Key points:

- Canine parvovirus ("Parvo") and Feline panleukopenia (“Panleuk”)
- Canine distemper
- Ehrlichiosis
- Transmissible Venereal Tumor (TVT)
- Heartworm disease
- Heatstroke
- Mange
- Coccidioidomycosis (“Valley Fever”)
- Rattlesnake envenomation

Canine parvovirus ("Parvo") and Feline panleukopenia (“Panleuk”):

Canine parvovirus ("Parvo") and feline panleukopenia infections are extremely common viral diseases encountered in any setting with feral dogs and cats, Both are parvoviral infections and carry high mortality, and both have effective vaccines commercially available. Canine parvovirus is specific to dogs, and humans cats cannot acquire the infection. Respectively, feline panleukopenia is specific to cats, and neither humans nor dogs can acquire the infection. Treatment consists of supportive care, but even with aggressive inpatient treatment in a hospital setting, a mortality rate of 20% or higher may occur in dogs, and up to 50% in cats.

Considering that stray dog and cat populations are relatively fixed at carrying capacity, parvoviral infections are probably the largest cause of canine mortality and constant population turnover. Parvoviral infections ultimately cause more dogs to die in any multi-year span than any other cause, and vaccine programs to limit the disease will ultimately lead to longer, better lives with overall reduction in any timespan of the total numbers of deaths (of affected individual as well as their replacements in each subsequent generation). Reducing parvo deaths leads to high numbers of adult animals competing for the same food resources, and this competition applies the

negative pressure towards young females becoming pregnant as they have to compete with other adult, healthy animals. In the end, it is harder for a female dog or cat to compete with other healthy adults for food than it is to compete with sick, dying puppies, and parvo is thus a major part of the dynamics of dog and cat populations.

Parvoviruses tend to cause vomiting, severe and frequent bloody diarrhea, severe lethargy, but can manifest as simple mild lethargy and eating less than normal. Parvoviruses attack the gastrointestinal tract and can cause sloughing of the intestinal mucosa, but also affect bone marrow and cause severe immunosuppression which can lead to death via secondary infections. Parvovirus infections tend to be very acute and severe, and most animals either make a full recovery or die within the first week. If a dog or cat survives, they are immune for life, but combination vaccines should still be administered since any animal infected with parvovirus likely also lacks immunity against other pathogens such as distemper.

Parvovirus is easily diagnosed in the field using a tableside test, but a negative test is common in affected animals several days after exposure (the test picks up shed viral particles, and many animals stop shedding during the late stages when they are extremely sick). If parvo is strongly suspected despite a negative antigen test, a blood smear (or CBC) can be done to evaluate the white blood cell (WBC) count. If the WBC count is severely low or even approaching zero (i.e. virtually on WBC's can be found on a slide), parvovirus is highly likely. In the latter case, whether or not parvo is the underlying infection may be a semi-moot point since a clinically ill young dog or cat with an extremely low WBC count would need medical treatment anyways.

Because parvo is a virus, there is no medication that will kill or eliminate the virus. Treatment consists of supportive care to try and rehydrate affected dogs, prevent secondary bacterial infections, control vomiting, and provide pain management and nutritional support.

The first priority is to rehydrate affected dogs and keep them adequately but not overhydrated. Most dogs that present with parvo are already significantly dehydrated because of the vomiting, diarrhea, and anorexia caused by the disease. Dehydration is a frequent killer and worsens all of the other symptoms of parvo. Additionally, dehydration makes affected dogs feel terrible. Because dogs with parvo will not drink water voluntarily and usually cannot keep water down without vomiting, the ideal way to provide hydration is through an IV catheter. To fully rehydrate most dogs requires a minimum of 24 hours, since giving larger amounts of IV fluids too quickly can cause major issues with fluid overload, causing fluid to build up in the lungs and other body tissues.

Giving fluids through an IV catheter does require the dog to stay in the clinic during this time. If this is not an option, in less severe cases it may be possible to give once or twice a day injections of smaller volumes of subcutaneous fluids on an outpatient basis.

The next major priority with parvo cases is to try and stop the ongoing vomiting that occurs. This frequently requires the use of several different anti-vomiting medications, and even with a series of different drugs the vomiting often continues. True

antidiarrheal medications are not frequently used nor effective in parvo cases. Diarrhea with parvo may take several days or even longer to fully clear.

The next priority with parvo cases involves the use of antibiotics. These medications do nothing for the virus but are used to try and treat and prevent secondary bacterial infections. This is especially important with parvo because of the immune system suppression that occurs with the frequently very low white blood cell count.

Pain management is important with parvo cases. Dogs with parvo frequently have intense intestinal and abdominal pain secondary to the inflammation and sloughing of the intestinal lining. Pain management involves the use of narcotic medications since anti-inflammatories can contribute to the GI ulceration already present.

It is important to note that all of the previously mentioned medications are usually started as injections in most cases, since dogs with parvo will vomit up oral drugs, including the anti-vomiting themselves. If the vomiting can be stopped, oral medications can then be used subsequently.

The final major priority with parvo cases is nutritional support. Ideally, we try to get dogs eating as soon as possible, starting with small amounts of a bland diet periodically. If this is not possible, the use of feeding tubes that bypass the need for oral feeding are sometimes used if the vomiting has stopped.

There are various over-the- counter and online products marketed to treat parvo or improve the success rates of treatment, but none of these products have ever been shown to be effective, and some actually can contribute to problems due to high alcohol content.

Canine distemper:

Like canine parvovirus, canine distemper is a preventable viral infection of dogs that can cause high mortality (many literature sources estimate up to 50% mortality, but personal experience treating 100+ canine distemper cases after Hurricane Harvey suggests a mortality rate closer to 20%). Humans and domestic cats cannot get distemper, although African lions (or cheetahs) can be infected and the consequence is severe mortality in wild populations.

Unlike parvo, canine distemper does not last in the environment for long periods, and must be directly transmitted (airborne) between dogs. The lack of persistence in the physical outside environment conveys a significant advantage over parvo, since it allows a vaccine program in a small area to actually get close to disease elimination not only for current young dogs but also immediate future generations. The end result of this is that intense, broad spectrum vaccine programs can heavily reduce distemper in a small area if virtually all dogs are vaccinated and there is no dormant viral infection lurking in the environment for future litters of dogs.

The lack of environmental persistence of distemper is good, but distemper has several negative traits as compared to parvo. Unlike parvo, distemper does not resolve quickly, and infection and shedding can persist for months. Additionally, affected dogs that recover can have permanent, severe neurological defects for life. A very common site in any Third World setting are dogs with obvious tics and tremors that are permanent from previous distemper infection.

Clinical signs in infected animals are primarily respiratory and neurologic, but gastrointestinal signs do occur. The most obvious respiratory sign is bilateral greenish-yellow eye discharge, as well as coughing, anorexia, and lethargy. Neurologic signs include tics and tremors and can progress to grand mal seizures that are frequently not responsive to anti-seizure medications.

Unlike parvovirus, no reliable tableside test exists for canine distemper, and PCR testing of urine or of ocular, nasal, and oral/pharyngeal swabs must be performed by outside labs.

Treatment of distemper, as with parvo, does not use antiviral medications but involves supportive care. Antibiotics are needed in cases of secondary bacterial pneumonia, and anti-seizure medications can be tried for neurologic cases but frequently have no effect. In anorexic dogs or those with gastrointestinal signs, subcutaneous fluids (or IV if possible) and anti-vomiting medications are also warranted.

In the field setting, if distemper is suspected (eg. a young dog with bilateral eye discharge, or any young dog with neurologic signs), it should be explained to the owner that their dog likely has distemper and should be isolated from any other dog that is not fully vaccinated. Ideally, this isolation should be for several months unless the owner is able and willing to submit distemper PCR tests weekly until two sequential negative tests are obtained.

Ehrlichiosis (“Tick Fever”):

Ehrlichiosis is an infectious disease caused by an intracellular blood parasite (Ehrlichia canis) that is transmitted from dog to dog by ticks and other insects. It is endemic in many areas, as are other similar blood parasites (eg. Anaplasma and other Ehrlichia species).

Infection may be acute and self limiting, or may be chronic and debilitating. Despite the name, no fever exists in most cases. Clinical signs can include (but are not limited to) anemia (low red blood cell count), thrombocytopenia (low platelets), bleeding disorders, weight loss, glomerulonephritis (kidney disease), meningitis, polyarthritis (pain in multiple joints), and general unthriftiness. Because dogs are not routinely screened for Ehrichiolosis nor treated prior to surgical field clinics, surgeons can expect more bleeding than they would during elective surgeries in private practice.

Screening for Ehrlichiosis in private practice typically involves antibody testing (4DX), but this does not discriminate between previous vs current infection. Resolved cases can maintain antibodies for life, thus causing "false positive" test results that require PCR testing to support a diagnosis of active infection, but the PCR test can also remain positive for years despite clinical resolution.

For field settings, this is problematic from a diagnostic standpoint since in some areas virtually every dog will be infected at some point in their life and virtually every adult dog will therefore test positive on the tableside screening test (4DX). Further PCR testing is expensive, takes several days to get the results, and is not fully confirmatory. Additionally, since the tableside test detects antibodies, dogs infected acutely may test negative for the first several weeks despite clinical illness. Given the above testing issues and the ubiquity of Ehrlichia amongst reservation dogs, most mobile surgical clinics do not routinely screen for Ehrlichia but look for clinical signs and treat based on the assumption that it is better to treat than to not treat. Treatment is with doxycycline 5-10mg/kg PO BID for 21-28 days.

This may seem like a misuse of antibiotics in an era of increasing antibiotic resistance, and it is up to the practitioner to decide whether treatment is warranted. Unlike staphylococcus and other bacteria that have developed antibiotic resistance, Ehrlichia do not appear resistant per se to doxycycline, although chronic cases frequently do not respond to the medication and thus carry a guarded to poor prognosis.

Considering that up to 99% of dogs in endemic areas test positive (90), a cheap and more practical approach to preemptively address surgical bleeding complications may be to use ACT tubes to check coagulation times prior to each surgery, effectively free and immediate. Yunnan baiyao has been suggested as a preemptive means to address coagulopathy, but its use is not recommended based on multiple studies demonstrating no efficacy (91, 92). Further, practitioners may wish to reconsider using a “proprietary” product whose ingredients are not divulged and whose manufacturer openly uses endangered species parts in its products (93, 94). Specifically, scales from pangolins are used, contributing to “devastation” of the species (93).

Finally, because Ehrlichia is so common on many native reservations, field clinics frequently make an effort to treat all animals with flea and tick medications, whether topical or oral. Tick collars that last 6-8 months are also frequently used but cost can be prohibitive.

Transmissible Venereal Tumor (TVT):

TVT is a contagious tumor in dogs and wild dog species (coyotes, wolves, foxes, etc.). It is most commonly found in regions with large free-roaming dog populations, and as such is endemic throughout Latin America, Africa, Asia, and on reservations in the United States.

Cancer cells are physically transferred from one dog to another via direct contact, typically during sexual intercourse but can also be transmitted by licking and biting. Lesions usually occur in the penile and vulvar/vaginal areas but can also be found in the oral, nasal, perineal, and ocular areas as well as in the rectum. Lesions grossly appear like raised, cauliflower-like red masses, and can be confirmed using cytology if needed. Affected dogs frequently have pain, bleeding, and discharge from the affected areas.

Vincristine is used to treat TVT, with a dose of 0.5-0.7mg/m2 IV once a week for 3-8 weeks. Improvement is usually seen after the first dose, and should be given for at least 2 doses after apparent full resolution. Fortunately, TVT has a low metastatic rate of <15%, so although thoracic radiographs may be ideal, they are not essential if finances preclude.

Heartworm disease:

Heartworm disease is common in many areas and is a killer of many dogs and cats. The disease is spread via mosquitoes and involves a complex life cycle that ultimately culminates with severe respiratory distress caused by right sided heart failure. It is typically diagnosed with either a tableside blood test that detects the female heartworm antigen, or a direct blood smear to look for immature worms (microfilariae). In dogs, the antigen test is accurate for both positive and negative test results with 99% accuracy, but in cats a negative test does not rule out the disease (a positive test is accurate, however).

Treatment of infected animals is limited to dogs (cats are not treated) and requires a several month regimen of steroids and doxycycline followed by 3 injections of melarsomine (arsenic) (95). From a field clinic standpoint, routine screening for heartworm disease can be considered but the cost and long duration of treatment frequently precludes broad spectrum testing in animals lacking any clinical signs, and testing may be of no value in feral animals for whom treatment is not an option. Preventatives (ivermectin, moxidectin, selamectin, milbemycin) are readily available for noninfected dogs and cats, but are not recommended by the American Heartworm Society for sole use in treating adult heartworm infection if already present. It is thus standard practice to screen for the disease before starting a preventative.

However, the issue becomes somewhat more complicated since certain heartworm preventatives can technically be used as a slow method to treat and eliminate the adult worms over several years. In fact, when the standard melarsomine treatment was commercially unavailable for an extended period several years ago, ivermectin given monthly (6 µg/kg (0.006 mg/kg) PO per month in dogs) for two years was the preferred treatment (aka “slow kill” protocol) for heartworm disease. Further study has confirmed clearance of adult heartworms in 96% of dogs studied (average median time to clearance of 8 months) with the use of moxidectin given twice a month for 90 days, then monthly thereafter in combination with an initial course of doxycycline at a median of

12.6mg/kg PO daily for the first 15 days (96). During the course of the above study, it is important to note that some (18%) dogs did develop a cough related to the die-off of the adult heartworms, and one was hospitalized for a day and given corticosteroids, but all recovered. Given that untreated heartworm disease is ultimately fatal, a greater than 80% success rate without complications and a 96% cure rate is a valid trade-off.

Despite this, the American Heartworm Society does not recommend the slow treatment method using ivermectin since it is not always effective, and in some cases the dog can die prior from heartworm disease before the ivermectin can slowly eliminate the worms. Additionally, there are serious concerns that “slow kill” methods may result in selection pressure for heartworms to evolve and become resistant to currently available preventatives, causing much larger issues for canine and feline populations at large.

Overall, in an owned animal for whom the recommended testing and/or treatment is not an option (whether due to cost, compliance, follow up, etc.), a judgment call can be made as to whether to start a monthly preventative. Although ivermectin and moxidectin can be safely used at heartworm preventative dosages even in heartworm positive dogs since they cause a slow microfilariae die off, another preventative (milbemycin) causes the rapid death of microfilariae and can potentially kill an infected dog or cat due to the rapid die off of immature worms. As such, heartworm prevention without prior testing can be done but should be ideally limited to the use of products containing only ivermectin or moxidectin since these are effective long term medications against adult heartworms, given enough time. Selamectin can safely be used without heartworm testing, but has no efficacy against adult heartworms.

Heatstroke:

Heatstroke can occur in the veterinary field setting and is unfortunately most likely to occur during a poorly scheduled veterinary clinic during the hot summer months. Even in hot climates common to the American Southwest and much of the Third World, most dogs and cats in feral or home settings will avoid the sun and find some form of shade or shelter, but when brought to mobile clinics are placed into truck beds, car trunks, and other areas where the combination of heat, sun, lack of airflow, and increased metabolism from stress can be lethal. Dogs are significantly more susceptible to heatstroke as compared with cats that evolved in desert regions. Heatstroke can occur in any dog but is more common in older dogs, short faced (brachycephalic) dogs such as bulldogs and pugs, any any dog with any medical condition. It is important to note that because dogs cannot sweat (the pads of the feet being a minor and not effective exception), heatstroke can be seen at ambient temperatures as low as 85 degrees Fahrenheit, especially with high humidity and direct sun.

The prognosis for heatstroke is poor under any circumstance and the mortality rate approaches 50% even in a fully equipped ICU setting. The best approach is to try and head off heatstroke before it occurs. This means avoiding scheduling summer clinics,

avoiding long lines at the clinic (using numbered arrival times, phone calls and texts, etc.), encouraging parking in covered or shaded areas, and wetting down animals in direct sun or displaying signs of impending heatstroke (panting, severe stress, etc.).

The importance of physically wetting down a dog to prevent (and treat) heatstroke cannot be overstated. Without the ability to sweat like a human or horse in a hot climate, the only mechanism a dog has to dissipate heat is to pant, and the surface area of the tongue and respiratory mucosa are severely limited as compared to an entire human body virtually covered in skin. Further, unlike a human that can sweat profusely and thus needs water to replenish large volumes of sweat, offering a panting dog water to drink is of limited use and will not prevent heatstroke. Wetting a dog's hair and skin with direct cool water effectively allows the cooling evaporative effect that we get from sweating, and dogs at risk of heatstroke should be wet down, placed under a fan if possible, with repeated wetting as necessary. It is the same principle as taking a quick cold shower then standing in the wind, with the immediate evaporative effect. Heatstroke is infinitely more common than hypothermia in dogs, and wetting them down is a life saving measure not to be underestimated.

Clinical signs of heatstroke are initially panting and increasing respiratory distress and effort, with rectal temperatures above 105.0 Fahrenheit. Without treatment, this can progress to lateral recumbency, seizures, and vomiting. Unfortunately, the final sequelae are the inability to clot blood, and it is common to have owners present a dog with severe apparent bruising and pinpoint hemorrhages (petechiae) several hours after returning home from an event in which a dog became overheated. By this time, the body temperature frequently has normalized or starts to drop into subnormal temperatures, and the cascade of fatal events has already started.

Treatment for acute heatstroke (i.e. clinical signs plus an elevated temp typically well above 105.0) is to immediately wet a dog down, place a fan in front of them, then start intravenous (IV) fluids at high doses. In some cases involving obvious laryngeal paralysis or an animal predisposed to a collapsing trachea (eg. small breed dogs), intubation can be done and oxygen started, but this requires anesthesia and also will reduce the evaporative heat dissipation from the tongue and oral cavity. Seizures should be controlled if necessary, as well as vomiting.

Because severe coagulation problems occur as a direct result of heatstroke, coagulation should be checked using an ACT tube or mucosal bleeding time. If elevated by more than 25% above normal, a plasma transfusion is needed if fresh frozen plasma is available. If not, a whole blood transfusion can be done from a donor, which carries some risk of a severely elevated red blood cell count in a dog with normal red cell counts receiving further red cell transfusion. This risk should be weighed against the high risk of death from heatstroke. (check this on VIN).

If a dog presents with heatstroke and significant treatment cannot be pursued, or treatment is initiated but the dog declines rapidly over the next several hours, euthanasia should be considered in order to spare a poor death.

Mange:

Mange refers to dermal infection with mites, typically Sarcoptes (“scabies”) and Demodex in dogs, and Notoedres (“feline scabies”) and Demodex in cats. Although rare in the United States, these infections are common anywhere that animals free-roam. Affected animals typically have pronounced hair loss, and can be severely itchy (pruritic). Although infection with Demodex in dogs is classically considered to be less itchy, infection with any mite in high enough numbers can result in pruritus.

Diagnosis is typically via a skin scrape, but a negative skin scrape does not rule out infection. Negative skin scrapes are more common in animals with scarred or thickened skin, or with low mite numbers. Since modern treatments with monthly oral tabs are safe and effective, it is better to treat if one is in doubt as to the possibility of mange. For field purposes, the most convenient treatment in dogs is a monthly oral dose of fluralaner, afoxolaner, sarolaner, or lotilaner given for 2-3 successive months. Treatment in cats is with the use of topical selamectin or fluralaner every 2-4 weeks for 1-2 months.

Coccidioidomycosis (“Valley Fever”):

Coccidioidomycosis is a soil borne fungal disease endemic to the Sonoran Desert, extending from northwest Mexico to the southwestern United States. Infection with the Coccidioides fungus is common in both dogs (and humans), but is rare in cats. It is typically considered an infectious but not contagious disease, i.e. it is an infectious organism but does not spread between individuals (the exception being a dermal form of the disease rarely seen in practice). Because infection occurs secondary to inhalation of soil borne spores, the disease is more frequently diagnosed in individuals living downwind from areas of soil disturbance, such as new housing developments. However, this is not a requirement for infection, and there is inherent exposure in living in or travel to endemic areas. Most dogs that are exposed will not develop clinical signs, and those that are clinically normal do not require testing nor treatment. Some individuals with clinical signs make a full recovery on their own, whereas others may have problems for years and can die from the infection. Treatment for the disease greatly increases the chance of resolution, but some dogs will not respond to treatment.

Clinical signs of coccidioidomycosis typically occur months after initial infection, and can persist for years. Most dogs present with one of 3 primary affected body systems: pulmonary (coughing, respiratory distress), orthopedic (limping, palpable bone lesions), or neurologic (seizures, tremors). Most dogs will only have clinical signs with one body system, rather than a combination. Many dogs will have a history of lethargy and/or weight loss, and may present in poor body condition, but this is not always the case. Further, despite the name, most affected dogs will not have a fever. Finally, some cases of valley fever have unusual presentations (vomiting, skin issues, etc.).

Effectively, dogs with coccidioidomycosis can have virtually any clinical sign (thus the mantra “valley fever does whatever it wants”), but usually have a harsh cough, limb lameness (frequently shifting between limbs), or seizures. Because these clinical signs are not unique to valley fever, diagnostic testing is warranted in endemic areas if possible.

Blood testing for valley fever does not look for the organism per se but measures serum antibody levels. The traditional AGID test takes 5-7 days at a laboratory and reports either a negative titer (i.e. no antibodies) or a number that reflects the quantity of antibodies present based on serial dilutions. In theory, the higher the titer number, the more likely the disease is and the more severe the case, but this does not pan out in practice since the worst cases frequently seen have no titer at all. I.e. an estimated 13% of dogs with clinical signs attributable to valley fever have a negative titer, effectively meaning that their immune systems are not recognizing nor trying to eliminate the infection. These cases are especially problematic since resolution is completely dependent on medications, and the initial diagnosis may slip through the cracks given the negative serum test. In these cases, or in cases with low titers that could either indicate active vs previous (resolved) infection, secondary diagnostic tests can include thoracic radiographs (to look for pulmonary nodules and/or hilar lymphadenopathy), orthopedic films (to look for osteolytic lesions), and MRI (for neurologic cases).

In field medicine, advanced diagnostic tests and even sending off a serum titer for coccidioidomycosis is usually not practical considering that the test can cost up to $150 (actual lab cost) and takes 5-7 days to get the results. Instead, field clinics may wish to consider the use of the newer tableside point-of-care tests now commonly used in both human and veterinary emergency rooms, with a cost of about $15 per test. Point-of-care serum valley fever antibody tests are FDA approved for human use and have also been used for several years by veterinary specialty centers in Tucson and Phoenix. Repeated studies at the Valley Fever Center for Excellence, the University of Arizona, The University of California-Davis, and others have demonstrated excellent sensitivity, specificity, positive and negative predictive values compared to traditional AGID testing (97, 98). The tests do not provide a titer per se, but subjectively it is clear that “strong positive” antibody test results correspond to high titers and are accepted by the FDA in humans for coccidioidomycosis diagnosis and initiation of treatment with fluconazole. Further, from a study published by UC-Davis, “if a high index of suspicion exists” as to the diagnosis, confirmatory testing can be done (98).

While the newer tableside tests have greatly improved options for field clinics, it is important to also consider that the 13% of true coccidioidomycosis cases in dogs that have no detectable antibodies to the organism will also thereby test negative on tableside tests, meaning that a dog with appropriate clinical signs is not necessarily free of the infection. Thus, when using serum tests and/or secondary diagnostic tests, clinicians must look at the larger picture and decide if the clinical picture fits with the signalment (age of the dog, breed, etc.). E.g. a clinician may be presented with a limping dog from an area with endemic valley fever, and if also given the luxury of

radiographs, may note significant osteolytic lesions of one or more long bones. Considering that osteolytic lesions are most commonly seen with either cancer (osteosarcoma) or valley fever (in endemic areas), the clinician may wish to get a serum titer or do the tableside IMMY test, if financially feasible. If a negative serum test is obtained, and a bone biopsy is off the table for practical or cost reasons, the clinician may still wish to start treatment for valley fever if the dog is young and neoplasia (cancer) is highly unlikely from a statistical point-of-view. Considering that the treatment is slow but relatively benign, this may be a way of hedging bets and effectively getting a diagnosis through the back door (i.e. if the dog improves, then cancer was not present).

Current treatment recommendations are to use fluconazole at 10mg/kg orally twice daily for 6-12 months (one year being more preferable, if possible), with recheck serum testing prior to stopping treatment. Older textbooks may list a lower dose of 5mg/kg twice daily, but this dose has fallen out of favor, as has shorter duration of treatment or use of older antifungals such as ketoconazole and itraconazole. Serum liver values (ALT, ALP) may elevate during the course of treatment but typically have no corresponding clinical signs, and liver failure and/or cirrhosis does not occur with any statistical frequency. Problems from stopping fluconazole far exceed and problems from the treatment in almost every case.

If treatment is not pursued for whatever reason, some individuals can make a full recovery on their own, whereas others may have problems for years and can die from the infection. Treatment greatly improves the clinical picture, but it is also important to note that some individuals relapse after stopping treatment and require years or even lifelong medication with fluconazole, and a very small subset die from valley fever despite treatment.

Finally, because of the need for twice daily oral medication, treatment is not an option for feral dogs, and the expense of 6-12 months of fluconazole (even through compounding pharmacies) may also be cost prohibitive.

Rattlesnake envenomation:

While rattlesnake bites to dogs are not nearly as common at field clinics as infectious disease, trauma, and other medical issues, clinicians will inevitably end up seeing the occasional snake bite if they are working in remote areas of the southwest United States as well as Latin America. As such, a treatment protocol is included here. Please keep in mind that this treatment reflects envenomation from rattlesnakes (crotalids) only, and does not apply to other venomous reptiles (Gila monsters, coral snakes, and other venomous reptiles commonly encountered outside the western hemisphere).

Rattlesnake bites typically present as acute onset of facial or limb swelling, typically worse near the local bite area. Two distinct punctures (or more) frequently can be

located. For facial bites, the swelling is usually lopsided and worse on the side where the bite occurred. However, multiple bites can also occur. Rattlesnake bites are painful, and typically cause bleeding issues, sloughing of tissue at the bite site, and in some cases neurologic effects.

When a rattlesnake bite is known or suspected, diagnostic testing ideally consists of standard blood tests for clotting / coagulation (PT/APTT tests every 6 hours for 24-48 hours). Since this is typically unavailable in the field setting, a homemade ACT tube (as described in the previous chapter) can be used to measure coagulation times every 6-8 hours. Blood in the tube should clot within 2 minutes, but the actual reference range should be established by the individual making the tubes (see previous chapter). Additionally, basic blood smear analysis and a PCV estimation can be done tableside for free if there is access to a microscope and centrifuge, respectively. Blood smears will show ecchinocytes if a rattlesnake envenomation has occurred, and a smear can also be used for a platelet estimate. If no coagulation tests are available, a buccal mucosal bleeding time test can be done (hold lip up, make 1mm stab incision into the gums, gently blot as needed to remove excess blood, and wait for bleeding to stop. Bleeding should stop within 5 minutes if clotting is normal).

Not all rattlesnake bites require treatment, since dry bites do occur. In the case of obvious envenomation (i.e. swelling is occurring, ecchinocytes are present, etc.), the 3 mainstays of treatment are pain medication, fluids, and antivenin. Steroids have not been shown to be of any value in improving outcomes, nor have antihistamines. Non-steroidal anti-inflammatories are avoided, since they can worsen systemic bleeding. There is no point at which timewise it has been “too long” to treat a snakebite, and if clinical signs of a bleeding disorder are present, treatment should be instituted.

Pain medications are always indicated, and typically are restricted to opioid analgesics. Fluid therapy is ideally IV continuous fluids at twice maintenance for at least 24 hours, but SQ fluids can be used if IV is not an option. The use of antivenin in every case is not always needed, and is generally based on clinical signs as well as clotting tests. If in doubt, antivenin should be given since the risk of death from a rattlesnake bite exceeds the risk of an adverse reaction to the antivenin. When administering antivenin that has been diluted into 100cc-500cc of IV fluids in a sterile bag, give the first 10% over 15 minutes and watch for a reaction (high temp, collapse, etc). If no reaction is noted, give the remaining 90% of the diluted antivenin over the next 15 minutes. Ideally, monitor the patient and the clotting times for the next 24 hours. If clinical signs worsen and/or clotting times / mucosal bleeding times remain prolonged, another vial can be given at the 6 hour mark or beyond.

However, as always with field clinics, finances should be first considered since antivenin typically costs hundreds of dollars per vial, money that may be better spent elsewhere.