 0.26 gm/dl,[12] and protein concentrations > 2.5 gm/dl are considered abnormal. Protein concentrations in tarsal sheath synovial fluid from horses in the present study ranged from 1.5 to 6.1 gm/dl, and 5 of 7 horses had a total protein concentration > 2.5 gm/dl. White blood cell counts ranged from 1,700 to 105,100 cells/µl, and most of the cells were nondegenerate neutrophils, which are not definitive proof of infection.

Enterobacteriaceae and non–β-hemolytic streptococci are the most common bacteria isolated from traumatic orthopedic infections.[13] Bone specimens obtained at the time of surgery provide the most accurate bacterial culture results, whereas specimens from draining sinuses are less reliable.[14] In the present study, bacterial culture of bone specimens was more likely to yield bacterial growth (7/7) than was bacterial culture of tarsal sheath synovial fluid (1/6). Organisms that were isolated were organisms commonly associated with wounds. Even though results of bacterial culture of tarsal sheath synovial fluid were negative for most horses in this study, we still recommend that samples be submitted for bacterial culture to increase the chances of identifying a causative organism. In addition, in 1 horse in this study, different organisms were cultured from bone and synovial fluid samples.

In the present study, treatment involved débridement of infected bone and fibrocartilage of the ST, along with drainage and lavage of the tarsal sheath when it was determined to be involved. To adequately débride lesions of the ST, the LDF tendon must be retracted to expose the fibrocartilaginous surface of the ST. The tarsocrural joint has extensions that lie adjacent to the dorsoproximal aspect of the ST; therefore, if a communication with the tarsocrural joint is established during débridement, the joint should be lavaged.

Tenotomy of the LDF tendon at the level of the tarsal sheath or in the midmetatarsus region has been reported in conjunction with débridement and lavage for treatment of osteomyelitis of the ST in horses.[10] This procedure could be beneficial in horses that are not responding to other treatments, particularly if the tendon appears to be substantially compromised. However, this procedure should be regarded as a salvage procedure, because athletic use after tenotomy is unpredictable.

When osteomyelitis of the ST is accompanied by tarsal sheath tenosynovitis, lavage of the tarsal sheath is

indicated. Lavage dilutes the bacterial population and removes fibrinous debris and inflammatory mediators.[15,16] For horses in this study, the tarsal sheath was lavaged during and after surgery through portals made in the tarsal sheath. Strict adherence to asepsis during lavage and bandaging will minimize this risk of secondary infections.

Tenoscopy has recently been advocated for evaluation of the tarsal sheath.[2] Tarsal sheath and ST lesions were reportedly débrided with good success using this technique. The main limitation reported was the poor exposure of the medial (abaxial) aspect of the ST, which is mainly extra-synovial.[2] Furthermore, not all lesions involving the ST have tarsal sheath involvement. Tenoscopy of the tarsal sheath can be advantageous in certain cases, but more chronic cases involving osteomyelitis of the ST with or without tarsal sheath involvement may require an open approach.

[a]Ideal Instruments, Lansing, Mo.

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