

ORTHOPEDIC DISASTERS AND REVISION STRATEGIES FOR FRACTURE COMPLICATIONS

Brian S. Beale DVM, DACVS, ACVS Fellow MIS-Ortho
H-Town Veterinary Specialists
3015 S. Main ST, Stafford, TX 77477

Learning Objectives

Learn the cause of fracture complications

Learn techniques to resolve complications

Complications are unfortunately possible with any orthopedic procedure. Complications can occur due to poor preoperative planning, poor decision-making, poor biologic condition of the patient, inadequate mechanical stability, poor patient or client compliance or bad luck.

Implant Failure

Implants fail due to a number of reasons including implant undersizing, improper type of implant, poor implant placement, poor bone quality and lack of patient compliance. Implant failure include bending of the plate, plate breakage, screw loosening and screw breakage. Surgeons can reduce the incidence of implant failure by proper pre-planning of the surgical procedure. Treatment of implant failure may or may not be required depending on the stage of healing and the clinical appearance of the patient. Implant replacement should be performed if limb alignment is poor, if the fracture is unstable or if significant pain is present. Revision surgery most commonly involves stabilization with a different implant to optimize placement of screws in uncompromised bone. Implants are often upsized with revision surgery, using implants that are larger in size and longer in length. Locking bone plates are particularly useful for revision of complicated fracture repair. Sometimes a combination of implants are used, particularly if bone damage has occurred leading to increased mechanical instability of the bone. If bone healing is nearing union, limb alignment is acceptable and minimal clinical signs are present, conservative therapy with cage rest may be successful.

Infection

The incidence of infection following fracture repair is 3-8%. Infection can involve the implant, the regional soft tissues or the bone. The most common isolate at the present time is *Staphylococcus pseudointermedius*, but a culture of the implant and deep tissues should always be submitted identify the offending organism and determine an antibiotic susceptibility profile. Most surgeons will begin antibiotics using a cephalosporin while awaiting the culture results. Clinical signs of infection include lameness, decreased appetite and pain. Physical signs include swelling around the fracture site, drainage or pain on palpation over the fracture site. Patients having an infected fracture may or may not have an elevated temperature or neutrophil count. Radiographic changes seen with infected fractures include periosteal reaction, soft tissue swelling, bone resorption around implants and occasionally broken implants. Some patients with infected fractures show no or minimal changes especially in the early stage. If infection is suspected, a deep aspirate of the fracture site can be obtained and assessed by cytological and microbiological examination. If drainage is present, the exudate can be cultured. It is best to clean the skin surface first using surgical scrub then express the soft tissues at the site of the draining tract to cause deep fluid to drain. The fluid should be carefully cultured being sure not to swab the skin. A fluid samples in a purple top tube (EDTA) and an unstained slide prep should be submitted to a lab. In-house cytology can be reviewed using Diff-Quick stain. The slide should be scanned at low power and then at progressively higher powers. Final viewing should be performed at 100x under oil immersion. The estimated cell count can be determined using the ratio of 3000 cells for every WBC seen per HPF.

Treatment of infections varies depending on the state of healing of the fracture and the severity of infection. If the fracture is healed, implant removal is recommended in addition to antibiotic therapy based on culture and sensitivity results. If the fracture is not healed, antibiotic therapy based on culture and sensitivity results should be initiated. Most infections do not require drainage unless highly exudative or if fluid is collecting in dead space in the deep tissues. If drainage is deemed necessary, a closed suction drainage system using a fenestrated drain (e.g. Snyder drain) is recommended. Sterile lavage through the drain can also be performed to help flush away debris and reduce the bacterial burden. Once the fracture heals, implant removal is recommended due to the high likelihood of recurrence of infection due to the likely formation of a biofilm on the implant. Occasionally the infection cannot be managed successfully with antibiotics and bone healing does not

progress. This is likely due to presence of bony sequestra or a biofilm formation on the implant leading to recurrent seeding of the area (nidus effect). Early implant removal may be required in these cases despite incomplete healing of the fracture. Bony sequestra must also be removed in order to get resolution of the infection. An alternative method of fixation can be provided to stabilize the fracture following implant removal. External fixators, orthotic braces are commonly used for this purpose. Another option is replacing the infected plate with a new plate and screws after thorough lavage. Severe infections may also be treated with antibiotic impregnated calcium sulfate beads or gels placed at the fracture site.

Non-Union

Fracture nonunion is categorized as viable and non-viable. Viable nonunion fractures have an intact vascular supply. The most common cause of this type of nonunion is mechanical instability leading to excessive motion at the fracture site. Treatment of this condition includes reducing patient activity, increasing stiffness and strength of the implant system and possibly use of an autogenous cancellous bone graft or bone graft substitute. Successful fracture healing typically occurs within 4-8 weeks after these steps are taken.

Non-viable fracture non-union is much more difficult to treat and has a guarded prognosis. This type of non-union has poor blood supply and is biologically inactive. They may also have mechanical instability leading to excessive motion at the fracture site. Many non-viable non unions have concurrent infection and sequestra. Aggressive action must be taken to change the course of healing in these patients. Infection should be treated as described above. Fracture stability should be increased if inadequate stability is present. The ends of the bone should be debrided and the exposure of the medullary cavity at the fracture ends should be reestablished by careful careful drilling at the fracture ends. Bone graft should be used in most of these patients. Additional stimulation of the biological environment at the fracture site can be achieved using stem cells, PRP or BMP.

Occasionally nonunion is associated with placement of an implant system that is too stiff or strong. In this situation, the bone is experiencing minimal force due the strong implant absorbing the force. Poor bone healing or bone resorption can be seen in some of these patients. These patients typically have a viable nonunion in the early stage, but they may progress to a non-viable nonunion in chronic stages. Fracture healing can be stimulated in these patients by destabilization of the implant system. This is often time performed in stages. An example of this is removal of 2 or more screws initially, followed by removal of the plate an screws 1-2 months later. A second example would be removal of the IM pin when used with a plate-rod construct. An adjunctive splint or brace can be used if needed following destabilization of the fracture.