Treatment of Posttraumatic Septic Arthritis

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Septic arthritis and tenosynovitis are serious problems in horses that can result in arthritis, irreversible cartilage damage, fibrosis and intrathecal adhesions, and unsoundness when the infection is not rapidly eliminated from the synovial space. Recommended treatments in horses include through-and-through lavage, systemic antibiotics, intra-articular drains, arthroscopy, arthrotomy, synovectomy and the use of nonsteroidal anti-inflammatory drugs. Many of these treatments are used simultaneously in affected horses, which makes evaluating the effectiveness of any one treatment difficult. Author’s address: Dept. of Veterinary Clinical Sciences, Washington State University, P.O. Box 647060, Pullman, WA 99164-7060. © 1998 AAEP.

1. Introduction

Controlled studies are available that evaluate various treatments in experimental septic arthritis in horses. Effective concentrations of systemic antibiotics, when combined with joint drainage, significantly decreased the isolation rate of the bacterium Staphylococcus aureus used to create experimental joint infections. The inclusion of antiseptics such as povidone-iodine in the lavage solution did not have advantages over joint lavage with balanced electrolyte solutions. The combination of joint lavage and systemic trimethoprim-sulfadiazine did not eliminate staphylococcal infection from equine tarsal joints. When used intra-articularly, gentamicin, originally considered to be too irritating to inject into a joint, has been shown to cause minimal inflammation in normal equine joints and to eliminate Escherichia coli effectively in an experimental model of septic arthritis. In addition, synovial fluid concentrations after a single intra-articular injection are 10 to 100 times greater than those that can be achieved with intravenous administration.

The treatment of septic arthritis or tenosynovitis is aimed at the rapid elimination of the infection to minimize the damage to articular cartilage and the formation of fibrous adhesions within tendon sheaths. Preserving the articular cartilage allows the joint to return to normal function once the infection is resolved. The principles of treatment of infection in a joint and tendon sheath are similar and are not different from treatment of a localized infection in other areas of the horse's body. Drainage and effective antibiotic therapy are necessary to eradicate bacteria from the synovial space. Adequate drainage of the synovial cavity removes the inflammatory exudate of neutrophils and proteins that cause degradation of the proteoglycans in the articular cartilage matrix. Drainage also removes bacteria and fibrin and prevents fibrous deposition on cartilage and synovial surfaces (pannus formation), which can impair cartilage nutrition and limit the chondrocytes' reparative capabilities. High concentrations of antibiotics in the synovium and synovial fluid are indicated to eliminate the infecting organism as quickly as possible.

The treatment employed to manage septic arthri-
tis varies from case to case. Some horses with acute joint infection can be managed with antibiotic therapy and joint lavage through needles. Other horses may have little or no response to this treatment and require lavage, debridement of fibrin and synovium, open drainage through an arthrotomy, and in some cases curettage of an area of osteomyelitis. Treatment selection depends on the duration and severity of the infection and on the economics and value of the horse. The treatment of septic arthritis has greatly improved in the past 20 years. The infection can be eliminated in the majority of cases with persistent and aggressive treatment; however, it is not without considerable expense. A joint infection is difficult enough to treat successfully; it is even more difficult to treat it successfully and inexpensively. The expense of hospitalization and care may prohibit treatment for some horses.

2. Culture of Synovial Fluid

Before treatment is initiated, a sample of synovial fluid should be obtained for culture. Five milliliters of synovial fluid are aspirated aseptically from the joint. Whatever volume is obtained is injected into a blood culture medium to maximize the chances of isolating the organism. Both clinical and experimental studies have clearly documented that recovery rates from synovial fluid are better than those from a piece of the synovium.16,17

3. Treatment: Acute Septic Arthritis

Joint lavage is recommended for every horse with septic arthritis. Flushing the joint is a form of drainage and removes the inflammatory exudate, which contains lysosomal enzymes, neutral metalloproteinases, collagenases, and hyaluronidases, all of which act to degrade the articular cartilage. Balanced electrolyte solutions are recommended for lavage. Dilute antiseptic solutions cause too much inflammation, and those that are nonirritating (dilute povidone–iodine) appear to offer no advantage over balanced electrolyte solutions.8 Antibiotics are not included in the lavage because of the transient contact time the fluid has in the joint during irrigation. Inclusion of dimethyl sulfoxide in the lavage solution does not cause inflammation in the joint and is recommended by some for its superoxide radical scavenging properties. Its current use is based on the personal preference of the treating veterinarian.

Joint lavage can be performed with the horse standing if it is tractable. A local anesthetic is injected into the joint 10 min prior to the lavage to decrease the pain experienced by the horse during distension irrigation. Large-gauge needles (14 or 16 ga.) are placed on opposite sides of the joint. Following lavage, intra-articular antibiotics are injected into the joint.

Intra-articular antibiotics have become an important treatment for horses with septic arthritis. The drug concentrations achieved in the synovial fluid are 10 to 100 times the levels that can be achieved with systemic administration, using relatively low doses (gentamicin 150 mg).11 Gentamicin causes only mild, transient inflammation when injected into joints.10 Amikacin, an aminoglycoside similar to gentamicin, has been injected into a large number of joints in horses (at a dose of 250–500 mg). Cefazolin has also been injected into infected joints without any observed ill effects (at a dose of 250–500 mg). Cefotiofur (150 mg), imipenem–cilastatin (Primaxin®), and ticarcillin–clavulanate (Timentin®) have all been shown to cause little or no inflammation in normal equine joints.14 Amikacin is most frequently used before culture results are known because of its broad spectrum and the high cost of systemic doses of this drug. Antibiotics are injected into the joint once daily until clinical signs (swelling, fever, and lameness) are resolving. In most horses with acute infection that respond to treatment, intra-articular antibiotics are continued for 3–7 days. When possible, the infected joint is usually bandaged after lavage or intra-articular injections to minimize or decrease swelling.

Systemic antibiotics are recommended for all horses with an infected joint. The initial therapy should be broad spectrum, bactericidal, and given intravenously to maximize penetration into the synovial fluid.14 It is difficult at this time to recommend treatment without systemic antibiotics. However, a small number of cases have been managed successfully with only joint lavage and intra-articular antibiotics. The benefit of systemic administration can be questioned in adult horses with only one infected joint when the organism is sensitive to the antibiotic being injected directly into the joint.

Phenylbutazone (4 mg/kg PO q 24 h) is usually given to these horses for its anti-inflammatory effect in the joint and to increase use of the affected limb. The negative effect of masking some of the clinical signs is far outweighed by the benefit of increased comfort and use of the limb, which helps to avoid the serious complication of opposite limb laminitis. Once the horse is responding and using the leg well, phenylbutazone can be discontinued to further evaluate the response to treatment.

4. Treatment: Chronic Septic Arthritis

More aggressive treatment is usually required to eliminate an infection from joints that have been infected for several days prior to treatment or that fail to respond to initial treatment. The longer the infection has been present, the more established the infection becomes, the greater the fibrin accumulation in the joint, the more severe the synovitis, and the less likely the horse is to respond to joint lavage through needles. Joint lavage through needles has limitations and cannot effectively remove the coagulum of fibrin and white blood cells accumulated in a chronic or nonresponsive joint. A better method of achieving chronic joint drainage is necessary to resolve the infection. The open drainage of the joint through a 3- to 6-cm arthrotomy incision is currently
recommended to allow fibrin and fluid to drain from the joint space. Other methods of providing joint drainage with drains have been reported. The difficulty of maintaining continuous suction drains in the stall environment and the inability to remove fibrin are limitations of these techniques. The rest of this paper focuses on the use of open drainage and antibiotics to manage horses with chronic infectious arthritis or tenosynovitis.

Open drainage of a joint is usually performed during joint lavage, either with an arthroscope or with a large-gauge needle that is placed in the side of the joint opposite the arthrotomy incision. Arthroscopy offers the advantages of evaluation of the cartilage surfaces, more complete removal of fibrin, and the ability to curette areas of osteomyelitis. The evaluation of articular surfaces is important and allows one to determine a more accurate prognosis for the owner. Arthroscopy is also more expensive, which may be a consideration in some horses. Regardless of the method used to irrigate the joint, a small (3–6 cm) arthrotomy incision is made in the joint to allow fibrin to be removed with an instrument. When the lavage is performed through a needle, a sterile instrument (Kelly forceps) is passed into the arthrotomy incision to grasp and remove fibrin; arthroscopic instruments are used through the instrument portal during arthroscopic lavage. Following the lavage, intra-articular antibiotics are injected into the joint; the arthrotomy is left open, and a sterile bandage is placed over the leg.

The postoperative management of these patients is currently similar to the treatment described in the Equine Veterinary Journal in 1992. Sterile bandages were changed every day. The skin around the open drainage incision was scrubbed with povidone-iodine soap and rinsed with alcohol-soaked gauze. Antibiotics were injected through an 18-gauge needle placed into the joint or sheath opposite the location of the incision every day for the first few days after surgery. Daily antibiotic injections into the joint or sheath were continued until the clinical signs of infection were resolving. Arthrocentesis was always performed using sterile technique. Sterile bandages were used, and povidone-iodine ointment was placed over the incision to protect the joint or sheath. When large quantities of fibrin were draining from the arthrotomy, the joint was lavaged with 1–2 L of sterile lactated Ringer’s solution. Ingress fluid flow entered the joint through a 14- or 16-gauge needle in the arthrocentesis site andgressed through the arthrotomy incision. A sterile curved Kelly forceps was used to remove fibrin from the incision while the joint or tendon sheath was being flushed. The lavage was repeated every 2 or 3 days in horses with continued fibrinous drainage or that had persistent synovial effusion or lameness.

Clinical signs were used to monitor the response to open drainage and joint lavage. In horses that were responding, use of the affected limb was improved within 24 h and the horses were walking with only slight lameness by 48–72 h after surgery. Although the affected joints or sheaths remained enlarged compared with normal, by 24–48 h the edema, joint capsule swelling, and especially synovial effusion were resolving. Failure to observe clinical improvement by 48 h was considered to be an indication that effective decompression of the synovial structure was not occurring. The effectiveness of drainage was evaluated by careful palpation; the synovial pouches were collapsed without fluid distension when adequate drainage was achieved. Palpable distension of the joint or tendon sheath was present when drainage was not achieved. When this occurred, lavage was performed to remove fibrin that was sealing the arthrotomy, the incision was extended, or the joint or tendon sheath was opened in a second site. Digital flexor tendon sheaths frequently required two incisions to decompress the sheath proximal and distal to the annular ligament. Resolution of the edema and swelling in the joint capsule, a return to a normal gait at the walk, and normal gross appearance of the synovial fluid were observed when the infection was resolving.

Most of the arthrotomy incisions were allowed to heal by granulation. Middle carpal and fetlock arthrotomies sealed more quickly than other sites, usually within 7–10 days. Some tibiotalar joints and tendon sheaths had persistent drainage for longer than 5 weeks, and the horses were sent home while these were still draining. Although all of these horses eventually healed, for long-term bandaging to be avoided, the open incisions were debrided and sutured closed in nine of these horses (five tibiotalar joints, two tendon sheaths, two fetlock joints, and one stifle were sutured). Incisions in all nine horses healed without complication and without recurrence of the infection. With one exception, the infection was eliminated from all the joints in the horses in this study.

Concerns about the technique of open joint drainage included desiccation of the articular cartilage, the possibility of secondary infection of the joint by environmental bacteria, and delayed healing of the arthrotomy incision. I have no evidence that drying of the articular cartilage occurred, and in fact, I believe the improved use and motion observed in these joints and the continued production of synovial fluid prevented drying of the articular surfaces. With the exception of the stifle joint, all of the arthrotomies were protected by a sterile bandage until they granulated closed or were sutured. The necessity of maintaining a sterile bandage can be debated. It is not possible to maintain skin and wound sterility for 24 h; however, minimizing the buildup of the bacterial population on the skin and in the incision may be important in preventing retrograde infection of the joint through an open incision. Continued drainage of synovial fluid from a joint or tendon sheath may also help to prevent secondary infections.
bacterial contamination. A subsequent infection of the joint or sheath by environmental or skin bacteria was not observed in any of the horses in this study. While delayed healing was observed in some anatomical locations such as the tarsocural joint, other sites such as the carpus sealed in 7-10 days and healed without complication. The arthrotomy incision was debrided and sutured closed in nine horses. None of these horses developed problems following closure of the arthrotomy, and all healed without recurrence of the infection. Closure of the joint shortens the length of time that the leg must be maintained in a sterile bandage and that systemic antibiotics must be administered. In sites where healing of the incision may be prolonged (e.g., hock, stifle, and tendon sheath), closure of the incision is recommended once the infection resolves. Excessive granulation or chronic fistula formation were not problems observed with the use of open joint drainage in these 26 horses.

Although there is considerable variation in the individual response to infection, clinical improvement in lameness and use of the limb following open drainage were impressive. The effectiveness of joint drainage could be monitored by evaluating the horse’s use of the limb and the swelling around the joint. Repeated joint lavage was performed in 22 horses in which continued drainage of fibrin and debris obstructed drainage through the arthrotomy.

Intra-articular antibiotics were also used in the treatment of 23 horses. The injection of gentamicin into equine joints had been shown to cause only mild, transient inflammation within the synovial membrane.10 The effect of amikacin, also an aminoglycoside antibiotic, on the synovium has not been determined. Intra-articular amikacin was used in the majority of the horses in this study because of its efficacy against a wide range of bacteria.21 In two horses cefazolin was injected into joints and tendon sheaths when the horses failed to respond to treatment with amikacin; the effect of intra-articular cefazolin on the synovial membrane has not been investigated. The use of intra-articular antibiotics in conjunction with open drainage and systemic antibiotics in this group of horses further demonstrates the effectiveness of this technique. The results of the present study in horses with naturally occurring septic arthritis support the results obtained with a once daily injection of gentamicin in horses with experimental septic arthritis.31 The quantity of antibiotic injection into joints or tendon sheaths in the present study was empirical, but it did not exceed a systemic juvenile dose. The use of intra-articular antibiotics may have been as important as open drainage in resolving the synovial infections in 23 of the horses in this study.

The treatment of infectious arthritis in horses continues to evolve and improve. Enrofloxacin is a fluoroquinolone antibiotic that achieves high concentrations in synovial fluid following oral administration (7.5 mg/kg) once a day.22 This antibiotic has been used in a small number of adult horses with resistant joint infections and should be considered when selecting antibiotics for the treatment of septic arthritis. It cannot be recommended for use in foals because of the negative effect this drug has on cartilage development in young, growing animals. It has the advantage of being effective with oral administration once daily. More antibiotics have been evaluated for their effect on synovium and articular cartilage. Ceftiofur, ticarcillin–clavulinate, and imipenim–cilastatin have been shown to cause transient, mild inflammation.18 The last of these is an antibiotic combination that is particularly effective against resistant staphylococcal infections in humans and has been used to successfully treat resistant or difficult joint infections in a small number of horses. This antibiotic should be saved for difficult or nonresponsive cases to avoid the development of resistant strains. Better methods of delivering or maintaining concentrations of antibiotics in the synovial fluid are being evaluated. At this point, advancements in intra-articular antibiotics and techniques for injection would appear to offer the most hope for the future.

References and Footnotes


aPrimaxin, Merck Sharp & Dohme, West Point, PA 19486.
bTimentin, Beecham Laboratories, 1500 Spring Garden St., P.O. Box 7929, Philadelphia, PA 19101.