Septic Tarsal Sheath Tenosynovitis

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ABSTRACT: Septic tarsal sheath tenosynovitis is an uncommon source of hindlimb lameness that may become career or life threatening. Diagnosis is based on radiography, ultrasonography, cytologic examination, and synovial fluid bacterial culture and antimicrobial sensitivity. Management with systemic antimicrobials, antiinflammatories, tarsal sheath lavage, and regional intravenous perfusion should not be delayed. Tenoscopic surgery is valuable as a diagnostic tool and a treatment modality because it permits direct visualization of the tarsal sheath architecture and allows debridement of pathologic lesions. Refractory cases may require transection of the tarsal flexor retinaculum, whereas transection of the deep digital flexor tendon may be used as a salvage procedure. Accurate and early diagnosis of this condition combined with aggressive therapy are imperative to obtain a satisfactory outcome.

The equine tarsal sheath (Figure 1) is a synovial structure enveloping the lateral digital flexor tendon, thereby allowing the tendon unrestricted passage over the calcaneal sustentaculum tali. The lateral digital flexor tendon, along with the medial digital flexor tendon, which has its own synovial sheath, unite distal to the tarsus to form the deep digital flexor tendon.¹ The tarsal sheath is 25 to 30 cm long, originating approximately 6 cm proximal to the lateral malleolus of the tibia and extending distally to insert on the proximal third of the metatarsus.¹,² At the level of the tarsocrural joint, a fibrinocartilaginous groove formed by the plantar tarsal ligament defines the dorsal and lateral borders of the tarsal sheath. The plantar and medial borders of the tarsal sheath are defined by a thick, transversely oriented, tarsal flexor retinaculum.³ The tarsal flexor retinaculum, which is approximately 3 to 4 cm long, encloses the tarsal sheath within an inelastic canal from the proximal border of the sustentaculum tali to the proximal third of the metatarsus.²,³ The outer fibrous layer of the tarsal sheath provides the vascular and neural supply to the sheath, whereas the inner visceral layer contains synoviocytes.⁵ An adequate blood sup-
Supply is essential to provide the nutrients required for generation of synovial fluid and to facilitate removal of metabolic wastes from the synovium. Neurovascular structures closely associated with the tarsal sheath include the plantar nerves, which arise from the tibial nerve, and the tarsal arteries, which arise from the caudotibial artery. Nociceptors within the proximal plantar ligament and fibrous layer of the tarsal sheath are responsible for transmission of pain signals and the resulting clinical signs exhibited by horses with severe tarsal sheath effusion.

**CAUSE AND CLINICAL SIGNS**

Lameness associated with septic tarsal sheath tenosynovitis is commonly severe and accompanied by heat, pain, and swelling of the tarsal region. Examination of the tarsus reveals plantarmedial effusion, and a painful response can be elicited by digital palpation of the tarsal sheath (Figure 2). Traumatic injuries to the soft tissue in this region typically cause immediate discomfort to the horse, resulting in severe lameness. However, if an open, draining wound is present, the horse may exhibit less obvious signs of pain and lameness, primarily due to the lack of distention of the tendon sheath. However, with continued infection and inflammation of the synovial membrane, the degree of pain and lameness increases because of distention of the sheath, increased pressure on the nociceptors in the soft tissue, and irritation of the lateral digital flexor tendon as it passes over the sustentaculum tali. As evidence of this latter effect, fraying of the dorsal surface of the lateral digital flexor tendon has been demonstrated in postmortem examinations of horses with septic tarsal sheath tenosynovitis. Once the septic component of the tarsal sheath infection is alleviated, chronic mechanical lameness may persist and may be attributed to formation of adhesions to the tendon sheath. A poor outcome in clinical cases can be attributed to delayed recognition and diagnosis of tarsal
vaginocentesis (synovial fluid aspiration from the tarsal sheath)
• Culture of synovial fluid for aerobic and anaerobic bacteria, and antimicrobial sensitivity testing of cultured bacteria

It is important to perform radiography and ultrasonography before tenovaginocentesis to prevent introduction of gas into the tarsal sheath.

Tarsal radiographs should be obtained to rule out abnormalities involving the bones and identify foreign bodies (Figure 3). Lateromedial, dorsoplantar, dorsolateral–plantarmedial oblique, plantarlateral–dorsomedial oblique, and plantarproximal–plantardistal (i.e., skyline) radiographic views are necessary to fully evaluate the tarsus. The sustentaculum tali is highlighted on plantarlateral–dorsomedial and skyline views. Lesions involving the bones that result in tarsal sheath sepsis include osteomyelitis or sequestra of the sustentaculum tali and open fractures or sequestra of the calcaneus. Radiographic abnormalities, such as sequestra, may not be initially detected; therefore, follow-up radiographs should be taken in 10 to 14 days if no improvement in the degree of lameness is observed or if effusion of the tarsal sheath persists.

Ultrasonography allows noninvasive structural evaluation of the tarsal sheath and adjacent tissue (Figure 4). A 10- to 12-MHz sector-scanner transducer with a standoff pad at a display depth of 5 to 6 cm should be used to evaluate the character of the synovial fluid and detect fibrin deposition, adhesion development, and lesions within the lateral digital flexor tendon. This technique can be used to assess the integrity of the fibrocartilaginous groove, flexor retinaculum, and edge of the sustentaculum tali. Septic synovial fluid has increased echogenicity and is heterogeneous because of the presence of fibrin clots and debris. Longitudinal tears in the lateral digital flexor tendon and superficial fraying of the tendon are the most common types of lesions detected via ultrasonography and should not be confused with hyperplasia of the visceral synovial membrane covering the tendon. Because it is difficult to assess the entire length of the tarsal sheath via ultrasonographic examination, lesions may not be detected, and intermittent lameness may persist.

**DIAGNOSIS**

Severe lameness accompanied by heat, pain, and swelling in the region of the tarsal sheath is presumptive evidence of septic tarsal sheath tenosynovitis. Confirmation of the diagnosis should be attempted by:

- Radiographic examination of the affected area
- Ultrasonographic examination of the tarsal sheath and the accompanying tendon
- Cytologic analysis of synovial fluid obtained by tenovaginocentesis

Early diagnosis and aggressive treatment of septic tarsal sheath tenosynovitis are imperative to improve the chance of an acceptable recovery.
sonography, tenoscopy may be required to diagnose subtle lesions within the sheath.\textsuperscript{10}

Tenovaginocentesis may be performed aseptically in standing horses or with horses under general anesthesia. If a wound is present, tenovaginocentesis should be performed through an area away from the wound to prevent inadvertent contamination of the tarsal sheath. It is also advisable to perform this procedure before exploring the wound. The fluid should be evaluated for color, turbidity, and viscosity and should then be submitted for cytologic evaluation as well as bacterial culture and sensitivity. Normal synovial fluid should be straw colored or yellow, translucent, and very viscous. A synovial sample that appears brownish to sanguineous and cloudy and has poor viscosity should be considered septic.\textsuperscript{5} Septic synovial fluid typically has an increased leukocyte count (i.e., nucleated cells >30,000/µl) and an increased total protein concentration (i.e., >3 g/dl).\textsuperscript{5} The cells are predominantly (i.e., usually 80% to 90%) neutrophils; in chronic cases, the neutrophils may have degenerative changes.\textsuperscript{5} Bacteria are seldom observed via cytologic examination of synovial fluid.\textsuperscript{5,11} If the sheath is open and draining distally, it may not be possible to obtain synovial fluid by tenovaginocentesis.

Aerobic and anaerobic bacterial cultures of the synovial fluid should be conducted. Infection can be confirmed with positive results of a bacterial culture; however, negative results of synovial fluid cultures are not uncommon and do not indicate the absence of infection.\textsuperscript{11} Difficulties in obtaining bacterial growth are associated with sequestration of bacteria in the synovial membrane or within neutrophils, with intrinsic bactericidal properties of septic synovial effusions, and with previous administration of antibiotics.\textsuperscript{5,11}

Infusion of the tarsal sheath with sterile polyionic fluid should be performed after tenovaginocentesis to deter-
mine whether the wound communicates with the tarsal sheath. Because multiple synovial structures are located in the tarsal region (i.e., tarsal joints, calcaneal bursa), it is important to determine whether there is involvement of adjacent synovial structures. Tarsocrural joint arthrocentesis, followed by joint distension, should be performed to determine whether that joint communicates with the tarsal sheath and/or the wound. Similarly, it may be necessary to distend the distal intertarsal joint, the tarsometatarsal joint, and the calcaneal bursa with sterile polyionic fluid to determine whether one or more of these cavities communicate with the tarsal sheath. Alternatively, a radiopaque contrast medium may be injected into the tarsal sheath and radiographs taken if communication between the tarsal sheath and adjacent tarsal joint(s) is suspected.

**TREATMENT**

Horses with septic tarsal sheath tenosynovitis should be treated similarly to horses with septic arthritis. It has been well documented that septic arthritis is best treated with a combination of systemic antimicrobial therapy, joint lavage, and/or regional intravenous perfusion with antimicrobials. Furthermore, experience indicates that an unsatisfactory response to noninvasive therapy warrants surgical intervention. A similar approach, including antimicrobial therapy, lavage of the tendon sheath, and, if indicated, regional intravenous perfusion, should be used for horses with septic tarsal sheath tenosynovitis. Surgical intervention in such cases may involve incision into the sheath to allow drainage of fluid, placement of indwelling fenestrated drains, tarsal sheath tenoscopy, transection of the tarsal flexor retinaculum, or midmetatarsal transection of the deep digital flexor tendon. Abnormalities involving the sustentaculum tali or calcaneus should be treated as the primary source of infection and addressed surgically.

**Antimicrobial Therapy, Lavage, and Regional Intravenous Perfusion**

Initiation of antimicrobial therapy should not be delayed, even if a synovial sample cannot be obtained immediately. Empirically, a combination of a β-lactam or cephalosporin and aminoglycoside antimicrobials should be administered systemically for approximately 7 to 10 days, followed by oral administration of antimicrobials based on the results of bacterial culture and sensitivity. Antimicrobial therapy should be continued for 4 to 6 weeks or until 2 weeks after clinical signs have resolved.

Lavage of the tarsal sheath may be performed by various techniques, including through-and-through lavage, tenoscopy, and indwelling fenestrated drains. Through-and-through tarsal sheath lavage with sterile polyionic fluids is recommended in the presence of acute bacterial infections. This allows dilution and removal of inflammatory components involved in adhesion formation, including cellular enzymes, inflammatory mediators, and, if indicated, regional intravenous perfusion.
and fibrin.11 Fourteen-gauge needles or teat cannulas should be placed in the proximal pouch and distal recess of the sheath, and then 1 to 5 L of sterile polyionic fluid should be used to lavage the tarsal sheath.9 Wounds communicating with the tarsal sheath can be used as egress portals and allowed to heal by second intention. Although this technique can be performed with the horse standing, a more thorough and effective lavage can be achieved with the horse under general anesthesia. In severe, chronic, or unresponsive cases of tarsal sheath sepsis, tenoscopic evaluation and lavage may be beneficial. In addition, antimicrobial agents (usually an aminoglycoside) may be injected directly into the tarsal sheath after lavage is complete. Regional intravenous perfusion with antimicrobials may be beneficial in chronic and severe tarsal sheath infections. Regional intravenous perfusion permits delivery of an appropriate antimicrobial agent (usually an aminoglycoside) to infected tissue in concentrations exceeding the minimal inhibitory level.13 The regional intravenous infusion technique is indicated because infected tissue undergoes changes in local pH, blood flow, and capillary obstruction by fibrin and debris that prevent local delivery of systemically administered antimicrobials.14 After application of a tourniquet, regional intravenous perfusion improves antimicrobial delivery to infected tissue by increasing capillary hydrostatic pressure and potentially opening capillaries that are obstructed by fibrin and debris.14 Daily treatment by regional intravenous perfusion can be performed with the horse standing, if it will tolerate the procedure, or under anesthesia for lavage of the tendon sheath. It is advisable to keep the tourniquet inflated no longer than 30 minutes at a cuff pressure not exceeding 300 mm Hg.15

### Tarsal Sheath Tenoscopy

Tenoscopy should be used when purulent material, adhesions, or bony lesions are present.9 Tarsal sheath tenoscopy (Figure 5) allows direct visualization and accurate examination of the lateral digital flexor tendon, sustentaculum tali, and synovial surfaces within the sheath.9 In addition, large-bore through-and-through lavage can be performed at the same time the tissue is being examined. This procedure also allows removal of lesions on the sustentaculum tali and bone fragments or debridement of adhesions, debris, hypertrophic synovium, and frayed areas on the tendon.9,16

Tenoscopic evaluation should be performed with the horse under general anesthesia in lateral recumbency and the affected limb down. An 8- to 10-mm skin incision should be made 2 to 3 mm plantar and parallel to the medial edge of the sustentaculum tali; a small stab inci-

#### Table 1. Suggested Antimicrobials and Doses for Managing Septic Tarsal Sheath Tenosynovitis

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Dose (mg/kg)</th>
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</thead>
<tbody>
<tr>
<td><strong>SYSTEMIC</strong></td>
<td></td>
</tr>
<tr>
<td>β-Lactams</td>
<td></td>
</tr>
<tr>
<td>Procaine penicillin G</td>
<td>22,000 IM bid</td>
</tr>
<tr>
<td>Potassium penicillin</td>
<td>22,000 IV qid</td>
</tr>
<tr>
<td>Ampicillin sodium</td>
<td>20 IV bid</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td></td>
</tr>
<tr>
<td>Ceftiofur sodium</td>
<td>2.2 IM bid</td>
</tr>
<tr>
<td>Cefazolin sodium</td>
<td>11 IV qid</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td></td>
</tr>
<tr>
<td>Gentamicin sulfate</td>
<td>6.6 IV sid</td>
</tr>
<tr>
<td>Amikacin sulfate</td>
<td>15 IV sid</td>
</tr>
<tr>
<td><strong>ORAL</strong></td>
<td></td>
</tr>
<tr>
<td>Trimethoprim–sulfadiazine</td>
<td>15–22 PO bid</td>
</tr>
<tr>
<td>Doxycycline hyclate</td>
<td>10 PO bid</td>
</tr>
<tr>
<td>Chloramphenicol palmitate</td>
<td>44 PO tid</td>
</tr>
<tr>
<td>Enrofloxacin</td>
<td>7.5 PO sid</td>
</tr>
</tbody>
</table>

Figure 5. Tenoscopic view at the level of the sustentaculum tali (ST) within the right tarsal sheath. The arthroscope is placed medial to the lateral digital flexor (LDF) tendon. The synovium (S) appears inflamed, and fibrin is present.
An arthroscopic cannula and blunt obturator should be forced into the plantar groove of the sustentaculum tali in a proximo-dorsolateral direction between the lateral digital flexor tendon and its tarsal groove. This approach permits complete visualization of the proximal and distal aspects of the tarsal sheath. The proximal aspect of the sheath is spacious, allowing easy navigation; however, the distal aspect of the sheath becomes more constricted and difficult to distend. Care must be taken not to retract the endoscope from its portal when redirecting the endoscope toward the distal aspect of the sheath. An instrument or lavage portal may be positioned in the proximal aspect of the tarsal sheath. The advantages of tarsal sheath tenoscopy include decreased surgical trauma and reduced wound-related complications, resulting in faster recovery. The main limitation of tenoscopy is poor visualization along the medial aspect of the sustentaculum tali, which is extrasynovial. Extrasynovial lesions involving the sustentaculum tali require an open approach. In addition, large wounds communicating with the tarsal sheath result in inadequate distention of the sheath, thereby limiting tenoscopic evaluation of the tissue. In such instances, through-and-through lavage should be performed until the wound heals.

Fenestrated Drains

Although placement of fenestrated polyvinyl chloride or silicone drains (Figure 6) in the tendon sheath is rarely necessary, they have been used in horses with recurrent septic tenosynovitis to facilitate drainage of synovial fluid and lavage of the tendon sheath without the need for repeated anesthetic episodes. Sterile polyionic fluids may be lavaged continuously or several times per day to promote removal of cellular debris, inflammatory mediators, bacteria, and fibrin. Fenestrated drains should remain in place for no longer than 5 days; indwelling drains left in place for longer periods may act as an irritant or provide an avenue for ascending bacterial infection. The drain portals should be allowed to heal by second intention after the drain has been removed.

Transection of the Tarsal Flexor Retinaculum

The tarsal flexor retinaculum can be transected percutaneously with a bistoury through a stab incision or an incision that extends the entire length of the retinaculum. Transection of the tarsal flexor retinaculum has been used to relieve pressure on the lateral digital flexor tendon in the tarsal canal when the tendon or tarsal sheath is swollen because of septic tenosynovitis. Transection of the tarsal flexor retinaculum should be reserved for cases in which alleviating constriction on the lateral digital flexor tendon may help resolve lameness by reducing mechanically induced tendon damage, pressure on the tendon, and inflammation.

The percutaneous approach avoids wound dehiscence, which can occur with a longer incision. In this region, the skin and subcutaneous tissue are subject to movement associated with flexion and extension of the tarsus; this movement may lead to dehiscence and formation of a synovial fistula. This procedure should be performed with the horse under general anesthesia and laterally recumbent with the affected limb down. A 2-cm skin incision should be made over the distal border...
of the tarsal flexor retinaculum along the plantar medial aspect of the tarsus. Subsequently, a stab incision should penetrate the tarsal sheath. To ensure a proper plane of retinaculum transection, a long pair of curved hemostats should be inserted into the tarsal sheath and advanced to the proximal border of the tarsal flexor retinaculum. The location of the hemostat tips should be digitally palpated and the hemostat replaced with a curved, blunt-ended bistoury. The bistoury should be gradually worked medially, ensuring complete transection of the tarsal flexor retinaculum. The incision should be left open to allow drainage and healing by second intention.

When using a long incision to transect the tarsal flexor retinaculum, a 6-cm longitudinal incision centered over the sustentaculum tali should be made on the plantar medial aspect of the tarsus. This technique allows examination of the lateral digital flexor tendon and the fibrocartilaginous surface of the sustentaculum tali. The proximal 4 cm of the subcutaneous tissue and skin should be closed primarily, leaving the remainder of the incision open to allow drainage and healing by second intention. This technique may result in a large cosmetic blemish over the surgical site.

**Transection of the Deep Digital Flexor Tendon in the Midmetatarsal Region**

Transection of the deep digital flexor tendon in the midmetatarsal region should be considered in horses that are nonresponsive to repeated tarsal sheath lavage, prolonged antimicrobial therapy, debridement of lesions involving the sustentaculum tali, and transection of the retinaculum.7 Midmetatarsal deep digital flexor tenotomy appears to be effective at reducing lameness and results in fewer complications than tenectomy performed at the level of the sustentaculum tali.7 Tenotomy should be reserved as a salvage procedure to increase a horse’s comfort level and reduce the load on the contralateral limb.7 Deep digital flexor tenotomy is thought to decrease lameness by reducing motion and the pressure of the lateral digital flexor tendon on the sustentaculum tali and by limiting further damage to the lateral digital flexor tendon. Athletic performance after deep digital tenotomy is unlikely, and the prognosis for soundness depends on the severity of the lameness associated with the primary lesion.7 An extended heel shoe should be placed on the foot to provide support and help prevent the toe from becoming elevated off the ground.

**Sodium Hyaluronan**

Sodium hyaluronan plays an important role in the function of the synovial structures. Despite elimination of bacteria, bacterial infection is associated with release of inflammatory mediators and a prolonged decrease in hyaluronic acid concentration in synovial fluid.17 Concentrated sodium hyaluronan is viscous and may provide a space-occupying effect to maintain separation of the lateral digital flexor tendon and the tarsal sheath; however, the pharmaceutic, rather than physical, properties of sodium hyaluronan may diminish development of adhesions within the tarsal sheath.18 Viscosupplementation of the synovial fluid with sodium hyaluronan helps reduce the amount of protein and cellular infiltration into the tarsal sheath and provides local analgesic, anabolic, chondroprotective, and direct antiinflammatory effects.19,20 Sodium hyaluronan can be postoperatively injected into the tarsal sheath following tenoscopy or transection of the tarsal flexor retinaculum every 2 weeks for two to three treatments.

**Antiinflammatory Agents and Other Supportive Therapies**

Phenylbutazone (4.4 mg/kg IV or PO q12h) is the most commonly used NSAID and should be gradually decreased based on clinical improvement. Epidural catheterization and/or direct epidural injections of α₂-adrenoreceptor agonists, opioids, dissociative agents, and local anesthetics, alone or in combination, can have positive results by improving a horse’s comfort level.21 Combinations consisting of morphine sulfate (0.2 mg/kg) and detomidine hydrochloride (0.02 mg/kg); lidocaine hydrochloride (0.2 mg/kg) and xylazine hydrochloride (0.15 mg/kg); or lidocaine (0.2 mg/kg), mepivacaine hydrochloride (0.2 mg/kg), and xylazine (0.15 mg/kg) have provided satisfactory levels of pain relief when administered epidurally in affected

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**Horses with tenosynovitis that is refractory to treatment require aggressive surgical intervention.**

**The result of such cases is often a nonathletic horse with some degree of unsoundness.**

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horses. Preservative-free morphine should be used, and 0.9% sodium chloride solution should be added to all combinations to achieve a final volume of 10 ml.

Wedge pads or an elevated heel shoe may improve lameness and help decrease the apparent level of pain. Heel elevation should decrease the amount of pressure exerted on the lateral digital flexor tendon as it courses over the sustentaculum tali, thereby providing some pain relief. As the degree of lameness improves, the heel angle should be reduced gradually. Hydrotherapy has been used for many years to help reduce effusion of the affected tendon sheath. Daily hydrotherapy of the tarsal region is acceptable as long as no open wounds or portals are present. Daily hand-walking of horses with tarsal sheath infections is warranted as long as the horse can place its heel on the ground while walking. Movement is important to restore normal synovial physiology and helps prevent adhesion formation. If adhesions are already present, exercise may encourage stretching and lengthening of adhesions so that they become less restrictive.

**CONCLUSION**

Septic tarsal sheath tenosynovitis can become career ending if not accurately diagnosed and aggressively treated. Without proper therapy, affected horses have a guarded prognosis for soundness because of the nature and severity of the lameness and the potential for associated complications. Antimicrobial and antiinflammatory therapy as well as lavage of the tarsal sheath should be initiated as soon as septic tarsal sheath tenosynovitis has been diagnosed. Diagnostic evidence of fibrocartilage damage or fragmentation of the sustentaculum tali or the presence of purulent synovial fluid, adhesions, or chronic septic tenosynovitis warrants tenoscopic evaluation and debridement of affected tissue. Aggressive surgical procedures should be reserved for horses that fail to respond to these treatments or to salvage a horse's life. Complications of septic tarsal sheath tenosynovitis include formation of adhesions between the tendon and tarsal sheath, contralateral limb laminitis, and unresolved infection. Horses with more extensive injuries, especially those with lesions involving the fibrocartilage of the sustentaculum tali or septic osteomyelitis, remain difficult to treat. Consequently, early diagnosis and aggressive therapy of septic tarsal sheath tenosynovitis are imperative to improve the chance of an acceptable recovery and the horse returning to its normal activity level.

**REFERENCES**

1. The tendon of the ____________ muscle is most commonly associated with septic tarsal sheath tenosynovitis.
   a. gastrocnemius  
   b. superficial digital flexor  
   c. medial digital flexor  
   d. peroneus tertius  
   e. lateral digital flexor

2. Regional intravenous perfusion with antimicrobials may be beneficial in tarsal sheath infections because
   a. increased capillary hydrostatic pressure occurs, decreasing antimicrobial delivery to infected tissue.  
   b. it permits delivery of an appropriate antimicrobial to infected tissue in concentrations exceeding the minimum inhibitory level.  
   c. capillaries obstructed by fibrin and debris become narrowed, thereby improving antimicrobial delivery to infected tissue.  
   d. all of the above  
   e. none of the above

3. During treatment of septic tenosynovitis, controlled exercise is recommended to
   a. decrease the amount of inflammation in the surrounding tissue.  
   b. prevent laminitis in the contralateral limb.  
   c. relieve boredom and keep the horse fit.  
   d. encourage granulation of the wound, if present, over the tarsal sheath.  
   e. prevent adhesion development or stretch existing adhesions so they become less restrictive.

4. The leukocyte count and total protein concentration of synovial fluid aspirated from a septic tarsal sheath generally are ____________, respectively.
   a. greater than 30,000 nucleated cells/µl and greater than 3 g/dl  
   b. less than 30,000 nucleated cells/µl and greater than 3 g/dl  
   c. greater than 100,000 nucleated cells/µl and greater than 3 g/dl  
   d. greater than 100,000 nucleated cells/µl and greater than 6 g/dl  
   e. none of the above

5. Diagnosis of septic tenosynovitis is based on
   a. clinical signs only.  
   b. bacterial isolation.  
   c. clinical signs and bacterial isolation.  
   d. the presence of a wound near the tarsal sheath.  
   e. radiographic findings.

6. Complications that can result from tarsal sheath sepsis do not include
   a. laminitis of the contralateral support limb.  
   b. adhesions between the lateral digital flexor tendon and the tarsal sheath.  
   c. arthrodesis of the sustentaculum tali.  
   d. unresolved infection.  
   e. sustentaculum tali osteomyelitis.

7. Sodium hyaluronan (viscosupplementation) provides
   a. local analgesia.  
   b. antiinflammatory effects.  
   c. reduced protein and cellular infiltration.  
   d. all of the above  
   e. none of the above

8. Which surgical treatment provides direct visualization and pathologic lesion debridement within the tarsal sheath?
   a. transection of the flexor retinaculum of the tarsal canal  
   b. midmetatarsal deep digital flexor tenotomy  
   c. tenoscopy  
   d. tibiotalar arthroscopy  
   e. placement of an indwelling fenestrated drain

9. As the lateral digital flexor tendon passes through the tarsal sheath, it glides unrestricted over which tarsal bone?
   a. calcaneus  
   b. sustentaculum tali  
   c. lateral trochlear ridge  
   d. third tarsal bone  
   e. lateral malleolus

10. If septic tarsal sheath is diagnosed or suspected, initial treatment following tenovaginocentesis should include
    a. lavage of the tarsal sheath only.  
    b. transection of the tarsal flexor retinaculum.  
    c. tarsal sheath lavage, broad-spectrum antimicrobial therapy, and intrathecal corticosteroids.  
    d. bandaging of the affected limb and monitoring of lameness.  
    e. tarsal sheath tenoscopy and broad-spectrum antimicrobial therapy.