COMMON SURGICAL CONSIDERATIONS IN WILDLIFE

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Introduction

Veterinarians may choose to work with wildlife patients in a number of different ways. Some may wish to partner with a local wildlife rehabilitator who will provide the supportive care and rehabilitation necessary in order to ensure that these animals will eventually be released back into their natural habitat. Others may choose to obtain their own rehabilitation permits and take orphaned, sick or injured wildlife through the entire process from admission to release. A smaller number of veterinarians work part or full-time with wildlife rehabilitation centers that see a large number of patients on an annual basis. Whatever the level of involvement of the veterinarian and staff, the medical and surgical expertise they possess are invaluable in caring for the wide variety of wildlife that are in need of such care.

There are a number of practical considerations that veterinarians should be aware of prior to working with wildlife patients. The typical small animal hospital is a busy environment with domestic species that are being treated for paying clientele. Wildlife patients, on the other hand, have no owners to provide financial support for their needs, require a quiet secluded environment to reduce stress, and need to be handled by personnel with the expertise to provide safe and appropriate care. Certain high stress species, such as cottontail rabbits and white-tailed deer, require minimal handling and will not do well in a noisy clinical environment. Veterinarians who will be providing surgical care for wildlife should also consider the post-operative recovery requirements for their patients and whether or not these are achievable. For instance, daily wound treatment may not be possible for the wild carnivore patient that requires sedation for any sort of safe handling and restraint. However, given these constraints, surgical treatment of wildlife patients is certainly possible for the veterinary practitioner and may be the critical step that allows that animal to be given a second chance for life in the wild.

Common Soft Tissue Presentations

The vast majority of wildlife patients that require surgical intervention have had some sort of trauma prior to admission. They may be hit by a vehicle, injured by a mower, attacked by a predator, gunshot, fly into a stationary object or any number of other scenarios. Common soft tissue presentations often require standard wound care procedures, the appropriate use of antibiotics and knowledge of species requirements to provide optimal healing. In addition, provision of analgesic medication should always be administered to injured wild animals. Fentanyl patches can be placed on larger mammals and injectable buprenorphine can be administered at 0.01-0.02 mg/kg SC or IM SID to BID in mammals and at 0.4 mg/kg SC BID to TID in birds. Once the patient is hydrated, meloxicam can be given orally, preferably in food if
the animal is eating, at 0.1 – 0.5 mg/kg SID to BID depending on the species. See Carpenter 2013 for specific dosing requirements.

Fishing line and other entanglements are most commonly encountered with waterfowl or other similar avian species. The most severe injuries are generally seen with constriction of the entangled material around extremities, which can result in vascular compromise and soft tissue injury. As with domestic animals, if the extremity is not viable distal to the entanglement site, the likelihood of return to function of the limb is unlikely. However, unlike domestic animals, a wild animal should not be released if there is any impairment in function of its limbs, as survival is unlikely with this scenario. If viability of the limb is not certain at the time of presentation, removal of the entangled material and standard wound care is provided until the extent of the injury is determined. Antibiotics such as enrofloxacin (15 mg/kg PO SID) or amoxicillin/clavulanic acid (125 mg/kg PO BID) should be administered in avian species. Veterinarians should be aware of state regulations concerning the use of antibiotics in certain species during hunting seasons. Care must be taken to pay attention to whether or not the flexor or extensor tendons in the distal limbs of the animals are injured as any decrease in these functions can again compromise release potential. The propatagial ligaments, which run along the leading edge of the wing from the shoulder to the carpus, are essential in flexion and extension of the wing. Any injury to these ligaments will also decrease the likelihood of successful return to function. In addition to injuries at the site of entanglement, the veterinarian should be aware that severe musculoskeletal injuries can also be present as a result of the animal struggling while it is entangled. Again, the extent of these injuries should be critically evaluated to determine release potential. Trap injuries are similar to entanglement injuries and may be seen in mammalian as well as avian species. As mentioned previously, it can be difficult to provide daily wound care for larger mammalian species and sedation may be necessary to accomplish this task every few days until complete healing occurs.

Fishing gear may not only become entangled around aquatic birds but can sometimes be swallowed along with the attached bait. If one end of the fishing line is still present in the oral cavity, attach it to a piece of lightweight material that will be bulky enough to prevent the bird from swallowing the line even further. It can be helpful to have this line in hand when trying to locate the rest of the gear during surgical removal. The bird should be anesthetized and radiographs should be taken in order to locate the gear. If the gear is located in the proximal esophagus, it is possible to remove it by incising the skin over the esophagus, then opening the esophagus over the palpable gear. If the hook has already penetrated the esophagus, cut the barbed end of the hook off, then back the gear up through the oral cavity if the end of the fishing line is available there to pull on. Close the esophagus with an absorbable suture such as PDS II (Ethicon, New Brunswick, New Jersey) in a two layer pattern and close the skin with the same suture material in a simple interrupted pattern. However, if the gear is located further distally in the esophagus, this is a difficult surgical approach since the sternum covers this area. If the gear is actually located in the ventriculus, it is often recommended that it be pushed proximally into the proventriculus as it is more difficult to incise into the muscular wall of the ventriculus. A description of the proventriculotomy procedure is available in Bowles 2006 and in Forbes 2008. Alternatively, it may be possible to remove the fishing gear from the proventriculus via an endoscopic procedure.
Predator attacks are another common soft tissue injury seen in wildlife patients. Standard wound care is again administered for most species. Be careful to assess any puncture wounds for potential penetration into body cavities. Do not flush any puncture wounds if unsure of the extent penetration. Cottontail rabbits have extremely thin skin and are susceptible to severe degloving injuries from predator attacks. If the degloving injury is extensive, euthanasia should be considered. If there are minimal degloving injuries, the edges of the rabbit’s skin can be adhered back together with surgical glue (VetBond Tissue Adhesive; 3M, St. Paul, MN). Do not try to suture these edges together as the suture material will rip through the delicate skin. Antibiotics such as trimethoprim-sulfa can be given to rabbits at 30 mg/kg PO BID. Avian species can be placed on enrofloxacin or amoxicillin/clavulanic acid at dosages described above. Puncture wounds in avian species can result in air sac rupture and subsequent subcutaneous emphysema in these patients. This air should be drained with a syringe and needle as needed; in most instances, the rupture will heal within 1-2 days. For wounds that persistently fill with air, a Teflon stent can be surgically implanted to allow air to escape (Bowles, 2006).

Gunshot or other projectile injuries present similar problems in wild mammals as they do in domestic mammals. In birds, feathers are often driven into the entrance wound by the projectile and should be carefully removed as deeply as possible in the wound. Take two radiographic views in order to determine the exact location of the projectile and assess the chances of surgical removal. In many cases of peripheral muscle penetration, the bullet can be left in place as the animal will wall it off. In other circumstances, especially with penetration of body cavities, it may be necessary to perform exploratory surgery in order to assess and treat projectile trauma. Approaches similar to those used in domestic animals are used in most wild mammals presented for treatment. A number of different approaches for avian celiotomy are utilized. These include left lateral, right lateral, ventral midline and cranial, mid and caudal transverse approaches (Bowles, 2006). In general, the left lateral approach provides the best exposure for the proventriculus, ventriculus, reproductive tracts, spleen, left kidney and left ureter. A ventral midline, transverse or combination approach provides surgical access to the middle and both sides of the coelomic cavity.

Common Orthopedic Presentations

While the reasons for the types of orthopedic injuries sustained by wild mammals may vary from those sustained by domestic mammals, surgical approaches and techniques are similar. Sedation techniques for wild mammals may range from hand injection to those that require specialized equipment such as dart guns and rifles. Sedative doses and immobilization techniques are provided in Kreeger 1999 and West 2007. Excellent training in these techniques is provided through a variety of sources, including those given by Safe-Capture International (www.safecapture.com).

Avian orthopedic techniques vary in many important ways from mammalian procedures. In general, avian bones have thinner, more brittle cortices and those that are pneumatized are connected to air sacs. Because of these factors, many avian fractures tend to be comminuted and open fractures of pneumatized bones, such as the humerus and femur, can lead to subcutaneous emphysema and respiratory infections. Healing times for orthopedic injuries are more rapid than in mammals, with clinical stability often achieved 3-4 weeks post-operatively and full bone
healing by 6 weeks after surgery. However, wild avian patients require full return to function for release and any problem that results in a decreased range of motion in any joint may be problematic. Therefore, surgical and coaptation techniques must not compromise joint mobility. In addition, fixation devices must be removed in their entirety after bone healing has occurred since any extra weight on an extremity can compromise survival of the wild bird after release.

The avian shoulder joint is comprised of four different bones that function together to provide the power needed for lift and sustained flight. The clavicle and larger coracoid bones serve as struts to support the body during the downbeat of the wings and also to provide attachment for the pectoral muscles which power flight. The scapula is palpable as a ridge over the dorsal aspect of the thoracic wall on either side of the spine. The humerus is a pneumatized bone that articulates with the radius and larger ulna at the elbow joint, which normally extends to 180°. These bones articulate distally at the carpal joint, which normally hyperextends beyond 180°. Distal to the carpus, two carpometacarpal bones articulate with the major and minor digits of the wing. Excellent line drawings of avian skeletal anatomy are found in Proctor 1998.

Fractures of the clavicle and coracoid are often sustained as birds collide head-on into objects. Non-displaced fractures of the clavicle can often be repaired with simple cage rest, especially in small songbirds. More displaced fractures, especially in larger birds, do not usually require surgical intervention and will respond to coaptation techniques in which the wing is held in flexion with a figure eight wrap and then bandaged to the body. The healing process should be carefully monitored and range of motion of the wing should be regularly evaluated to detect any compromise in joint mobility. Techniques have been described for plating coracoid fractures (Davidson, 2005) though these techniques do require manipulation of pectoral musculature and involve prolonged healing times. A study by Redig et al analyzed surgical vs. coaptation techniques for coracoid fractures and found that the overall success rate for return to full flight was only 25% for surgically managed cases vs. 85% for conservatively managed cases (Redig, 2000a). However, another study showed that 2/9 birds with coracoid fractures treated conservatively were released vs. 6/8 released with surgical intervention (Holz 2003).

Fractures of the avian humerus tend to be open due to the strong pull of attached flexor muscles. The radial nerve runs caudal to cranial in the mid-diaphysis and must be evaluated and preserved during surgical procedures. Proximal humeral fractures are most often transverse and, because it can be difficult to stabilize these fractures with an intramedullary pin, the preferred method of fixation is with tension band placement. See Helmer & Redig, 2006 for details of this surgical procedure. Fractures of the humeral diaphysis are best repaired with an intramedullary pin tied into an external skeletal fixator (ESF). In open humeral fractures, the IM pin is retrograded into the bone through a dorsal approach. The pin is usually normograded for closed fractures with the entry site for the pin through the dorsal aspect of the distal humerus just proximal to the lateral condyle. The triceps tendon must be retracted prior to pin insertion at this site. Regardless of the point of insertion, once the fracture has been reduced, the pin is bent at 90° where it exits the bone. Two or more positive threaded cross pins are placed in the proximal and distal fragments of the bone. The cross pins are then linked to the IM pin with a lightweight bar, which can be metal (FEASA tubular fixator system; Jorgensen Laboratories, Loveland, CO) or acrylic. Distal humeral fractures are more problematic because there is usually accompanying joint damage, the fractures are often open and there is not good purchase for fixation devices.
A cross pinning technique for supracondylar fractures has been described (Redig 2000b).

Radial and ulnar fractures are frequently sustained in wild birds, though ulnar fractures tend to be encountered more frequently. This can be attributed to the greater elasticity of the radial bone compared to the ulna. External coaptation is an option in small passerine birds, though the range of motion post-fixation may limit release capability. Radial fractures, even with an intact ulna, should always be fixed, since limitation in movement of the radius with suboptimal repair will interfere with normal range of motion of the wing. The radius can be pinned with an IM pin introduced at the site of the fracture and driven retrograde to exit at the distal end of the bone as the carpus is flexed. The fracture is then reduced and the pin driven across the fracture site into the proximal fragment, taking care to avoid penetrating the elbow joint. The ulna is pinned in a normograde fashion with the site of entry on the caudal aspect of the ulna between the shafts of the second and third to last secondary feathers. This IM pin is then incorporated into an ESF.

Fractures of the carpal and metacarpal bones are complicated by the fact that there is very little soft tissue support around these bones to protect them and to provide a vascular supply, commonly resulting in open comminuted fractures and/or vascular compromise. A curved edge splint technique is used for closed, easily reduced metacarpal fractures. Splinting material such as SAM splint (Jorgensen Laboratories, Loveland, CO) or moldable thermoplastic materials can be used for this purpose. An external skeletal fixator works well for comminuted open metacarpal fractures in larger birds, provided the surgeon exercises care not to compromise the delicate soft tissue structures of the distal wing.

It is especially important for the veterinarian to recognize that any avian leg fracture results in extra weight-bearing on the contralateral limb. This can easily result in pododermatitis of the contralateral limb; the incidence of bumblefoot is reduced with proper attention to maintaining an appropriate body weight, providing clean, varied perching surfaces, and inspecting the feet on a regular basis for any evidence of flattening of the papillae, redness or open sores. If these are encountered, clean the foot gently with dilute chlohexiderm solution (Nolvasan; Fort Dodge, Overland Park, KS) and apply a protective layer of a collagen product such as Collasate (PRN Pharmacal, Pensacola, FL).

Pelvic fractures are generally managed with cage rest for 5-6 weeks provided there are no associated neurological deficits. Femoral fractures are often oblique and comminuted. Rotational and bending forces must be stabilized. Open fractures are rare as the bone is well protected by surrounding musculature. Proximal fractures are managed with a tension band apparatus similar to that described for the proximal humerus. The preferred surgical fixation method for a femoral diaphyseal fracture is a IM pin tied into an ESF. The IM pin is introduced at the fracture site and retrograded to exit at the hip. Cross pins are placed from slightly craniolateral to caudomedial to avoid the neurovascular bundle.

Tibiotarsal fractures are common in birds as, in most cases, this is the longest, most exposed bone in the leg. Transverse fractures are most common and rotational and shear forces must be stabilized. They are usually closed and the prognosis for repair is good with an IM pin and coaptation in smaller birds (< 300g) and an ESF in larger birds. The IM pin can be placed in a
retrograde fashion from the fracture site or can be introduced at the cranial aspect of the proximal tibiotarsus, avoiding the patellar ligament and, following fracture reduction, advanced into the distal fragment. Placement of the cross pins must avoid the fibula and the neurovascular bundle laterally and the gastrocnemius muscle medially.

The tarsometatarsus bone shape varies among different families of birds with varying amounts of medullary cavity. Fractures of this bone are often open since there is very little soft tissue covering. IM pins are not recommended and ESF cross pins must be placed to avoid the metatarsal artery and extensor tendons running dorsally and the flexor tendons ventrally. Many tarsometatarsal fractures will heal well with splinting, taking care to allow the toes to function freely in order to avoid flexor tendon entrapment in callus formation.

**Conclusion**

Veterinary practitioners can utilize their surgical knowledge and skills in order to benefit wildlife with soft tissue or orthopedic injuries. While there are certainly some differences in working with these species as opposed to domestic animals, a good working knowledge of specific anatomy and physiology, natural history and captive care requirements will enhance the chances of successful return to function and eventual release.

**References**


