Orthopedic infections in horses usually involve bone, synovial cavities, or metaphyseal growth plates. These infections may be difficult to treat and may result in chronic lameness or death. Delivery of effective concentrations of antimicrobial drugs into infected tissues is impeded by local areas of ischemia, necrotic tissues, abscessation, increased intraarticular or intraosseous pressures, the presence of pus, and the presence of metal used for repair of fractures. Principles for effective treatment of all orthopedic infections include early recognition, culture and sensitivity testing of infected tissues, systemic and local antimicrobial delivery, drainage, removal of infected bone and devitalized tissues, stabilization of fractures, removal of contaminated implants when possible, and the implantation of bone grafts or bone substitutes. The objectives of treatment are to eliminate microorganisms, promote tissue healing and restore a normal environment in synovial cavities and in bone.

**INFECTED SYNOVIAL CAVITIES**

Contaminated and recently infected synovial cavities may be treated successfully with through and through needle lavage prior to accumulation of fibrin, which often will plug the needles and prevent effective lavage. Large bore, 14 gauge, needles should be placed across the joint from each other and fluids should be administered under pressure using a fluid pump or pressurized fluid bags. Distention irrigation is accomplished by the temporary and intermittent occlusion of the egress needle. Arthroscopic surgery of joints, tendon sheaths, and bursas is recommended when fibrin prevents effective needle lavage or contamination with foreign material such as hair is suspected. Single nail punctures can introduce numerous hair strands into synovial cavities. Arthroscopic surgery is also recommended when necrotic cartilage and bone requires debridement. Motorized synovial resectors and burrs can assist in removal of fibrin, infected synovial membrane, devitalized cartilage and necrotic bone but are not essential. High pressure lavage directed through one or more arthroscopic portals and multiple egress portals is recommended. A minimum of 3 liters of fluids is used per joint. I recommend using a balance electrolyte solution although sterile saline is acceptable. In large or heavily contaminated joints this volume may be 10-12 liters. The advantages of arthroscopic treatment include a thorough evaluation of the synovial cavity, ease of effective lavage, debridement under direct visualization, removal of large amounts of fibrin easily, and minimal tissue trauma to healthy tissues. Horses are often much more comfortable within hours of surgery. Open arthrotomy may be needed for treatment of chronic infections or infections that have failed to respond to routine treatment. The arthrotomy may be done immediately after arthroscopic surgery or as a primary surgical treatment. One or more 2-4 centimeter long incisions directly into the joint are made over an accessible area of joint capsule. Adjacent tendon, tendon sheaths and vessels should be avoided. The incisions may be left to heal as open wounds or may be freshened and sutured closed after the infection has resolved. This generally takes 10-12 days. The main advantage of open arthrotomy is that it requires no specialized equipment. Results have been favorable. Horses are often much more comfortable within hours of surgery. Open arthrotomy may be needed for treatment of chronic infections or infections that have failed to respond to routine treatment. The arthrotomy may be done immediately after arthroscopic surgery or as a primary surgical treatment. One or more 2-4 centimeter long incisions directly into the joint are made over an accessible area of joint capsule. Adjacent tendon, tendon sheaths and vessels should be avoided. The incisions may be left to heal as open wounds or may be freshened and sutured closed after the infection has resolved. This generally takes 10-12 days. The main advantage of open arthrotomy is that it requires no specialized equipment. Results have been favorable. Horses are often much more comfortable within hours of surgery. Open arthrotomy may be needed for treatment of chronic infections or infections that have failed to respond to routine treatment. The arthrotomy may be done immediately after arthroscopic surgery or as a primary surgical treatment. One or more 2-4 centimeter long incisions directly into the joint are made over an accessible area of joint capsule. Adjacent tendon, tendon sheaths and vessels should be avoided. The incisions may be left to heal as open wounds or may be freshened and sutured closed after the infection has resolved. This generally takes 10-12 days. The main advantage of open arthrotomy is that it requires no specialized equipment. Results have been favorable. Horses are often much more comfortable within hours of surgery. Open arthrotomy may be needed for treatment of chronic infections or infections that have failed to respond to routine treatment. The arthrotomy may be done immediately after arthroscopic surgery or as a primary surgical treatment. One or more 2-4 centimeter long incisions directly into the joint are made over an accessible area of joint capsule. Adjacent tendon, tendon sheaths and vessels should be avoided. The incisions may be left to heal as open wounds or may be freshened and sutured closed after the infection has resolved. This generally takes 10-12 days. The main advantage of open arthrotomy is that it requires no specialized equipment. Results have been favorable.
antimicrobial impregnated polymethylmethacrylate (PMMA) beads, intraosseous regional perfusion, and intravenous regional perfusion has all been used successfully for treating osteomyelitis. Stabilization of fractures and implantation of bone grafts or bone substitutes may also be helpful. Specific surgical treatment for osteitis and osteomyelitis depend upon the cause and location of the infection. Special considerations for 5 types of infected bone are described:

Osteitis of long bones secondary to trauma – Sequestration secondary to wounds with periosteal loss and bacterial contamination takes 14 to 21 days for separation of the superficial sequestrum from the damaged bone. Very small sequestrations may resorb or be extruded from the wound. Systemic antimicrobial administration may facilitate resorption by controlling infection. Most sequestrums should be surgically removed soon after radiographic evidence of separation. Delay of sequestrectomy will delay wound healing and allow formation of a large involucrum which can surround the sequestrum and make sequestrectomy more difficult.

Osteitis of the coffin bone – Osteitis of this bone often occurs secondary to severe sub solar or laminar abscessation or by direct trauma to the bone from a nail or other foreign body puncture. The osteitis may involve the solar, or dorsal surface of the coffin bone, or both, and sequestration is possible. Complete debridement of necrotic infected bone is recommended. Surgical exposure requires partial removal of the hoof capsule. This will result in damage to solar and laminar corium. Solar and laminar corium can regenerate if the hoof capsule is stable and kept in a clean environment. Stability of the hoof wall can be maintained during the reparative phase by corrective shoes. Large defects in the dorsal hoof wall can be stabilized with small bone plates or by leaving struts of hoof wall near the sole. Horses that undergo removal of large amounts of hoof wall or sole in order to completely remove necrotic and infected bone will regenerate lost corium and subsequently horn, and often are sound for athletic use. The defects in the coffin bone will rarely fill in with new bone. Large defects predispose the coffin bone to pathologic fracture.

Articular Osteomyelitis – Bones within joints may become infected primarily as in epiphyseal osteomyelitis in foals or secondary to hematogenous or iatrogenic joint infection. Early arthroscopic surgery to flush the joint and debride the bone is necessary in order to control infection within the joint and treat the osteomyelitis. Epiphyseal osteomyelitis must be debrided and treated concurrently. Local antimicrobial drug delivery is recommended and this should include direct intraarticular instillation of antimicrobials plus regional perfusion. Systemic antimicrobial therapy is essential to success.

Osteomyelitis of the sustentaculum, proximal sesamoid bones and navicular bone – Treatment of osteomyelitis in these bones is complicated by the constant motion and pressure of the deep digital flexor tendon over the infected bones, septic tenosynovitis or bursitis, and restrictive tarsal retinaculum and palmar/plantar annular ligaments which increase pressure in the tarsal and digital canals. In addition to thorough surgical debridement of infected bones, lavage and drainage of infected synovial cavities, and LAD, the palmar/plantar ligament or tarsal retinaculum should be transected to decrease pressure in the respective canals. Deep digital flexor tenotomy or tenectomy should be considered for treatment of severe osteomyelitis of the sustentaculum and navicular bone. This procedure will make extremely lame horses more comfortable. Horses have been used for light riding following tenotomy/tenectomy providing the osteomyelitis has been successfully treated.

Osteomyelitis of long bones – Osteomyelitis following repair of long bone fractures is a very common complication. The infection rate is as high as 100% in some open or comminuted fractures. Internal fixation greatly increases the odds of postoperative infection by impairing host defense mechanisms and providing a surface for bacterial adherence and biofilm production. Prevention of osteomyelitis in long bone fractures is the ultimate goal of the surgeon. Although fracture stability is desirable, in my opinion there has been too much emphasis on internal fixation and absolute stability at all costs. Hardware should be kept away from open fractures. Transfixation pin casts are a good option for highly comminuted or open fractures of the proximal phalanx and middle phalanx in mature horses and for open fractures of the metacarpus/metatarsus in foals. When internal fixation of open fractures is the only choice, then thorough wound debridement, intraoperative lavage with antimicrobials and hyperimmune plasma, preservation of periosteum, intraoperative regional perfusion at the time of repair, and
Implantation of antimicrobial impregnated PMMA beads or plate luting cement will aid in preventing postoperative osteomyelitis. In some foals with open fractures, minimal internal fixation combined with external coaptation is beneficial in preventing or managing post-operative osteomyelitis. Treatment of osteomyelitis following long bone fracture repair should include removal of necrotic bone, removal of hardware if not contributing to stability, local and systemic antimicrobial administration, implantation of antimicrobial impregnated PMMA beads and bone grafting or implantation of bone substitutes such as CaSO₄ beads. Grafts may be soaked in antimicrobial solution prior to implantation and CaSO₄ can be impregnated with antimicrobials.

References