Intra-Articular Therapy to Treat Septic Arthritis in a Dog

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ABSTRACT

A 6 yr old female spayed Labrador retriever was examined for severe pain and a nonweight-bearing right forelimb lameness due to swelling and wounds with direct communication into the elbow joint. The medical management of \( \beta \) hemolytic \textit{Streptococcus} septic arthritis with needle lavage of the joint, systemic and local antibiotic therapy, and analgesic therapy is described. This case provides information on the need to address septic arthritis in the dog as an emergency situation and the treatment with intra-articular medication. Earlier medical management for septic joints could be considered in dogs to help decrease the long-term complications that can result from septic arthritis. (\textit{J Am Anim Hosp Assoc} 2011; 47:280–284. DOI 10.5326/JAAHA-MS-5667)

Introduction

Septic arthritis is an uncommon disease in canine patients. When reported, the elbow and stifle joints are most commonly affected.\(^1\) The source of the infection may arise from direct penetration of the joint from surgery or trauma, hematogenous localization, or local spread from adjacent tissues.\(^2\) Previous reports have found stifle surgery or hematologic spread to account for most cases of infective arthritis.\(^3\) The most common bacteria cultured in septic arthritis are \textit{Staphylococcus intermedius}, \textit{S. aureus}, and \( \beta \) hemolytic \textit{Streptococci} spp.\(^2,3\) Unlike septic arthritis in dogs, this disease is more commonly reported in human and equine patients as an emergency, with a variety of treatments available.\(^4\) Treatments commonly used include joint lavage via arthroscopy or large bore needles, intra-articular and regional antibiotics, and systemic antibiotics.\(^4\) It has been found that early, aggressive treatment in humans and horses improves the prognosis for recovery after septic arthritis.\(^4\)

Case Report

A 6 yr old, 27 kg, female spayed Labrador retriever presented to the referring veterinarian for a moderate, right forelimb lameness. Examination revealed swelling and decreased range of motion of the right elbow. Radiographs of the right elbow were within normal limits. Systemic doxycycline was prescribed, and the elbow was bandaged with dimethylsulfoxide and nitrofurazone. Despite treatment, the lameness progressed over 12 days until a wound with dark-colored, malodorous drainage appeared. At this time, the dog was referred for further evaluation due to generalized myalgia, nonweight-bearing lameness, and progression of the swelling of the right forelimb despite treatment.

Physical examination on presentation to the emergency clinic revealed generalized, severe pain and a nonweight-bearing forelimb lameness with a large amount of swelling and drainage localized to the right elbow region. Upon manipulation of the right elbow, there was significantly decreased range of motion with resistance from the dog and vocalization. There was a 3 cm diameter wound on the medial aspect of the right elbow, an 8 cm diameter wound on the proximolateral aspect of the elbow, and a wound on the distolateral aspect of the elbow that was 1 cm in diameter. The medial wound appeared deep, whereas the lateral wounds were superficial (Figure 1). The dog’s temperature was elevated (39.9\(^\circ\)C), the heart rate was normal (120 beats/min), and tachypnea was noted (100 breaths/min). No other abnormalities were found on physical exam.
Hematologic evaluation revealed a normal total WBC count (13,990/μL; reference range, 6,000–17,000/μL) with a mild neutrophilia (12,171/μL; reference range, 3,000–11,400/μL) and mild lymphopenia (979 cells/μL; reference range, 1,000–4,000/μL). All blood biochemistry analytes were within the reference ranges.

Radiographic evaluation of the right elbow revealed soft tissue swelling around the right elbow joint with gas pockets present in the swelling. Small osteophytes were present at the cranioproximal aspect of the radius and lateral aspect of the distal humerus. A focal area of lysis was present in the medial portion of the humeral condyles, adjacent to the joint. There was relative narrowing of the lateral aspect of the elbow joint and widening of the medial aspect of the elbow joint. Upon review of the referring veterinarian’s radiographs, soft tissue swelling was present around the right elbow joint, but no osseous abnormalities were found.

Based on the radiographic findings, degree of lameness, and swelling, arthrocentesis of the right elbow joint was performed from the lateral aspect of the joint, away from any wounds. The synovial fluid was collected for cytology and culture. Following aspiration, the joint was distended with sterile lactated Ringer’s solution. The fluid egressed out the medial wound and a cranially placed 18 gauge needle (Figure 2). A total of 1 L of lactated Ringer’s solution was lavaged through the joint during the treatment. After the lavage, 250 mg amikacin was placed into the joint, after the wound had been packed with gauze soaked in betadine. Amikacin was chosen before the culture and susceptibility results were reported because it is frequently used to treat septic arthritis in horses and is empirically effective against many bacteria found in septic arthritis in horses and dogs at the elevated concentration achieved in the joint. The limb was bandaged.

Systemic antibiotics were started due to the progression of the infection, bony changes, and severity of pain. Antibiotics administered included ampicillin sodium/sublactam sodium (30 mg/kg IV q 8 hr), enrofloxacin (17 mg/kg IV q 24 hr), and metronidazole (15 mg/kg IV q 12 hr). Initial analgesic management with hydromorphone (0.1 mg/kg IV q 6–8 hr) was ineffective. Pain was effectively managed with a continuous rate infusion of morphine (0.1 mg/kg/hr), ketamine (3 μg/kg/hr), dexmedetomidine (1.5 μg/kg/hr), and lidocaine (25 μg/kg/hr) in saline at 10 mL/hr. She also received normosol-R IV at 90 mL/hr for 4 days.

Daily monitoring included physical examination, ambulation, packed cell volume, total protein, blood glucose, and lactate. Each

Streptococcus was intermediate in susceptibility to gentamicin and resistant to amikacin.

Due to the presence of infection, an open joint, and pain localized to the joint, the dog was treated aggressively with joint lavage, intra-articular administration of amikacin and clindamycin, systemic antibiotics, and systemic analgesic medications. For the local joint treatment, the right elbow joint was lavaged from the lateral aspect with a 16 gauge needle. The fluid egressed out the medial wound and a cranially placed 18 gauge needle (Figure 2). A total of 1 L of lactated Ringer’s solution was lavaged through the joint during the treatment. After the lavage, 250 mg amikacin was placed into the joint, after the wound had been packed with gauze soaked in betadine. Amikacin was chosen before the culture and susceptibility results were reported because it is frequently used to treat septic arthritis in horses and is empirically effective against many bacteria found in septic arthritis in horses and dogs at the elevated concentration achieved in the joint. The limb was bandaged.

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of these values remained within normal limits during the 6 days of hospitalization. On day 2 of hospitalization, the joint was lavaged again with 1 L of lactated Ringer’s solution. A significant improvement in the color of the joint fluid was noted. Because the joint capsule had sealed prior to this second lavage, an antibiotic gel\(^8\) (100 mg amikacin and 50 mg clindamycin) was injected for a prolonged antibiotic effect (Figure 3). The joint was not flushed again.

The dog slowly improved with increased weight-bearing, increased range of motion of the joint, and decreased swelling after each day of treatment. As the dog started to bear more weight on the leg and had less swelling, the dog was switched to carprofen\(^9\) (2 mg/kg per os \(\text{PO}\) q 12 hr), a fentanyl\(^9\) patch (75 \(\mu\)g/hr), and gabapentin\(^9\) (4 mg/kg PO q 24 hr) on day 4 of hospitalization. The enrofloxacin and metronidazole were discontinued on day 4 of hospitalization after the culture results became available. A single subcutaneous dose of cefovecin\(^8\) (8 mg/kg) was administered on day 5 of hospitalization. The ampicillin was also discontinued.

On day 6 of hospitalization, the swelling in the elbow was markedly improved and the dog would fully bear weight on the leg. A mild lameness was still present on the right forelimb. Due to her improvement in gait and swelling, the dog was discharged with carprofen and tramadol\(^4\) (4.5 mg/kg PO q 8 hr), polysulfated glycosaminoglycan\(^4\) (120 mg intramuscularly 3 times weekly for 2 wk, then once monthly), and gabapentin (4 mg/kg PO q 24 hr). Carprofen and tramadol were each prescribed for 10 days, polysulfated glycosaminoglycan for three times for 2 weeks then once monthly for 3 months, and gabapentin for 14 days.

Initially, the dog did well at home and gradually improved. The joint swelling and draining wounds resolved completely; however, over the following few months, the dog started to use the leg less and developed severe muscle atrophy. The dog was able to move the leg, but was nonweight-bearing when ambulating. According to the owner, once swimming was instituted, the dog started to have increased weight-bearing during ambulation.

**Discussion**

Septic arthritis is a severe and debilitating disease that can arise from direct penetration of the joint, hematogenous spread, or local infection that spreads into the joint. In human and equine patients, early recognition, thorough diagnostic examinations, and aggressive therapy are critical to control the infection and limit injury to the joint.\(^{4-6}\) This approach should be used in canine patients as well due to the long-term debilitation that can occur.

A variety of treatments are available for septic arthritis, but resolution of the problem without developing long-term osteoarthritis can be challenging. The treatment options range from systemic antibiotics, local and regional antibiotics, joint lavage via large bore needles, and arthroscopic lavage, to open arthrotomies for continuous drainage.\(^4\) In one retrospective study, Clements et al. (2005) found that the prognosis after septic arthritis in canine patients with medical or surgical treatment was 94% for resolution of the infection, but they were often unsuccessful in restoring normal joint function.\(^1\) In that study, there was an average of 7 days between clinical signs and treatment of the disease.\(^1\) No difference between medical or surgical treatment (which included joint lavage through needles) was found, but local therapy with antimicrobials was not administered in either treatment group.\(^1\)

Local therapy can be administered with direct articular injection, continuous intra-articular infusion, implantable antibiotic-impregnated delivery systems (such as polymethylmethacrylate, hydroxyapatite, or calcium sulfate), collagen sponges, or regional perfusion into a vessel.\(^4,9\) Local therapy is often combined with systemic therapy for enhanced antimicrobial effect.\(^4\) Regional perfusion is dependent on the distal location of the infected joint in order for a tourniquet to be applied proximally. This technique could not be used in the case described herein. The addition of local antimicrobials is important since prolonged, high concentrations can be reached. In equine patients, direct articular administration of gentamicin reaches a 1,000-fold higher concentration than systemic administration.\(^9,11\) Since aminoglycosides, such as gentamicin and amikacin, are concentration-dependent, their bacterial killing action is improved at higher concentrations.\(^11\) Amikacin was chosen in this case because it can be used safely in equine joints with minimal inflammatory effects.\(^12\) Since
the canine elbow joint is smaller than the typical equine joint, 250 mg amikacin was used. In humans, clinical efficacy is strongly correlated with the ratio of peak concentration to minimum inhibitory concentration of the infective organism, which is enhanced with local therapy. Although β-lactams are time-dependent and have not been well researched for local therapy, they are used clinically if the culture determines susceptibility and the patient has a severe infection.

Because the infection in this case was chronic, not resolving with appropriate systemic antimicrobial treatment, and started to develop osteoarthritis and osteomyelitis, local therapy was instituted. The dog received joint lavage with sterile fluids and intra-articular antibiotics. Although joint lavage has not been found to be effective in osteoarthritis without sepsis, it is recommended in septic arthritis to remove some of the inflammatory mediators and debris.1–4 Large portals allow for removal of purulent debris and use of a large volume of fluid. Repeated lavage or continuous drainage of the joint may be indicated if clinical signs persist from continued synovitis or production of purulent debris.5,6 After the lavage, the intra-articular pressure decreases, which allows for improved synovial blood flow.6 Risks of joint lavage are uncommon but can include contamination of a joint that was not previously infected, synovial fistulae development, thrombophlebitis, and infection of adjacent soft tissue structure.5 If a single portal is used, pocketing of debris may occur in distant recesses.5 Because needle lavage does not allow visualization of the articular surface, arthroscopy may have provided further benefit by allowing for visualization of the cartilage and removal of inflammatory debris adhered to the synovium.4,5 The arthroscopy portals could have been left open for continuous drainage of the joint, if needed.

Although the bacteria cultured were resistant to amikacin on culture, it was only tested at the minimum inhibitory concentration reached with systemic administration. Since local administration achieves very high levels, the amikacin potentially could have helped resolve the infection. The bacteria were susceptible to the β-lactams administered systemically and the lincosamide antibiotic given intra-articularly. Although the intra-articular gel containing amikacin and clindamycin had not been previously used in canine patients, it has been researched and used in equine patients as an alternative to continuous antibiotic infusion with catheters or antimicrobial containing beads that can be painful in joints.13 There were no immediate complications from the joint lavage, such as soft tissue swelling, synovitis, or infection in adjacent tissues, seen in this canine patient, and the patient’s pain level decreased after administration. The degree of pain exhibited was marked at presentation, but the dog had minimal lameness and swelling at the time of discharge. Unfortunately, the lameness slowly recurred after treatment.

**Conclusion**

This case is an example of osteoarthritis developing rapidly in a dog’s joint after being treated for septic arthritis. Because the joint was normal at the start of the injury, the injury to the elbow and subsequent infection in the joint may have led to a debilitating osteoarthritis. Local and systemic antimicrobial therapy helped resolve the infection in the joint, but osteoarthritis still developed in this dog’s joint. Wounds adjacent to joints should be thoroughly investigated to determine joint involvement, even though this can be difficult at times. If the wound involves a joint, treatment options include joint lavage to remove the debris, local antimicrobial therapy, and systemic antimicrobials. The goal of therapy is to control the infection of the joint and limit the progression of osteoarthritis. It is crucial for veterinarians to be aware of synovial structures adjacent to wounds to determine synovial structure involvement to help prevent long-term disability to patients.

**FOOTNOTES**

- Lactated Ringer’s solution; Hospira, Lake Forest, IL
- Amiglyde-V; Fort Dodge Animal Health, Fort Dodge, IA
- Unasyn; Roerig Division of Pfizer Inc, New York, NY
- Baytril 2.27%; Bayer Health Care LLC, Animal Health Division, Shawnee Mission, KS
- Metronidazole; Baxter Healthcare Corp., Deerfield, IL
- Hydromorphone; Baxter Healthcare Corp., Deerfield, IL
- Morphine; Baxter Healthcare Corp., Deerfield, IL
- Ketamine hydrochloride; Fort Dodge, Fort Dodge, IA
- Domitor; Pfizer, Exton, PA
- Lidocaine; Hospira, Lake Forest, IL
- 0.9% saline; Hospira, Lake Forest, IL
- Normosol-R; Abbott Laboratories, North Chicago, IL
- R gel; Royer Biomedical, Frederick, MD
- Rimadyl; Pfizer, Exton, PA
- Duragesic; Janssen Pharmaceutica, Titusville, NJ
- Gabapentin; Amneal Pharmaceuticals, Hauppauge, NY
- Cefovecin; Pfizer Animal Health, Kalamazoo, MI
- Tramadol; Amneal Pharmaceuticales, Paterson, NJ
- Adequan; Luitpold Pharmaceuticals, Shirley, NY

**REFERENCES**


