# Liberty Wildlife Medical Services

Medical Services
Training Program

• Section Nine •

Wound Care and Management



**Liberty Wildlife, P.O. Box 14345, Scottsdale AZ 85267**
**Wildlife Hotline (480) 998-5550**

# Avian Assessment Review

It is important to always keep in mind the criteria for safe and successful avian assessment. Before beginning the material on wound care, review the assessment basics listed below.

- Can you safely assess the animal? Is the animal compromised to the degree that handling it for even the simplest exam could be detrimental? Remember our three easiest treatments (warmth, dark, and quiet) sometimes provide the best results.

- When you assess an animal, it's important to be thorough, but it's important to use your good powers of observation and common sense, too! Was the bird standing? Was it moving easily and comfortably? Did it run away from the rescue volunteer? If so, its legs are probably fine. You can wait to complete the leg exam until the animal is stable and less stressed. Did the bird fly? If so, its wings are probably fine. Be sure to note these as *assumptions* in the chart and include your reasoning.

- Don't treat the first injury you see. There may be other serious injuries you have not discovered that will affect your assessment of the animal.
    - You may have an animal that was found near a road that is very depressed, head hanging, bleeding from the mouth, and showing neurological impairment—understandably suggesting a "hit by car" scenario. However, further investigation might reveal trichomoniasis (canker) traveling up into the head—a condition requiring different treatment.
    - You might see a bird that is holding out one wing or dragging it on the ground indicating damage to the wing or shoulder. Further investigation might reveal a broken leg or pelvic injury which is causing it to use its wing for balance.
    - You may take the time to clean and treat an injury only to later discover sadly that a second condition exists, so severe that the animal has to be euthanized.

- Remember the two-minute exam: Have a system that allows you to provide a good thorough exam in two minutes or less.
    - Palpate the entire wing including bone structure and the patagium. Check the movement in the shoulder by firmly, but gently grasping and rotating the humerus. Check rotation in other wing joints. Check ventral and dorsal surface of wing for wounds.
    - Check legs, feet, and toes. Check the movement in the hip and other joints.
    - Feel the keel and breast area. Check for abnormalities in the surface of the keel. Check for wounds to the breast. Check weight.
    - Look over the torso. Check skin to estimate the dehydration level. Note scabs, tears, or abrasions.
    - Open the mouth. Note color and condition. Estimate dehydration level. Study the head. Note any unusual tilting. Check eyes, cere, throat, and surrounding tissues. Look for indicators of depression or shock
    - Check overall feather condition

- Limit interaction: Keep your interaction with an animal as brief as possible. If you find yourself with a task that requires an extended period of time, put the animal back in to its enclosure. Even the calmest, kindest restraint is still stressful. Do not continue to have an animal held while you complete work or preparations.

- Prioritize treatments: You may find fractures, diseases such as pox or trichomoniasis, soft tissue damage, bleeding, or other conditions.
    - Decide if you have a life-threatening condition and determine what is most important or possible to treat immediately.

- Euthanasia: The decision to euthanize an animal is never made lightly. If the animal does not have the possibility of surviving in the wild after its injuries have healed we try to determine if it can be placed in an educational or display program with another licensed facility.

# Introduction to Avian Wound Care

The skin is the largest organ of the body. It provides protection from microorganisms. The skin also protects the tissue underneath from injury and helps to insulate tissue and other organs against heat and cold. The skin has many other beneficial functions. Openings in the skin or in the skin and its underlying tissues can cause disruption of some of these functions. These openings are wounds.

Depending on the location and severity of a wound, other difficulties can arise. A tear in a muscle can affect movement. Infections can set in from exposure to dirt and debris. Organs may be injured.

This section is about wounds. We will discuss types of wounds and how wounds heal. Products and supplies used in the treatment of wounds will be presented. Five steps of wound care will be introduced, along with common types of wounds and how they are treated. Wound management will also be discussed.

This section will end with a lab in which you will treat a variety of wounds. In Sections Seven and Eight you learned about bandaging. This section will incorporate the treatment of wounds with bandaging techniques.

# How Wounds Heal

Healing is the process by which the interruption in the continuity of the body's structure is restored with viable tissue. The healing process starts immediately after an injury and may continue for months or even years depending on the problem. Variations in wound healing are the result of differences in location, severity of the wound, and the extent of injury of the tissues. Other factors affecting wound healing are age, nutritional status, and general health of the animal and its body reserves and resources for the regeneration of tissue.

The healing process is basically the same for all types of wounds and follows one of the following three methods.

- Healing by first intention
    - Primary union. Restoration of tissue occurs directly, without granulation. Healing by first intention includes surgical procedures, such as suturing, as well as non-surgical procedures such as the use of Steri-strips or skin glue.
- Healing by second intention
    - Secondary union. Wound repair following tissue loss (as in an ulceration or open wound) is accomplished by the closing of wound with granulation tissue. Dressings, ointments, or antibiotics may be used to aid healing by second intention.
- Healing by third intention
    - Delayed primary closure. Occurs when a wound is initially too contaminated to close and is closed surgically four or five days after the injury. This is a combination of the other two types of healing. Healing by second intention occurs, followed by healing by first intention as soon as a positive result can be achieved.

# Wound Management

An understanding of wound healing is important in order to access and devise a treatment plan. Although there are many types of wounds, most undergo similar stages in healing. The three omplex but basic phases of wound healing are inflammatory, collagen, and maturation.

The inflammatory phase begins immediately following traumatic injury . Inflammation is the first stage of wound healing and can be divided into 2 phases. First, blood vessels constrict to control bleeding. Then, within minutes, blood vessels dilate, which causes swelling, heat, pain, and redness at wound site.

Collagen phase is the second stage and occurs 3-5 days preceding aninjury. During this phase cells grow and migrate across the surface of the wound rebuilding missing and damaged tissues causing scabs to form.

Maturation phase is the final stage of wound healing. During this period, the newly laid collagen fibers reorganize. The maturation stage takes weeks to months during which time the collagen matrix remodels to form thicker, stronger fibers. This process allows wound strength to increase slowly over a long period of time.

Factors that can impair or prevent normal wound healing include dehydration, starvation, and improper wound cleaning and debridement.

A greenish discoloration of the skin is normal in injured birds. The color is due to an accumulation of a pigment following the breakdown of hemoglobin. The discoloration typically develops two to three days after an injury and can persist for a week or more.

## Healing

Is the process of returning to health and the restoration of structure and function of injured or diseased tissues. The healing processes can include blood clotting, tissue mending, scarring, and bone healing.

**Healing by first intention**

Occurs when the tissue surface has been closed. This can be with sutures, skin glue (like Derma bond), or even with tapes (like steri-strips). This kind of closure is used when there has been very little tissue loss. It is also called "primary union" or "first intention healing." It is the best choice for clean, fresh wounds

**Healing by second intention**

Used on a more extensive wound involving tissue loss, and in which the wound edges cannot be brought together. Wound is left open to heal naturally without surgical intervention. Secondary intention healing differs from primary intention healing in that the repair time is longer and the chances of infection are greater.

**Healing by third intention**

A method of closing a highly contaminated wound in which the wound is left open until contamination has been reduced, and the inflammation has subsided, at which time the wound is then closed by first intention. Also called delayed primary closure. Useful for managing wounds that are too heavily contaminated or there is extensive swelling and or infection present. The wound is monitored closely and then closed by first intention when the conditions have improved.

Types of injuries often seen and treated are electrocution, trauma-associated cuts and abrasions, gunshot wounds, degloving injuries, and puncture wounds. Healing by primary closure is generally preferable to healing by secondary intention, though the latter is more common in raptors because of the delayed presentation of most wounds. Debridement and lavage with chlorhexidine solution provides optimal results and is required for all wound care.

Some types of wounds have special requirements or treatments, therefore wound assessment is a critical part of the examination and treatment of wildlife.

# Types of Wounds

Wounds are sites where the continuity of the body's structure has been injured by physical means.

Common types of wounds or open tissue trauma:

- Abrasion mucous: A wound caused by rubbing or scraping the skin or membrane.
- Laceration: A wound in which the tissue is torn.
  Open: A wound that communicates directly with the
- Puncture: A wound caused by a sharp, usually slender object, which passes through the skin and into the underlying tissue. Also called a penetrating wound.
- Sucking: A penetrating wound through which air is drawn in and out.
- Degloving: The avulsion or tearing away of skin from structures, like peeling off a glove or a sock. Besides the possibility of injury to other structures, there may be a problem with viability of the skin involved.
- Compound Fracture: A fracture with a wound that communicates directly to the site of the break. Also called an open fracture.

# Products and Supplies

- Outer cleaning solutions
  - Tap water
  - Betadine *scrub*
  - Chlorohexidine
  - Normal Saline (0.9 Sodium Chloride)
- Flushing solutions for inside the body
  - Betadine *solution*
  - Chlorohexidine
  - Normal saline (0.9 Sodium Chloride)
- Wound dressings
  - Telfa
  - Telfa with Furazone ointment
  - Wound powder
  - Comfeel
  - Duo Derm
  - Elastigel
  - Tega Derm
- Other products
  - Steri-strips
  - Vet wrap
  - Rolled cotton
  - Gauze

- Telfa
- Splints
- Trypzyme spray
- Caravet

# Avian Wound Care

Birds handle infections in their systems differently than mammals do. Rather than creating pus, the avian system tends to wall-off or encapsulate infections. It is still important, however, to provide an atmosphere in a wound that is conducive to healing.

For the purpose of this section, the procedures involved in avian wound care have been divided into the following five steps.

| | |
|---|---|
| Assess | Determine the type of wound or trauma |
| Clean | Prepare an environment conducive to healing |
| Treat | Complete appropriate procedure for injury |
| Stabilize | Secure treatment and prevent further injury |
| Manage | Plan and document further care |

## Assess

Assessing the wound

- What type of wound do you have? Is just the outer layer of skin torn? Does it penetrate deeper? Are other structures or organs involved?
- Is there an unusual amount of bleeding? You may have a vein or artery that has
- been damaged.
- Can the animal tolerate further investigation and care?
- What steps will be needed?

## Clean

It is important to provide a thorough initial cleaning of wounds to provide a condition that is conducive to healing. *Debridement*, or the removal of all foreign material and devitalized tissue from the wound area, can be a simple as wiping an abrasion with moistened gauze or as complex as cutting away dead tissue and bone fragments.

- Skin and feathers (outside the body) that need to be cleaned can be washed with warm water or with Betadine scrub.
- Removing debris: Large pieces of debris can be removed with a forceps or hemostat. Softening matted feathers with warm water will often expose the true problem below.
- Flushing open wounds: Flushing rinses a wound carrying away smaller dirt and debris. Flushing with an antibacterial solution may help counteract infection. Open wounds should be flushed thoroughly too clear debris that may have entered the area. Wounds can be flushed with normal saline (.9% Sodium Chloride) or with a dilute Betadine solution (use Betadine *solution*, not Betadine *scrub*). Never flush open wounds of the humerus or femur as the bone is part of the respiratory system.

- Advanced debridement: Some wounds will be old and have additional damage to the surrounding tissues. These wounds may require more complicated cleaning. Advanced debridement may include cutting away dead tissue, removal of bone fragments, further opening of the wound to allow for removal of dead tissue, and other procedures. Advanced debridement procedures are completed by experienced medical staff only.

## Treat

Once you have determined the type of wound or injury, and decided on an action plan, you can begin the treatment. Again, treatments vary according to the condition. Treatments can be non-surgical or surgical in nature. You will be providing non-surgical treatments.

Common types of non-surgical treatments

- Hydration
- Systemic products such as antibiotics
- Debridement (may be surgical if tissue removal is required)
    - Clear foreign matter
    - Allow time for tissue to granulate in
- Pressure (control bleeding)
- Clean and leave alone
    - Scientific neglect! Complete cage rest often gives the animal's system the opportunity to heal itself.
- Administration of topical products
    - Agents to dry the wound (exudate draining)
        - Keep environment dry if it is too wet
        - Open to air to dry
    - Agents to keep the wound moist (muscle exposed)
        - Keep environment moist
        - Antibiotic ointments or powders
    - Eye drops or ointments (non-steroidal)
- Wound dressings or coverings
    - Dressings to dry the wound
        - Gauze will pull away moisture
        - Keep environment dry
    - Dressings to keep the wound moist
        - Telfa, Elastigel, Comfeel
        - Keep environment moist

Common surgical procedures (experienced veterinary staff only)

- Advanced debridement
- Advanced splinting
- Suturing
- Pinning
- Exploratory procedures

## Stabilize

You wouldn't want to apply an ointment with a wound dressing only to have it fall off the first time an animal moved, would you? Stabilizing your treatment is a necessary step!
Stabilizing can be accomplished with:

- Wrap: Vet wrap is an elastic product that adheres to itself. It is available in many widths and can be cut into small strips for tiny wraps. The advantage of vet wrap in avian situations is that it does not stick to feathers. Caution must be taken when using vet wrap. If it is applied too tight it can cause swelling that can irreparably damage a limb or the patagium.

- Tape: Tape has the advantage of fixing firmly to a surface. Paper tape adheres lightly and can be removed with minimal damage to feathers. Masking tape is very useful for splinting or for shoes on small birds. White adhesive tape sticks firmly in place and does not stretch, but does damage feathers. *Elasticon* is an adhesive tape that stretches. Caution must be taken when using *Elasticon*. If applied too tight, *Elasticon* can cause swelling that can irreparably damage a limb or the patagium.

- Splints: Splints are commonly used to secure compound fractures. In order to provide the best opportunity for healing, the joints above and below the fracture site should be immobilized. Splints may keep a bone from sticking through tissue

- Shoes: Birds will often need "shoes" for injuries or trauma to the foot. Shoes can be made from tape, cardboard, or other materials.

- Ball bandage: Injuries to the foot can be helped by the application of a ball bandage which distributes the pressure evenly across the foot. This bandage can help damaged toes or bumblefoot.

- Substrate: Substrate is a particular surface below the animal that aids in the healing process. Animals with wounds on the feet must have very clean substrates to avoid infection. Removing papers and allowing mutes to fall below an open grate floor will help reduce the opportunity for infection. Also, a softer, firmer, easier to grip, rougher, or smoother surface might be selected, depending on the condition being treated. The cage flooring is usually sufficient.

- Cage rest: Just do nothing! Sometimes this treatment is the best.

**Manage**

Plan for the continued care of your patient. Notes on care management should include every planned provision you have made. Some areas to be included are:

- Medical charts
- Medication schedules
- Schedules for physical therapy or other treatment
- Monitoring of weight and eating
- Monitoring of swelling
- Monitoring of general condition
- Monitoring cleanliness or wound and wound area
- Monitoring condition of cage
- Noting mental as well as physical condition
- Noting appropriate social behaviors
- Redoing wraps (especially orphans since they grow so fast)
- Wellness checks

# Common Wound Conditions

There are many types of wounds that are commonly seen at Liberty Wildlife. These conditions and their treatments are outlined below.

## Degloving wounds to the head

Although any species can have this type of wound (and it can be in areas other than the head) it is a common condition found on doves. It frequently leaves the skull of the animal exposed. First, the area must be thoroughly cleaned. Use saline to avoid damage to the eyes. At this point, the wound should be covered until advanced debridement or suturing can be completed. Degloving wounds can be covered by moist wound dressings such as Duo Derm or Comfeel. They usually have to be secured with a stabilizing product such as wrap or tape. Degloving wounds can also be covered by using the flap of remaining skin as a bandage. The flap is pulled over the open area and then secured with Steri Strips. Only use this last procedure if you were able to completely clean the wound and if the Steri Strips completely close the open area. The wound can then be sutured at a later time when the animal is stable.

## Electric shock injuries

Injuries from electrical shocks are not always immediately evident. A “burned” smell might be your only clue initially, however small wounds eventually appear, followed by sloughing of a larger area of dead tissue. This sloughing period can continue for a few weeks. Electric shock injuries usually have an entrance wound and an exit wound indicating the path of the electricity. Since the tissue surrounding these wounds has been “cooked” with high voltage, infection is not usually an issue. The electricity has basically sterilized the site.

These wounds will need to heal by second intention. The healing process can be very slow if a large amount of tissue is affected. Wounds of this nature should be covered with Elastigel and wrapped to secure. Bandages should be changed regularly and checked frequently during the sloughing period.

Continue to check body surfaces regularly to monitor any new areas of sloughing or dead tissue.

## Compound fractures leg/wing

With a fractured bone communicates with the outside air through an opening in the tissue, it is called a compound fracture. Compound fractures have a good potential for infection. Antibiotics are commonly needed. Initial treatment for a compound fracture is the securing of the limb along with the covering of the ends of the bone if it is still exposed. This can be completed by the use of nitrofurazone ointment, Telfa, and vet wrap. Senior medical personnel will complete the process of debriding the bone and reinserting it into the limb if needed. Splints may be needed to secure bones in the proper place.

## Torn crops

An opening in the crop allows the escape of food as well as dehydration and the other complications that wounds can bring. Crops wounds should be cleaned with normal saline. The wound can then be covered with a dressing to close it until it is sutured. Depending on the location, other precautions must be taken. Wounds in the caudal crop must be securely closed so that food lying in the crop does not escape into the body cavity. Wounds in the anterior portion of the crop are not as critical, as limiting the amount of food can prevent leakage from the area.

## Cat attacks

Cat attacks usually leave puncture wounds from teeth and claws. These wounds can leave bacteria deep into the animal's tissue. Cats have natural bacteria that can be toxic to birds. If a bird is presented with multiple punctures from a cat attack, it should be placed on antibiotics. If the paperwork indicates cat attack and you cannot locate any punctures or lacerations, antibiotics are not needed.

## Dog attacks

Dog attacks tend to leave bigger wounds and abrasions. If you suspect a dog attack and a bite, be sure to check the other side of the body for the opposing teeth marks. These wounds should be cleaned. Antibiotics might be indicated depending on the severity and age of the wound.

## Gunshot

Just because you see a hole in an animal, does not mean it has been shot. Other types of trauma can produce a similar wound. Sadly, however, gunshot wounds do still appear with regularity. When the bullet or pellet enters the body, it usually brings with it a "plug" of debris that includes dirt and feathers. This material needs to be removed. It may take more than one session to do this. Until the body is debris-free, the hole does not usually completely close. Thus, an open wound may indicate that there is still material inside that needs to be removed. Remove obvious debris. Flush the wound with saline if you can safely do so. Cover the wound with nitrofurazone ointment and Telfa and wrap to secure. The pellet does not always need to be removed. If the pellet is lead, it will only be a problem if it has settled in the digestive tract where the digestive juices will release lead into the bodies systems. If it has settled into tissue, the body will encapsulate it, rendering it harmless.

Barbed wire fence

Surprisingly, we do see a significant number of injuries from birds flying into barbed wire. If this results in damage to the patagial area (which it commonly does) the animal may be non-releasable. The patagial area has a very thin layer of skin that does not close easily. Holes in this area often heal leaving an opening. This opening prevents the wing from obtaining the necessary "lift" needed for flight. On occasion, the wing coverts will grow to cover this area. If this happens, the coverts "close" the hole, returning function to the wing.

Cactus needles

When a bird has been on the ground in the desert, it is common to find cactus spines in its feet and other areas. Hemostats will often be needed to pull out the spines. After removing the spines, wipe the area with Betadine to clean. Wrap is usually not needed as long as care is taken to provide a clean environment.

# Successful Wound Management

If you have assessed correctly, cleaned and treated the condition according to procedure, stabilized the area as needed, and provided a sound plan for continued management, you have given the animal its best possible chance for survival.

How do you make sure that the plans you have made for the animal will be completed as you planned? Do *your* part, if everyone, each day, completes the necessary procedures, treatments, and wellness checks as they are assigned, our care will truly be the best we are able to provide.

Keep current. Read through the charts and become familiar with each animal and its condition, even if you are not treating it personally that day. Do what you can and ask for help when you need to. Make sure each animal receives the care necessary to complete its successful treatment.

# Common Conditions

There are many conditions that you will learn to readily recognize as you see more and more wildlife being treated. Here are some of the common conditions you will experience.

## Trichimoniasis (Canker)

Canker is caused by a protozoa. It is spread easily from one infected bird to another, often from doves, finches and other seed-eating birds sharing the same food and water sources. The disease moves up the food chain when an affected bird is eaten by a larger bird.

- Symptoms
  - Clumps of cheesy looking yellow/white matter in the bird's mouth and throat. It can also be in the crop and up in the sinus areas.
  - Birds may have difficulty breathing due to obstructed airways.
  - Birds may be emaciated due to inability to swallow food.
- Treatment
  - Carnidazole tablets (Spartrix)
  - Metronidazole (Flagyl) suspension
- Precautions
  - Keep all isolation birds separate, even if two have the same condition.
  - Do not necessarily leave food. The animal can choke trying to feed itself without a passage in its throat.
  - Wash your hands immediately after handling.
  - Avoid cross-contamination of food and water bowls, perches, or other utensils by disinfecting everything during cage cleaning.
  - Cages must be cleaned and disinfected with dilute bleach or other strong disinfectant. If an animal dies, disinfect the cage immediately.
  - If a bird is being tube fed, the tube and syringe should be washed immediately in hot soapy water, rinsed, and put into a soaking solution.
  - Post "Medical Isolation" signs on the cage indicating the condition

# Canker

**What is canker:**
Canker, also known as Trichomoniasis is caused by a protozoan. It is not transmittable to humans or other mammals but can be transmitted to other birds that share the same water, seed, through beak-to-beak contact, or by raptures who consume an infected bird. It needs moisture to survive and if left untreated is fatal.

**Canker Symptoms**:
The most common symptom of canker is a yellow or brownish cheeselike growth in the mouth.

**These are some other common symptoms of canker**:
Keep in in mind not all symptoms will be present in each case. The symptoms appear approx 6 – 7 days after infection.

- Lump in the neck
- Cheesy growth in mouth or throat.
- Inability to swallow seed
- Mouth may be partially open with inability to close mouth
- Distortion or swelling of forehead (if sinuses have been invaded)
- Increased mucous in the throat
- Hard crop (in severe cases crop may be blown out)
- Noticible sinus drainage
- Head tilt
- Swollen closed eyes
- Immaciated

**Treatment**

- Flagyl suspension
- Spartrix tablets

**Precautions**

- Do not necessarily leave food. The animal can choke trying to feed itself without an adequate passage in it's throat. Hand feeding or tube feeding may be necessary.
- Keep all isolation birds separate, even if there are two with the same condition
- Wash hands immediately after handling
- Avoid cross contamination of food and water bowls, perches, or other utensils by disinfecting everything during cage cleaning
- Cages must be cleaned and disinfected with dilute bleach or other strong disinfectant. If animal dies disinfect the cage immediately
- If a bird is being tube fed the tube and syringe should be washed immediately in hot soapy water, rinsed and put in a disinfecting soaking solution
- Post "Medical Isolation" tag on the cage indicating the condition
- Canker is highly contagious between birds
- Pieces of canker must not be broken off as the bird can bleed out
- If canker is visible and bird is on meds, tube fed or hand fed only. Do not leave food in enclosure
- **ALL** Kestrels are given either a ¼ or ½ tab of oral spartrix upon intake

Note how the lesions completely block the passage of food through the esophagus

## Avian Pox

Avian pox is a viral condition. It is most likely seen in birds with compromised immune systems or those under extreme stress.

- Symptoms
  - Pox manifests itself in several ways. The most easily noticed is an inflammatory swelling of small lumps on exposed areas such as the feet, face, and vent. This cutaneous form begins as tiny white bumps, becoming larger and changing color to yellowish or pink. Finally, they form a dark tough, brown scab.
  - The scabs that drop off naturally leave smooth scar tissue underneath. This form is called *dry pox*. The opposite form, *wet pox*, is caused by the same virus but affects the mucus membranes of the mouth, throat, and nasal passages. It starts as tiny white nodules and may later become larger yellow cheesy areas lining the mouth.
- Treatment
  - Keep lesions clean and watch carefully.
  - Medications are not currently available to treat.
  - There is no cure for pox. It is a virus that must run its course.
- Precautions
  - Keep all isolation birds separate, even if two have the same condition.
  - Wash your hands immediately after handling.
  - Avoid cross-contamination of food and water bowls, perches, or other utensils by disinfecting everything during cage cleaning.
  - Cages must be cleaned and disinfected with dilute bleach or other strong disinfectant. If an animal dies, disinfect the cage immediately.
  - If a bird is being tube fed, the tube and syringe should be washed immediately in hot soapy water, rinsed, and put into a soaking solution.
  - Post “Medical Isolation” signs on the cage indicating the condition

# Pox

Avian Pox is a viral condition most likely seen in birds with compromised immune systems or those under extreme stress. It is often transmitted by mosquitos

### There are two forms of Avian Pox:

- In the more common dry form, tiny white nodules develop on the featherless areas of the bird including the legs, feet, nares, beak, and around the eyes. The nodules become larger and change to a yellowish or pink color. They develop into pus filled lesions that break open and form dark tough brown scabs that eventually dry up and fall off naturally leaving smooth scar tissue underneath. If the eye is involved, reddened lids, discharge, inflammation of the cornea, cataracts, and a shrunken eye may occur. Some lesions can be very large and may be present up to 6 weeks or more.

- The second wet form is caused by the same virus but affects the mucus membrane of the mouth, throat, and nasal passages. It starts as tiny white nodules and may later become large, yellow cheesy areas lining the mouth. In extreme cases the bird may have difficulty eating and drinking.

- One of the primary sources of infections are contaminated bird feeding stations; or contaminated food / water. Bird baths / feeding stations need to be regularly disinfected with a 5% chlorine bleach solution

- The avian pox virus is not zoonotic ; however, it is a highly contagious virus between birds

### Treatment

- There are no medications that will kill pox therefore it's a virus that must run it's course.
- Treatment involves supportive care to help the bird recover. Antibiotics may be used to prevent or treat any secondary infections. Scabs around the eyes can be softened with moist compresses. Do NOT attempt to remove the scabs. eye ointments may be used if the eyes are affected.
- Keep lesions clean and watch carefully

### Precautions

- Keep all isolation birds separate, even if there are two with the same condition
- Wash hands immediately after handling
- Avoid cross contamination of food and water bowls, perches, or other utensils by disinfecting everything during cage cleaning
- Cages must be cleaned and disinfected with dilute bleach or other strong disinfectant. If animal dies disinfect the cage immediately
- If a bird is being tube fed the tube and syringe should be washed immediately in hot soapy water, rinsed and put in a disinfecting soaking solution
- Post "Medical Isolation" tag on the cage indicating the condition






## Bumblefoot

Bumblefoot (posodermatitis) is a term commonly used that refers to an injury to the foot. Its most common in captive raptors.

- Symptoms
  - Large open sores commonly found on the bottom of the metatarsal pad or the digital pads. These sores appear to look like a corn or are open, swollen or infected. They can start out as an abrasion or a puncture.
- Treatment
  - Treatment varies depending on the severity of the bumblefoot. If it is more severe with infection, the foot is cleaned with Betadine solution or Chlorohexidine solution, then an antibiotic ointment is applied with Telfa, gauze for padding, and vet wrap. If there is infection, sometimes the wound is often cultured and the bird is started on antibiotics. The wraps need to be checked to see if there is any swelling around the toes if the wraps are too tight. The wraps also need to be monitored for dryness. If a bird is standing in water, the vet wrap can become tight and the moisture on the feet can become a bed for other bacteria. If the wounds are less severe, sometimes the foot may be wrapped with A&D ointment, telfa, and vet wrap. This helps to soften the corn and condition the foot.
- Precautions
  - Bumblefoot is often a sign of housing problems. The enclosure and perches may need changes that are conducive to the bird's needs.

# Bumblefoot



**What is Bumble foot?**
A bacterial infection on the feet of birds which causes lesions on the ball of the foot, (tarsal pad) or one or more of the toes This infection is much more likely to occur in captive animals than in those in the wild.

**Symptoms**
Large open sores commonly found on the bottom of the metatarsal pad or on the digital pads. These sores appear to look like corn , or are open, swollen, or infected. They can start out as a abrasion or puncture

**The Cause**
Captive birds, may suffer from bumblefoot because of unsuitable perches, or simply due to periods of inactivity, during which time they are taking excessive weight on their feet. If weight is consistently taken by on by a certain part of the foot, the blood supply to that area is compromised. This can lead to bacteria passing deeper into the tissues of the foot causing infection and resulting in bumblefoot. In severe cases surgery may be required.

**Treatment**
Treatment varies depending on the severity of the condition. The wounds are first cleaned with Betadine solution or Chlorahexedine solution. Then an antibiotic ointment is applied along with telfa, and a ball bandage. The wraps needs to be checked for any swelling around the toes and to ensure the wrap is not too tight. If there is infection the wound may be cultured and the bird started on anitibiotics.

The wrap also needs to be monitored for dryness. If the bird is standing in water the vet wrap may tighten and the moisture on the feet can become a bed for other bacteria. If the wounds are less severe, sometimes the wounds may be wrapped with A&D ointment, telfa, and the a ball bandage. This helps to soften the corn and condition the foot.

## Fractures

Fractures are breaks in parts, especially in bones. Most bird bones are hollow. Fractures often cause shattering of the bone, making it difficult to align the pieces. Common fractures involve the wings, legs, back, or pectoral girdle.

- There are many types of fractures, some of which are listed here:
    - Complete - Involving the entire cross-section of the bone
    - Comminuted - The bone is splintered or crushed
    - Compound - An open wound that connects to the break
    - Non-union - An open space between the ends of the bone
    - Stress - Produced by stress created by the pull of muscles
    - Closed - A fracture that does not break the skin
- Symptoms
    - Interruption of bone or part
    - Unable to use limb or part
    - Unable to fly or walk
- Treatment
    - Align bone correctly and secure
    - Secure joint above and below fracture site if possible
    - Provide cage rest until limb heals
- Precautions
    - Provide cage rest when first unwrapped
    - Provide for joint movement as soon as possible
    - Check wraps frequently for swelling and security

## Types of Fractures:

- Simple Fracture: A break in a bone without an accompanying wound at the
- fracture site.
- Compound or Open Fracture: A break where the bone has penetrated the skin to the exterior, or the wound that broke the bone has exposed the broken ends.
- Comminuted Fracture: Bone is crushed or splintered. Multiple Fracture: Bone is broken in more than one place.
- Impacted Fracture: A break in which one broken fragment is firmly driven into the other.
- Greenstick Fracture: A break in which the bone is not broken all the way through.
- Capillary Fracture: A break that appears as a fine hair-like line on x-ray, with the bone not displaced from its normal position.
- Pathologic Fracture: A break due to abnormally weak bone structure, such as from dietary deficiency or other disease. Metabolic bone disease (MBD) is an example of this.
- Transverse, Oblique, Spiral: Terms used to describe the direction or shape of a fracture.
- Callus: Enlarged fibrous and boney bridge that forms during the healing of a fracture. The bridged area is remodeled as healing is completed and is ultimately replaced by true bone. The better the fracture fragments are aligned, the smaller the callus will be. A callus may interfere with joint function if the fracture is close to the joint. The closer the break is to a joint the better the alignment needs to be.
- Mal-union: Occurs when the body repairs the fracture with the bones in the wrong position.

- Non-union: A failed healing. This occurs when the body has not been able to build a bridge between broken bone fragments. This usually occurs when the fragments are not close enough together due to poor alignment or when the fracture is infected or blood supply is damaged.
- Reduction of the Fracture: The act of pulling gently at the joint beyond the fracture to reduce the overlap of the broken ends; used when necessary to bring the bone ends into a more normal position when applying a splint
- Luxation: When the bones are not broken but are displaced from the joint, this entails substantial damage to the ligaments that normally stabilize the joint.

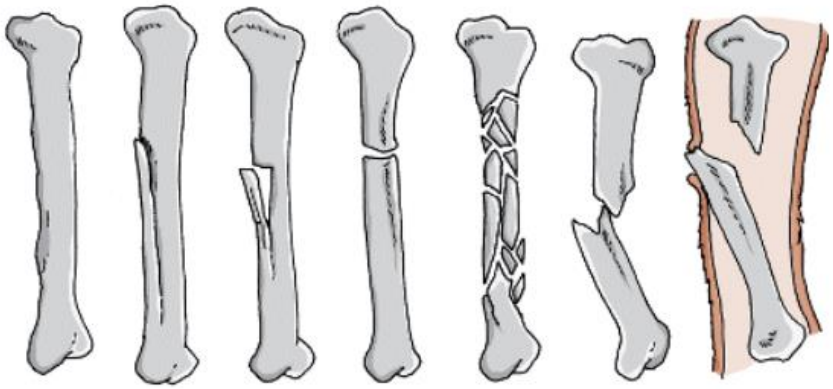
## Fractured Keel

Description: Fracture of the keep or breastbone. Fracture can be compound. Bone may be chipped, dented, cracked vertically or horizontally, or even splayed open.

- Symptoms:
    - Cannot fly
    - Flight limited or labored
- Treatment: Cage rest to restrict movement
- Prognosis: Varies with degree of injury and location
- Identifying Keel Injuries
    - The keel is the anchor for the large breast muscles that control flight. Injuries to the keep can affect these muscles. In cases where muscle attachment has been compromised, the bird may not be able to fly. Birds that have fallen from great distances or have other impact trauma are always candidates for keel injuries. If an animal cannot fly, you should rule out an injury to the keel. Fractures of the keep can sometimes be felt or seen. If you run a finger down the front edge of the keel, you might feel a depression or break in the edge signifying an injury. Lateral X-Rays can be useful in identifying the location and degree of injury. Keel fractures can be compound.
- Treatment
    - Keel injuries require complete cage rest. Make sure enclosures are designed to limit movement. Lower all perches to prevent attempts at flight. Limit activity in area to reduce instances of defensive behaviors utilizing the wings. By limiting wing movement, you will limit the strain on the breast muscle where it attaches to the keel.
    - If the injury is compound, it should be treated with the standard protocol established for that type of wound. If wraps are required, a body wrap will be needed. Be sure to include a wrap above and below at least one wing to present slipping. Monitor wounds in the keep area closely, as wraps and bandages are likely to slip. Antibiotics should be administered if indicated by the type or condition of wound.
    - Cage resting for this condition will vary depending on the type of injury. Three to four weeks often shows improvement. To test, move the animal from its limited movement enclosure to a flight enclosure to test fly. Allow the animal some time to adjust, but if it is not flying, return it immediately to the smaller cage for more time. Test flying can continue weekly until the situation resolves. Animals not flying after a reasonable period must be re-evaluated.

# Types of Bone Fractures

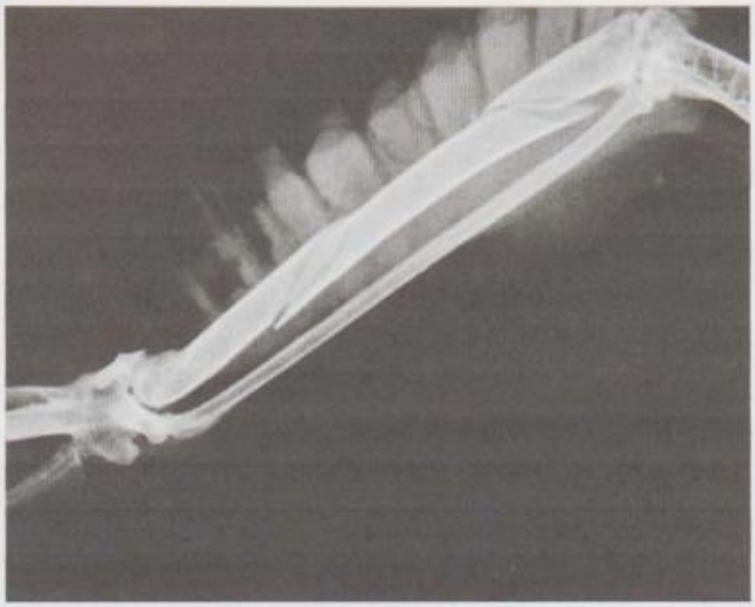
Transverse Linear Nondisplaced Displaced, Compound Spiral Greenstick Comminuted

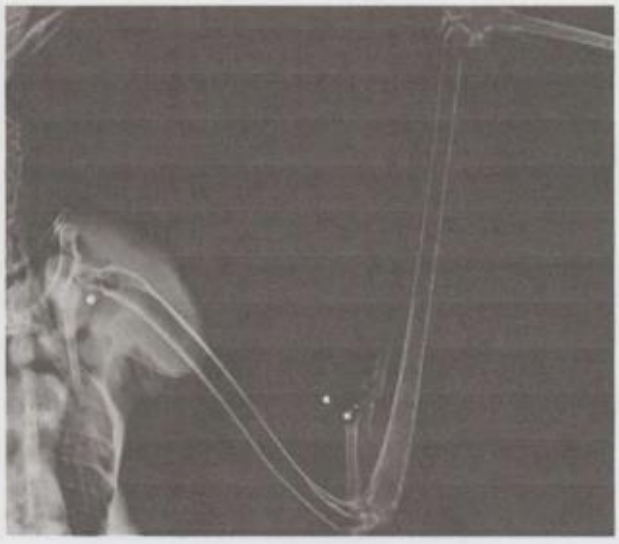


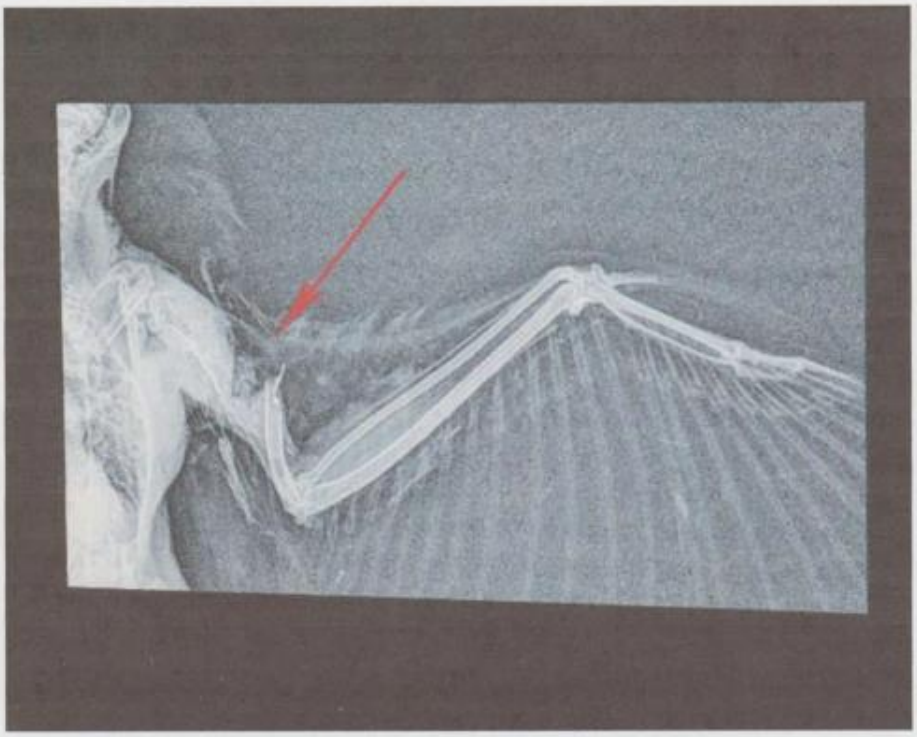
Normal Fissure Incomplete Simple Multiple Complicated Compound

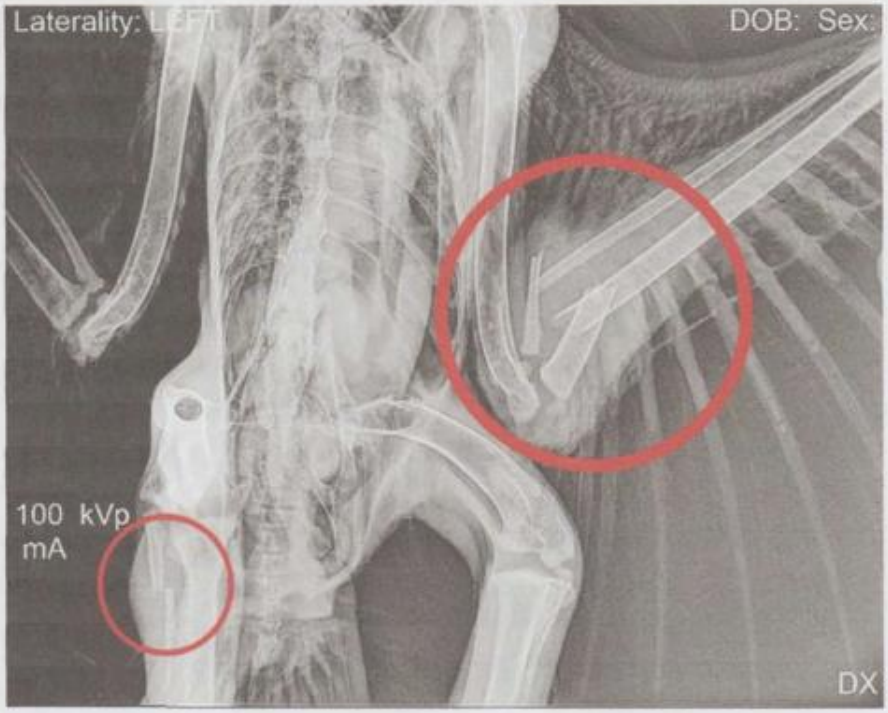

Malunion Nonunion

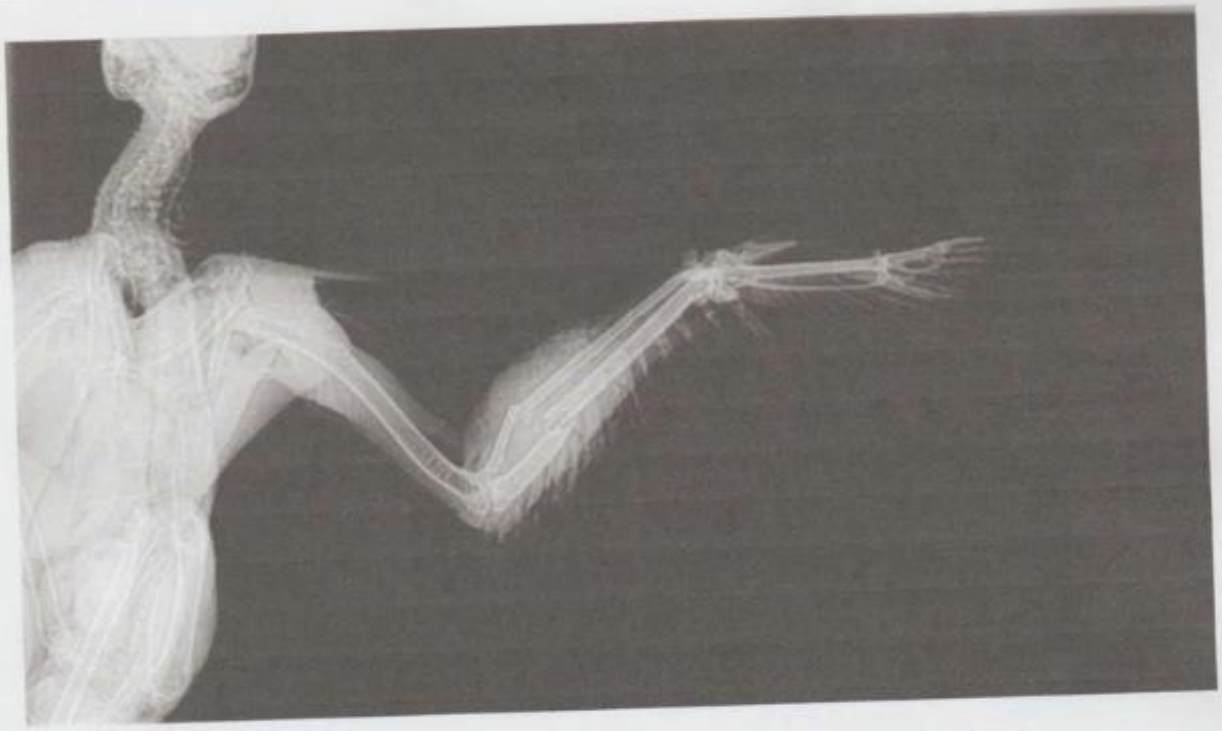
# Name the Bone , Name the Break

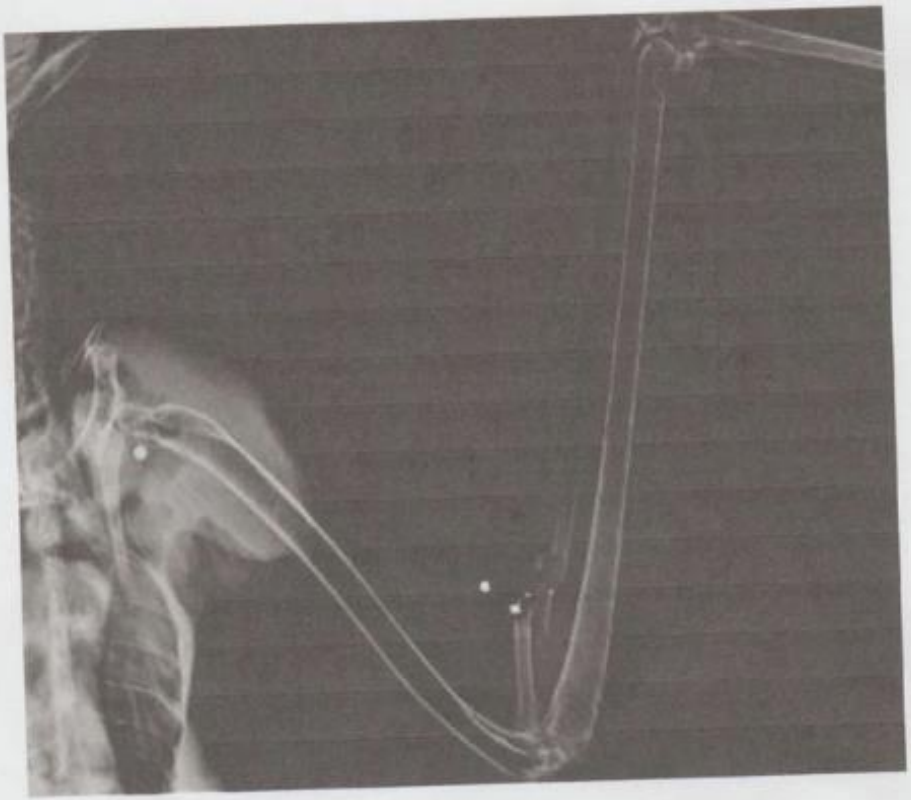


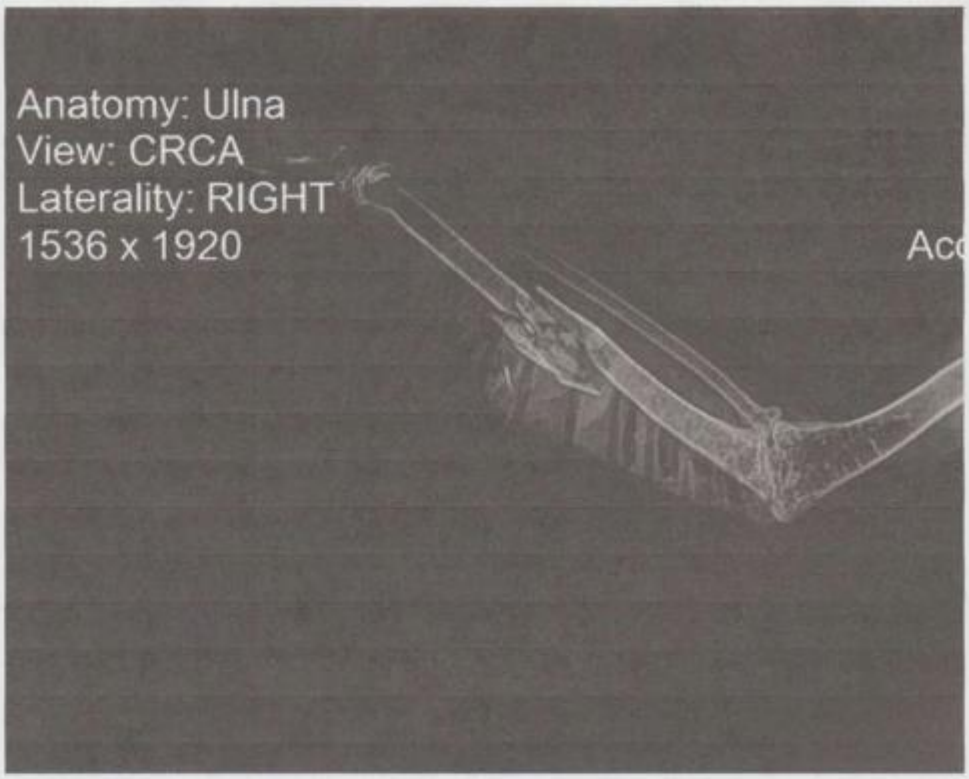


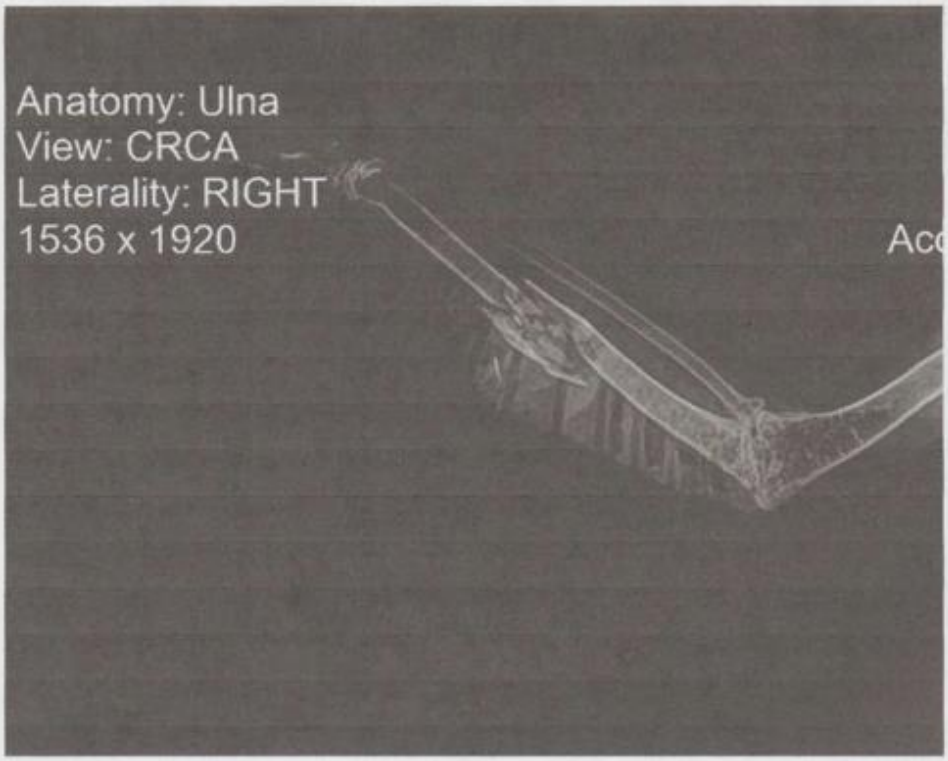



Laterality: LEFT
DOB: Sex:
100 kVp
mA
DX

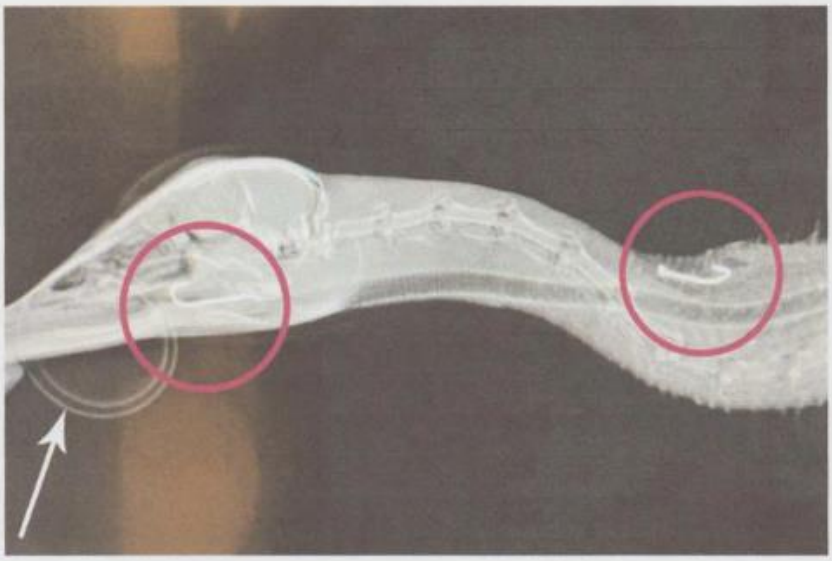


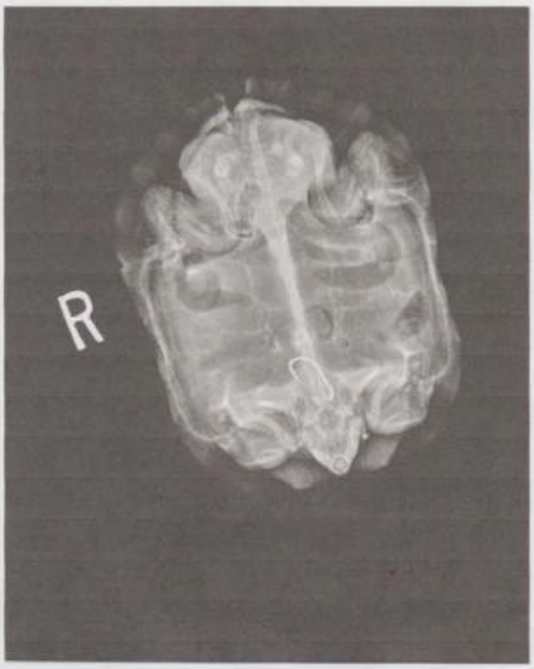



Anatomy: Ulna
View: CRCA
Laterality: RIGHT
1536 x 1920


Anatomy: Ulna
View: CRCA
Laterality: RIGHT
1536 x 1920

# What's That????





## Head Injury

- Symptoms
  - Poor balance or spinning
  - CNS problems
  - Cranial tilt or inversion
  - Head tracking
  - Blind
  - Blood in eyes, ears, mouth
  - Broken beaks
- Treatment
  - Steroid medication
  - Cage rest
  - Provide donut if not standing
  - Hand or force feed if necessary
- Precautions
  - Do not provide open water unless standing correctly

## Spinal Injury

- Symptoms
  - No pain response (toe pinch)
  - Rounded rump or “shrimping”
  - Unable to stand
  - Unable to use feet
  - Unable to mute
- Treatment
  - Steroid medication
  - Cage rest
  - Provide donut if not standing
  - Hand or force feed if necessary
- Precautions
  - Do not provide open water unless standing correctly

## West Nile Virus (WNV)

West Nile Virus (WNV) is a Flavivirus that was introduced to the U.S. in 1999 from Africa. It has slowly but surely made its way across the country, and has now been found in every state in the continental U.S., except Oregon. It is spread by mosquitoes; several species are susceptible, including humans, horses, and many avian species, particularly crows, jays, and raptors.

- Symptoms
  - The symptoms of WNV disease are neurological – birds may show signs of weakness, circling, torticollis (twisting of the head and neck), seizures, etc.
- Treatment
  - There is no specific treatment for WNV. Supportive care is all that can be done at this point.
- Precautions
  - As this is a mosquito-borne virus, environmental control of mosquitoes – i.e. do not allow standing water, spray with safe insecticides, etc. – is a key step in prevention.
  - Vaccination – WNV vaccine is available as an equine preparation at this time. The equine vaccine's efficacy in birds is still being tested, but has been shown to be nonharmful. Collections of birds across the country (zoos, Liberty, etc.) have been vaccinating in the hope that the vaccine will provide at least some immunity for susceptible species.

## Exotic Newcastle Disease (END)

Exotic Newcastle Disease (END) is a viral disease that is highly contagious, and highly virulent, among birds. It is a reportable disease, meaning suspected cases need to be reported to the State Vet who then takes over the case. The virus is quite hardy and can be spread by bird to bird contact or via fomites (inanimate objects), people, mice, etc. that travel/move from infected areas to noninfected areas. Because END is easily spread and has a high mortality rate, eradication of sick or exposed birds with subsequent quarantine in surrounding areas is the 'treatment of choice'.

- Symptoms
  - Clinical signs of END can range from no symptoms (birds can become asymptomatic carriers) to sudden death. The disease can affect the respiratory, gastrointestinal, and/or the nervous systems, with signs including respiratory distress, sneezing, coughing, nasal discharge, diarrhea, depression, nervousness, muscle tremors, drooping wings, twisting of head and neck (torticollis), complete paralysis, swelling of tissues around the eyes and neck, drop in egg production, and sudden death.
  - There is no cure. Some birds can recover on their own.
- Precautions being taken at Liberty include:
- Foot baths at every entrance and in strategic locations around the property
- Physical separations between education and rehab birds
- During high-risk times (i.e. spring 2003 when nearby counties were quarantined) volunteers in contact with birds in other locations must shower and change clothes before entering the facility
- Rodent control

- Restriction on bird intake to native wildlife only – pigeons have been named as a potential carrier species

Unfortunately, despite all our precautions there is a very real risk that if END were to be found within a one-mile radius of Liberty all the birds on the property would be destroyed. If it were to be found in the county, Liberty would go into complete lockdown, with no animals allowed on or off the property.

# Botulism

## What is it?

Avian botulism is a paralytic disease caused by ingestion of a toxin produced by the bacterium Clostridium botulinum. This bacteria is widespread in soil and as with other bacteria needs warm temperature. Most botulism outbreaks take place during the summer and fall when temperatures are high causing the bacteria to grow and multiple. Decomposing vegetation and insects combined with warm temperatures can provide ideal conditions for the botulism bacteria.

## Transmission

Avian botulism is not contagious in that it is not spread from bird to bird. Instead it is spread to birds through their consumptions of insects and maggots infected with the toxin. Waterfowl can develop botulism after eating only a few toxin laden insects. Insects are not affected by the toxin and store it in their body

## Clinical Signs

Botulism is lethal because it causes paralysis. It acts by blocking nerve function leading to respiratory and musculoskeletal paralysis. Birds are unable to use their wings and legs, control the third eyelid, or retain normal muscle function. In the wild birds with paralyzed neck muscles cannot hold their heads up and often drown. Death can also result from respiratory failure, or predation.

## Treatment:

Upon intake infected birds will initially be tubed an oral dose of toxiban followed by warm H20.

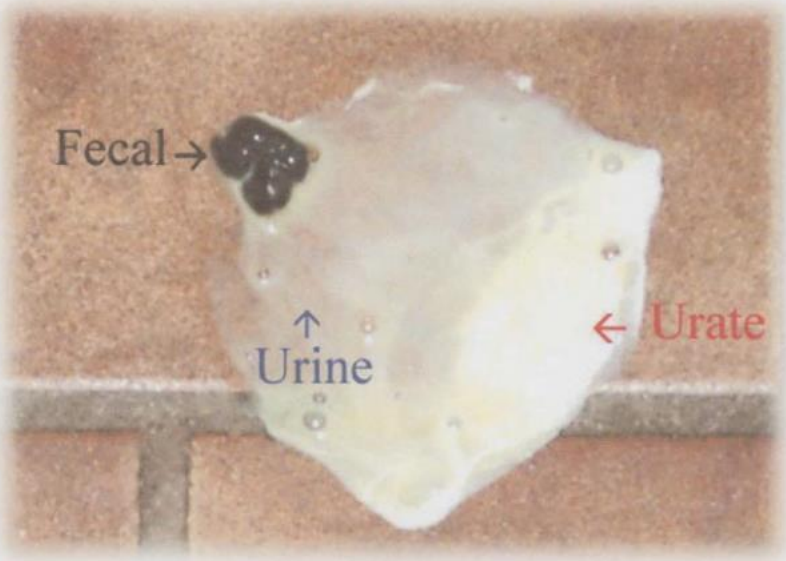
Depending on the severity the bird may need to be tube fed exact several times a day in addition to being tubed H20 several times a day.

Supportive care is the only viable treatment for botulism

# Bird Mutes (Poop)

Birds have a very fast digestive system and what they eat quickly passes through to the fecal. Because of this, mutes are excellent for diagnosing and indicating disease or illness

**Normal Mutes**




There are three parts to mutes

**Fecals (the semi-solid mass, frequently this is colored)** - should have a firmness and shape, but not be hard. When fresh and wet, it should have a consistency like toothpaste.

**Urates (white, chalky material)** - should be bright white and will be thick when wet. When the urates are any color other than clean white, there may be a problem. The urates do often pick up colors from the fecal, but there is a noticeable difference between this and a colored urate. The lack of urate may indicate kidney malfunctions.

**Urine (clear water that flushes the waste from the system)** - is watery and stringy, like a thin mucous. The urine helps flush the uric acid from the system. Some birds such as desert birds are highly efficient and need very little urine to flush their waste. Others have far more urine expelled. Lack of urine may indicate dehydration.

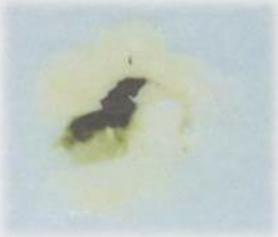
The urine and urate may pick up some color from the fecal. This is not abnormal coloration, but just some fecal distributing into the urate and urine.

## Normal Mutes

Variations in fecal color can be completely normal and will vary depending on factors such as diet and age. For example, if the staple diet is seed, feces will be dark green. Some foods are richer in blood causing the mute to appear black. Almost all fecals have green in them, and this will color the urine to some degree. Regardless of the color all healthy fecal should be firm.

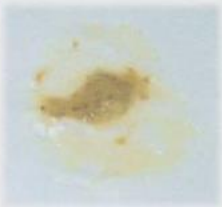
**Empty Mute**
An empty mute - no fecal. The entire GI system may be empty or she may just have an empty cloaca. Likewise this may be normal for the bird or this may be a signal of stress, injury, illness, or hunger.

**Normal Green Mute**
Although green, this is a normal mute. The urates have picked up some color from the fecal mass. The key is the whiteness and evenness of the urate.

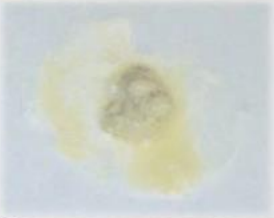


**Well-hydrated**
This type of mute might be mistaken for diarrhea as the fecal is broken up. This is not diarrhea, but rather a very well hydrated bird.

**Over Supplemented**
There is almost a granular texture to the mute and it is yellow or orangey in color. This comes from over supplementing a bird.



**Normal White Mute**
Although the fecal is difficult to see, this is a perfectly normal mute. This mute is the result of a light, fatty meat and a high calcium intake (turkey meat and bones). The system can only absorb so much of the mineral and the rest is passed through in the mute



**Normal Black Mute**
This is a black fecal from feeding a hawk beef heart. This is normal

**Normal Black Mute**
Although this looks very diseased, this happens to be from a healthy owl. In this case the bird had fasted, then gorged on beef heart producing a mute that was all fecal and no urate. Without understanding the context, this could have been mistaken for a very diseased mute.

**Brown Mute - Normal**
This is a normal brown mute caused by feeding rat

## Abnormal Mutes

There are several common colors and signs to beware of when observing bird mutes.

- Increased urates or lack of urine - can signal dehydration
- Red urine – red is never a good sign. internal bleeding most likely from the vent or from the lower GI tract or from the kidneys
- Pink or red urine/urates - kidney bleeding, lower GI tract damage
- Brown or chocolate urates - can mean lead poisoning, but very strong smelling brown mutes may indicate sour crop
- Light green or yellow urates - can mean a liver disease, an empty GI tract, or even starvation
- Black fecal - can indicate internal bleeding in the upper GI
- Neon green mute and frothiness - pancreas is creating too much bile. Can be from genetic disease and proper nutrition will balance it
- Feces light in color, mustard yellow, rusty brown, or containing blood
- Unusually large feces or feces that are coarse-textured, watery, or mushy
- Feces that contain undigested food or have a foul odor
- Urine with any color at all
- Urates that are yellow or green

**Brown Mute - Bad Meat**

This is a brown mute from a Hawk resulting from feeding meat that was slightly bad. The mice were left out in the sun and not properly defrosted. The mice in the bag were noticed to have a definite stench having decomposed slightly in the sun. The bird did test negative for all worms and has had no more such "muddy" mutes after returning to her regular diet. Note how the fecal is not distinct from the urine or urate.

**Brown Mute - Fishy Smelling**

This mute is from an adult female Peregrine who has primarily been eating quail. A fecal float was performed and the bird tested positive for Strongyl

## Under what circumstances could you perform a fecal test?

- Crop not emptying
- Eating but not gaining weight
- Eating and losing weight
- Abnormal color, consistency, or blood in mutes
- Abnormal mutes accompanied by any of the above symptoms
- Thin body condition accompanied by any of the above symptoms

## Avian Parasites

Avian parasites range from single celled protozoans such as Coccidia, Trichomonas, and Giardia to multicellular helminth such as Nematodes (roundworms), Trematodes (flukes), Cestodes (tapeworms), Gapeworms, Hookworms, Whipworms, and Threadworms

## Treatment

Ivomectin is a common anti parasitic used to treat and control worms. Metronidazole is used to treat Coccidia and Giardia. While these two drugs are some of the most commonly used the treatment plan and medication used would depend on the parasitic agent present.

# Fecal Test

A fecal flotation test, otherwise known as a 'fecal float', egg flotation or Fecalyzer Test is a diagnostic test commonly performed in-house in most veterinary clinics as a way of diagnosing parasitism in animals.

1. Remove the blue cylinder from the fecal ova float container. Place the smaller end into the feces to obtain a sample

2. Replace the blue cylinder into the fecal ova float container

3. Fill the fecal ova float container halfway with the fecasol solution

4. Grabbing the top of the blue cylinder, twist back and forth to agitate the fecal sample in the fecasol solution

5. Push down on the top of the blue cylinder to lock in place

6. Add fecasol solution to the top of the blue cylinder creating a meniscus (curved upper surface of a liquid)

7. Gently place a microscope cover slip over the top of the blue cylinder. There should be no air bubbles between the cover slip and fecasol solution.

8. Wait 10 minutes to allow the eggs (oocysts) to float to the top and adhere to the microscope cover slip

9. Carefully remove the cover slip and lower it at an angle over a microscope slide with the sample sandwiched between both pieces of glass.

10. Examine the specimen using the lowest power on your microscope

**Supplies Needed:**

- Microscope with a movable stage, (eyepiece 10x) setting range 4x, 10x, 40x, 100x.
- Glass slides and coverslips
- Fecalyzer test vials
- Sodium Solution (i.e. Fecasol)

**TIPS:**

- Used to look for internal parasites such as roundworms, strongyles and coccidia oocysts.
- A fecal float will not identify bacteria or yeasts
- Examine under the low power of a microscope.
- Worm eggs are seen under the 4x power, and coccidia (for the untrained eye) are best seen at 10x power.
- Coccidian will look similar to pollen and plant material.

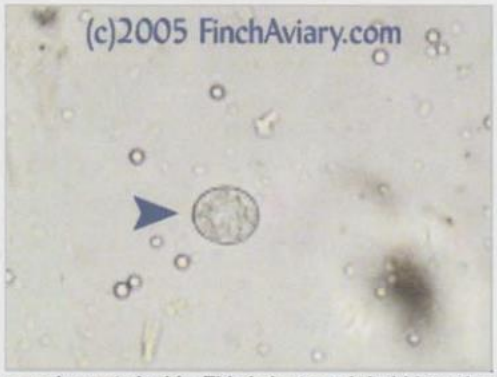
## Microscope settings and slide reading

**(10x)**
Faster to read, less detail and light needed
Scan for platelet clumps, staining, large abnormal cells

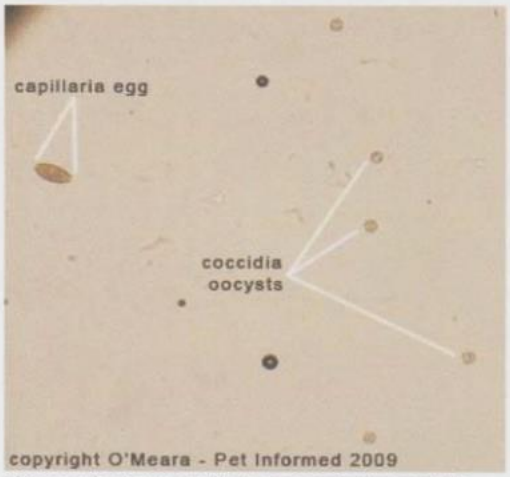
**(40x)**
to examine object more closely
Field of view is decreased, need more light

**(100x)**
Need lots of light, small field of view
Used to see bacteria, yeasts, spores, and cell details

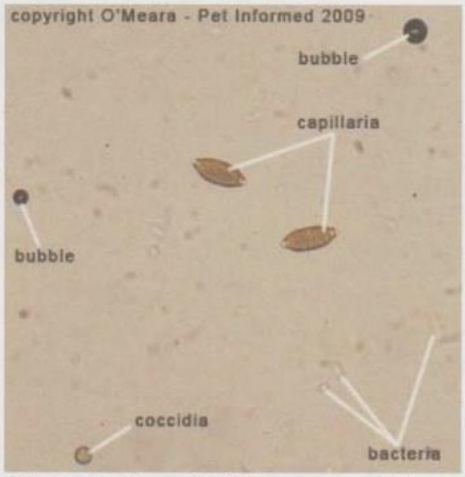
**SLIDE SAMPLES:**




**Note the solid black rim is pretty much empty inside. This is just an air bubble and many first-timers confuse air-bubbles with parasite eggs.**




**This sample shows Capillaria eggs and avian coccidia**




**This sample shows Capillaria eggs. coccidia, normal Bacteria, and air bubbles**

# Subcutaneous (SQ) Emphysema

**What is it?**

- Subcutaneous emphysema is seen in birds with ruptured air sacs or with fractures of the humerus, thoracic girdle or of some ribs.
- Typically caused by air sac rupture due to trauma but may also be caused by a pre-existing air sac infection.
- It is very common in small birds or any species of baby that has fallen from the nest
- The air filled swellings are typically found in the dorsal cervical region and the flanks .
- Upon careful palpation of the area crepitation may or may not be present. Crepitation or Crepitus describes the grating, crackling or popping sounds and sensations experienced under the skin and joints due to the presence of air in the subcutaneous tissue.

**Treatment**

- Treatment involves the drainage of the air filled sac with a sterile needle. Needle aspiration empties the swelling but this may rapidly or slowly refill again with air. Therefore this process may need to be repeated daily or several times a day till resolved.
- The choice of drainage opening depends on the size of the bird, the size of the swelling, and the refill status.
- A green med card should be made indicating the area be checked and if necessary emptied daily

**Note:** Do not give SQ fluids to a bird with SQ Subcutaneous emphysema as this may cause the animal to drown.

# Stress Bars

**What is it?**
Lines found going across a bird's feather shaft

**Cause**
Stress bars form while the feather is developing. The majority are caused by either stress in a bird's environment or poor nutrition. Since stress bars form as the feathers develop, they can serve as a record of stress that the bird was going through during the last molt.

**Prevention**
Evaluate the bird's diet and living situation. Correcting the problem will cause the stress bars to subside with subsequent molts.

# Angel Wings

Angel Wing is a disease that primarily affects waterfowl such as swans, geese, and ducks.

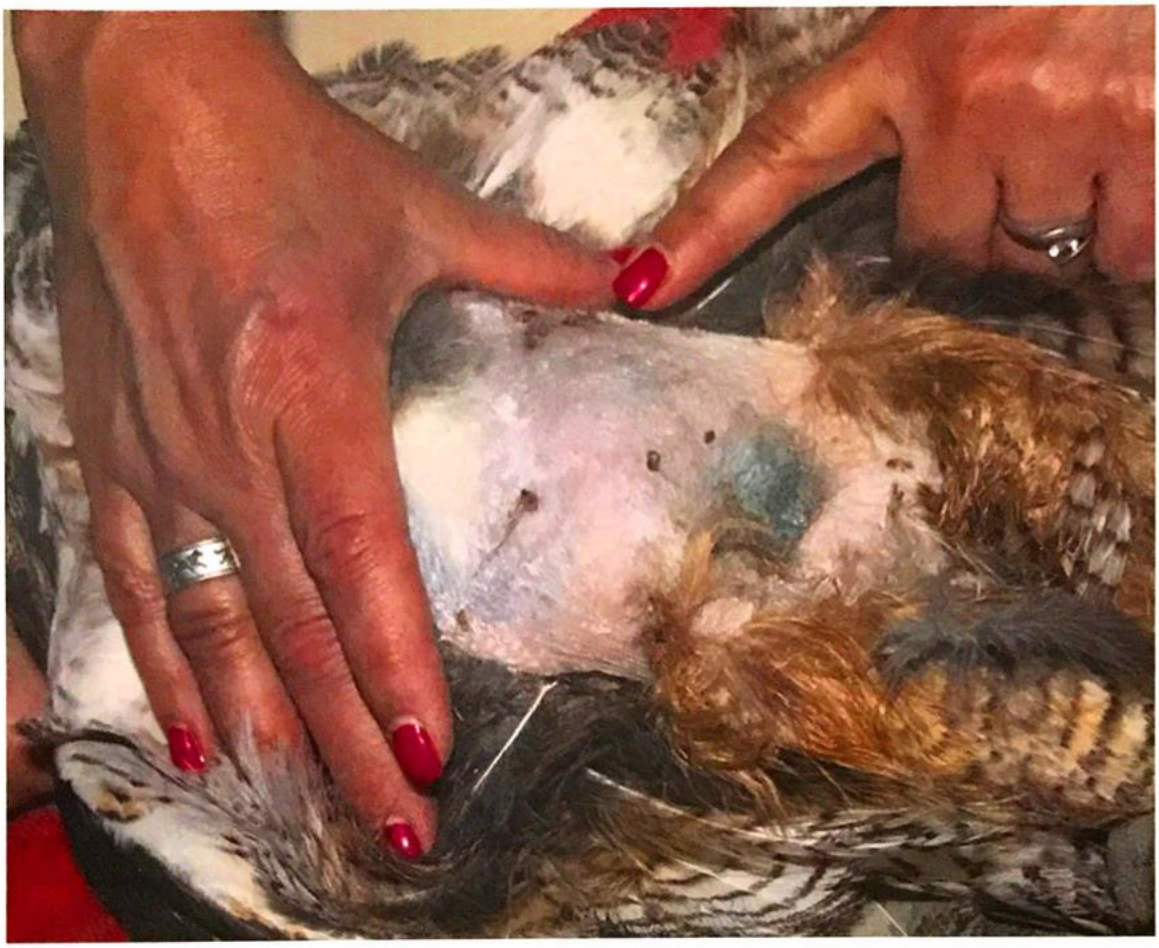
**Symptoms:**
The deformed wing developed during growth, resulting in one or both wings sticking out from the body leaving the bird unable to fly.

**Cause:**
Angel wing is an incurable anatomical condition which is acquired in young birds due to a high-calorie diet, especially one high in carbohydrates and proteins, and/or low in vitamin D, vitamin E and manganese. Angel wing is frequently observed in waterfowl living near humans, and the disease can often be observed in areas where geese or ducks are excessively fed bread (especially white bread).

**Possible Treatments :**
In adult wild birds the disease is incurable

In young birds wrapping the wing and binding it against the bird's flank for a few days, together with feeding the bird a more natural diet, may reverse the damage.

# GHO with brood patch and puncture wounds



# Turtle and Tortoise Medical Care

Barring visible life-threatening injuries, all turtles and tortoises must be evaluated for dehydration upon intake.

## Dehydration

The main methods for determining dehydration if the simple method of comparative weight: does it feel heavy like a bag of sand or have some heft to it? If not, it is probably dehydrated. If you are not sure or it's the summertime, err on the side of caution and treat as if dehydrated.

Other signs of dehydration can be:

- Sunken or teary eyes
- Reduced, thickened, or whitish urine,
- Dry feces
- Dry, flaky, loose skin
- Loss of appetite
- Lethargy, depression, lack of activity
- Thick ropey mouth mucus

**Note**: Very young and sick turtles will need to be soaked every other day regardless of their hydration status.

## Hydrating a tortoise

The easiest way to hydrate is a forced soak. Place the patient in an escape-proof tub big enough for it to walk around some. Fill with warm water to about half way up the shell. Soak for 15-30 minutes.

Soaking tortoises often urinate or defecate while soaking so don't be alarmed as this is normal.

# Shell Fractures in Turtles

Shell injury is one of the most common presenting problems encountered in turtles. These injuries arise mostly from road traffic accidents or predator attacks. Occasionally, pet turtles endure shell fractures after falls, as they're avid climbers or after being dropped or stepped on.

Shell; injured turtles can be very difficult and time-consuming to repair and manage. The length of time in care that's required for sufficient healing can be upwards of 1-2 years.

One of the biggest problems with managing shell wounds in semi-aquatic turtles is wound care—specifically maintaining the turtle out of its usual water environment. This is due to the fact that aquatic turtles generally require immersion in water to wat and drink.

## Anatomy

In order to properly treat turtles with shell fractures it is important to have at least a rudimentary understanding of their anatomy. While differences in size and shape occur across the species the basic anatomical arrangement of the shell remains the same. The top part of the shell is called the carapace and the bottom is called the plastron. These two sections are joined on either side by components referred to as bridges.

The shell itself is comprised of at least 50-60 bones from assorted locations such as modified front and rear leg bones, vertebrae, and rib bones. The turtle's vertebral column is incorporated into the carapace. Further support of the shell is achieved by the fusing of both the pectoral and pelvic girdles to both the carapace and the plastron. The outer layer of the shell is composed if a layer of keratin arranged in a distinct pattern of scutes. The scute pattern is particular for a species and does not correspond to the underlying bones. This arrangement provides additional strength to the shell. Because the individual scutes can be names and numbered it allows any shell injury to be anatomically described with respect to the location and severity.

The main goals to consider in turtle shell repair and management are:

## Begin stabilizing the injured turtle at first encounter

Weight the turtle, give fluids, warmth, antibiotics, and clean any wounds. Some parts of the shell can be difficult to stop bleeding. Protect open wounds and stabilize mobile shell areas. NEVER CUT BROKEN PIECES OF SHELL OFF.

Turtles suffering a recent shell fracture are likely to be in a state of shock. In general animals suffering from shock have low blood pressure and can develop poor provision of oxygen too. As such, they can benefit from fluid therapy as can those animals.

In injuries are confined to the upper carapace only, and there is no evidence of head trauma, the turtle can be placed into a shallow amount of warm water for 10-20 minutes. This may give the turtle sufficient time to drink. The depth of the water should not reach wound areas. This may be useful in cases where the turtle is only mildly dehydrated. Turtles placed into water should be observed closely. It is vital to ensure that there is no evidence of head or neurological dysfunction present as affected animals may drown if they're unable to lift their heads from their water bath.

## Assess the degree of injury present

Assess for life threatening injuries. Look for any obvious injuries that would preclude it being treated. Examples would include head trauma, large shell deficits, loss of eyes, loss of multiple limbs, compound limb fractures, evisceration, inability to retract the head, paralysis of the hind legs indicating spinal trauma, etc.

## Plan a method of stabilizing fractured shell parts

The most painful part of any fracture in any animal is when fragments are unstable. This applies just as much to shell fractures as it does to broken limbs. Unstable fragments will also not heal. Because of this it is beneficial to try to prevent as much movement of fractured shell fragments as possible. This can be achieved by using adhesive tapes and light bandages such as VetWrap. These can be easily removed if necessary to allow cleaning of wounds and more permanent shell stabilization to be performed when required.

Moving any fractured shell segments can cause a great deal of discomfort to the conscious turtle and can also risk further injury. It is always important to consider the use of pain meds in these cases.

In any repair process, one of the main aims is to achieve stabilization of the shell fragments. Any movement between shell segments may lead to a significant delay in the healing process and in severe cases may lead to no healing at all. There does not have to be a complete reduction or close union of the broken shell fragments (though this would be more ideal and may help to reduce the required healing time). Union of bony fragments can take as long as 6 to 30 months. Spaces left between fractures shell pieces (if pleurocoelomic membrane is intact and remains viable) should granulate, epithelialize, and eventually ossify given the appropriate care.

## Start antibiotic therapy

Injectable Baytril is the antibiotic typically used. This is given once a day, every other day, and is injected alternatively in the front legs only. Why the front legs? Because of the renal-portion system that turtles and tortoises possess. This means that any medications injected in the back area will be absorbed and go directly through the kidneys before entering the general circulation, potentially causing kidney damage. In addition, the drugs may be excreted by the kidneys without ever being absorbed effectively into the body. Therefore, never give injections in the back area and back legs.

**Note**: Medicating turtles and torts is not an easy task. Even a sick turtle will pull his head and limbs into the shell making it impossible to administer any needed medication. Additionally, most turtles will attempt to hide.

## Treat the wounds

Shell fractures should be treated as open, contaminated wounds. As such they should thoroughly cleaned and free from any debris and infection before any attempt to stabilize or close the fracture is made. Wounds can be flushed with warm saline, ).05% chlorhexidine or 0.1% povidone iodine 1 to 3 times a day depending on the level of contamination. Ensure that contaminants are not being flushed into the body cavity. Between flushings the use of wet-to-dry bandages can be used to remove further contaminants. These can be as simple gauze swabs soaked in saline or chlorhexidine, applied to the wounds and bandaged in place. Other products that can be used include Flamazine cream, Solusite Gel, and Manuka honey.

Any surface material should be gently removed using cotton tips or a soft toothbrush. It is not necessary to clean the entire shell but it will reduce the potential level of contamination of the wounds during treatment. It is also not necessary to remove all the Algal growth off the shell that some turtles have. It should however be removed from near the fracture sites and anywhere else deemed necessary.

Wound care may initially be needed each day. Wounds to the shell may require debridement of dirt and dead tissue as this will slow healing. Shell fractures can be scraped clean using hypodermic needles, scalpel blades, hand dental curettes or even high-speed dental drills. Shell edges should be debrided to the point of achieving capillary bleeding as this indicates viable tissue. Depressed fragments should be lifted back into place. If this is not possible then the overlapping shell fragment should be cut back to the level of the underlying fragment's edge. This will allow healing to occur between two fresh edges. Missing areas of shell can be covered with waterproof dressing such as Opsite and Tegaderm.

## Continue supportive care on a daily basis

Provide warmth within the turtle's preferred body temperature range by means of heat mats, lamps, globes, etc. Many of these turtles will require a period out of water. Placing turtles with shell fractures into full immersion in water is not recommended as this may increase the risk of infection as the fracture sites or risk inadvertent leakage of water through a compromised membrane.

### Some important points to remember

There does not need to be a complete reduction of broken fragments for it heal but the closer the fragments the better shell fragments can take up to 30 months to fully heal. Spaces left between fragments will heal via ossification of the coelomic membrane. Most shell fractures should be treated as open wounds.

## Rehabilitation and release

During the rehabilitation of a turtle it is important to keep good records. Specifically, body weight, activity levels, feeding behavior and any other observations should be recorded. Everything tends to happen slowly with turtles and so changes for the worse can happen over a period of weeks and can easily missed.

Turtles must be provided with adequate warmth and the ability to carry out thermoregulation. This can be achieved by creating a thermal gradient in their enclosure by using a basking lamp or heat mat placed at one end. Additionally, species that require UV light should have access to this whether it is provided by artificial light or the sun.

## Determining when it is safe to allow a turtle to go

Back in the water may not be an easy thing and is based on experience and the presence of adequate healing over the fractured areas.

Dry docking comes with some problems. Turtles need to be in water to drink and feed. Dry docked animals also run the risk of developing plastral pressure sores and so should be housed on soft bedding such as shredded newspaper.

## Dry-docking aquatic species

It is often necessary to keep turtles with fractured shells out of water (dry-docked) while the initial stages of shell healing progresses. This may take as little as 2 weeks for very minor injuries or as long as 1 to 2 years for very complicated fractures. Additionally, any turtle undergoing injury repair should not be allowed to enter hibernation. The “safe” time to return a turtle to full water immersion may not always be easy to determine. Typically, though, it may be signaled by the presence of sufficient epithelialization over the fracture/wound area.

It is clear that a turtle kept dry-docked must be provided with means other than water immersion and routine feeding to effectively nourish and hydrate the animal (freshwater generally need to be in water to feed, drink, etc.). Similarly, turtles should be provided with adequate warmth and the ability to carry out appropriate thermoregulation. Species that require UV light access should also have this provided. Dry-docked animals should also be provided with a substrate that minimizes the development of plastral pressure lesions. This is perhaps more readily averted by providing them with shredded or crumpled newspaper or newspaper sheets placed over towels as a substrate. These materials can aid in dispersing the weight-bearing load on the plastron as still act as an effective dry absorptive material for excreta.

Regardless of how the turtle is housed, all animals should be kept under quarantine throughout their length of time in care.

## There are a range of levels of dry-docking that can be undertaken

**Level 1** – **Dry-docking with intermittent periods of full water immersion**

Some fracture sites may be small enough or accessible enough so that the area can be effectively covered and water-proofed with appropriate dressings, using adhesive dressings such as Opsite Flexigrid or Opsite Incise (Smith and Mephew). This may allow a turtle sufficient time (say 30-60 minutes) each day to be immersed in water to feed, drink, excrete, etc.

**Level 2 – Dry docking with intermittent periods of partial water immersion**

Turtles with fractures confined to the carapace may offer a managerial advantage. These individuals can usually be immersed in shallow water (not reaching the injured areas) for a short period each day to allow them to feed, excrete, etc. It is important to ensure that turtles in this situation do not climb and potentially flip over onto their wound side.

**Level 3 – Dry-docking continuously**

Turtles with fractures of the plastron or bridge, or those who have injuries that cannot be made waterproof, may need periods of continual dry docking. This may also apply to turtles that have sustained head injured. These individuals need to have their nutrition provided by means alternative to the normal method of placing the animal in water. If the dry-docking period is suspected to take only a short period of time (say 2-4 weeks) then depending on the animal's dry condition, feeding not essential. Maintaining hydration, is always essential. Fluids can be delivered parentally as stated above.

Turtles that are continually dry-docked will pass feces/urine onto enclosure substrate. There is no need to immerse then into water for them to be able to excrete (even though this may stimulate excretion). However, careful attention should be paid to the cleaning of smeared excrement from the plastron and feet to void secondary infections to these areas. If feeding is necessary (turtle in poor body condition, or needs to be kept dry-docked for longer periods of time, etc.), then turtles can be assist-fed by passing a gastric tube from the oral route. Alternatively, a turtle can be fitted with a feeding tube and placed under general anesthesia. This can make the process of feeding, hydrating, and medicating much simpler and ultimately less invasive for the turtle.

An alternative approach is to provide the dry-docked turtle with a specially designed "sunken" water source that only the turtle's head and neck can access (this is not the same as providing a turtle with a water bowl sitting on the floor of an enclosure – which would be inadequate). This method has been accomplished and developed by turtle enthusiast Michal Frith and reptile veterinarian Dr. Robert Johnson.

Main aims of shell repair process

- Providing the injured turtle with the ability to return to sufficient function for survival in the wild (or for pet turtles, their captive environment)
- Providing adequate nutritional, hydrating, and medical supportive care measured during their time in care
- Minimizing risk of infection of any healing wounds
- Stabilizing any mobile shell fragments and protect any open wounds
- Carry out regular wound care in support of wound decontamination, granulation, and epithelialization

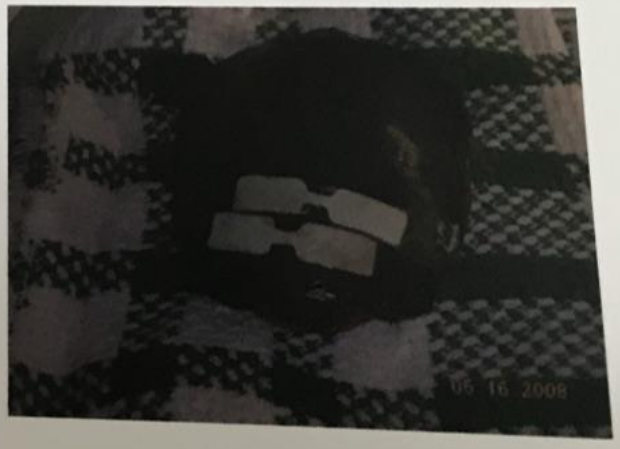
**Shell Repair**

**NO!!!!!**

**YES!!!!!**

**Shell fracture stabilization**

- Use white medical tape across fracture site to pull in
- Use super glue on ends of tape only
- Apply waterproof dressing such as Tegaderm or Opsite

# Section Nine Wound Management

## Avian Wound Care Lab

- Look for the following conditions on your specimen:
    - Abrasion
    - Laceration
    - Puncture
    - Sucking wound
    - Degloving wound
    - Compound fracture
- Add a wound dressing to the following wraps
    - Wing wraps
        - Wrist
        - Radius/Ulna
    - Wing and body wraps
        - Humerus
        - Shoulder
    - Leg wraps
        - Toes/talons
        - Tarsometatarsus
    - Leg and body wraps
        - Tibiotarsus
        - Femur

# Medical Services Practice Worksheet

Section Nine: Wound Management

1. Wounds are sites where the continuity of the body's structure has been injured by physical means. Name and describe five types of wounds.
    a.
    b.
    c.
    d.
    e.
2. The healing process is the same for all types of wounds. True or False?
3. Healing can be affected by age. True or False?
4. Healing by second intention allows the body to heal itself after tissue loss. Healing by second intention can be aided by the application of dressings, ointments, and antibiotics. True or False?
5. Which of the following products can be used on wounds inside the body?
    a. Chlorohexaderm
    b. Tap water
    c. Betadine scrub
    d. Betadine solution
    e. Normal saline (0.9 Sodium Chloride)
    f. Wound powder
    g. Fura-septin ointment
    h. Sulfatrim
    i. Cefa drops
6. Describe the five steps to wound care. (Use the back of this page.)
7. How do you make sure that the plans you have made for the care management of an animal will be completed as you planned?
8. How would you treat the following conditions?
    a. Degloving wounds to the head
    b. Electric shock injuries
    c. Compound fractures leg/wing
    d. Torn crops
    e. Cat attacks
9. What is canker and how is it treated?
10. What do you use to treat pox?
11. How can you reduce the chance of bumblefoot?
12. You have now completed Section Nine on wounds. What was the most interesting part of this section for you?