

Diseases of Bearded Dragons

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Beardies are the most popular lizard right now. They are prone to their own peculiar problems, the object of this lecture will be learning how to diagnose and treat them, as well as keep them healthy. From feeding, to hibernation, to the many diseases and problems they develop, you will become a bearded dragon expert!

Captive Care

Bearded dragons are Agamids belonging to the genus *Pogona* (formerly *Amphibolurus*) which has multiple species. They are diurnal and terrestrial to semi-arboreal, spending most of their time in bushes and trees, basking on rocks and escaping the heat with underground burrows

Bearded dragons arm wave to show submission to avoid aggression, and a head-bobbing to show dominance over other males and signal females they would like to mate with them. Their beard becomes blacker during rivalry between males, but can also turn black to absorb heat. Adults weigh between 350 to 600 g; males grow up to 16 to 24 in, females up to 12 to 20 in long. In the wild bearded dragons are solitary. In captivity males will fight with other males and should be housed singly, or in groups of two or more females. Juveniles can be raised in screened 10 to 20 gallons aquariums, adults need 50 gallon aquariums, minimum, or larger. Newspaper, paper towels, or paper pulp substrate work well. Sand, gravel and many other substrates can cause colonic impaction. Climbing branches, cork bark hides, basking rocks and burrowing areas, such as a humid retreat, should be available. Bearded dragons don't drink well from water bowls. Shallow water bowls, large enough to climb into, are good. Encourage drinking by dripping or spraying water on the dragon's head, spraying the sides of the enclosure, or soaking in shallow lukewarm water several times per week. Lack of drinking available water is a major cause of constipation.

Cage temperature should be 60–70°F at night, rising to 80–85°F during the day, with a basking area of 95–105°F. Overhead self-ballasted mercury vapor lamps (Powersun, Zoo Med, San Lois Obispo) are recommended for basking sites to provide both ultraviolet (UV) light and heat. Do not allow dragons to get closer than 12 inches to lights or dorsal burns may result. Photoperiod should be 12 hours light and 12 hours dark, except during hibernation. Replace UV lights every 6 months as UV output falls before visible light burns out, or check with a UV meter.

In the wild juveniles consume 50% plant material and 50% animal material, adults consume 90% plant material and 10% animal material. Suitable vegetables include calcium dusted dark leafy greens (kale, collards, mustards, turnip or beet tops, spinach, dandelions, cabbage, bok choy, broccoli rape, and lettuces such as Romaine, red leaf, green leaf or Boston lettuces, but not iceberg lettuce), carrots, squash, zucchini, peas and beans. Flowers such as roses, nasturtiums, carnations and hibiscus are also good. Dragons should be fed a wide variety of insects including mealworms, crickets, super worms, waxworms, Dubia cockroaches, black soldier fly larvae, locusts, silkworms, butter worms, grasshoppers and tomato hornworms. Insects should be well fed before becoming prey and insects that can be gut loaded should be fed a commercial gut loading diet with > 6% calcium, nothing else, besides water. Cubes are nutritionally worthless but do provide water. Commercial pelleted (not cubed) bearded dragon foods can also be fed. Baby mice can be offered several times per month. Even though bearded dragons love fruits, they are not recommended. Overfeeding and obesity are a major problem in captivity. Juvenile growing animals can be fed daily, adults should be fed every other day to every third day if obese. Growing dragons need more calcium than adults. Calcium is provided in calcium rich insect gut loading diets, dusted on insects or sprinkled on food. Multivitamins can be given twice a month, if fortified foods, such as commercial gut loading diets, are not part of the diet.

Reproduction

Bearded dragons are easy to breed and prolific. Breeding occurs during the spring and summer. Mature male dragons have larger femoral pores compared to females. In males, if the tail is lifted, two bulges are

visible at the base of the tail while looking straight down the tail. Males have larger heads and more prominent darker beards as well. Females reach sexual maturity between 18 to 24 months of age, sooner is possible with optimal nutrition but breeding younger dragons is not recommended. A winter cool down from mid-December to mid-February with a 10 hr. photoperiod helps synchronize breeding. Most dragons are already off feed by this time. Night time temperatures should drop to 60–75°F with a daytime basking around 80°F. Water should be provided, either by soaking, sprinkling or spraying it on their head (unless they drink from a water bowl). In mid to late February photoperiod and temperatures can slowly be increased to 12 hrs light and 80°F ambient, with a hot spot of 95–105°F, and a night time drop to 70–75°F. Appetite should return after a few warmer days and dragons should be fed heavily in preparation for breeding within a month. As females become obviously gravid, appetite decreases, the female is more active and will be digging, until she stops eating altogether for a few days prior to egg laying. A nest area should be present with at least 10 inches of sandy soil, such as a box or 8 to 10 gallon plastic tub. The female will excavate a burrow and lay eggs in the late afternoon or early evening, then fill in the burrow. Oviposition commences 4 to 6 weeks after copulation, females average 15 to 25 eggs and 2 to 7 clutches per year, at 4 to 6 week intervals. Eggs should be incubated at 82–86° F in a mixture of vermiculite and water at a ratio of 1:1 to 1:2, by weight. Damp Perlite, sand or soil can also be used. Fertile eggs will chalk up, and enlarge. Eggs hatch in an average of 2 months but can range from 50 to 80 days. Allow hatchlings to emerge on their own, within 24 to 36 hrs of pipping, and remain in the incubator a day or two after hatching, to absorb yolks, then transfer them to a cage with damp paper towels, mist twice a day. Any remaining umbilical yolk will be absorbed and the dragons usually start taking crickets and finely chopped greens within several days. Hatchlings can be housed communally until size discrepancies emerge, at which point they should be separated. Bearded dragons are cannibalistic, cage mate trauma is common.

Tube Feeding

Do not use metal gavage tubes or hard plastic speculums or the dragon will bite down and fracture teeth. Instead use the flared end of a red rubber catheter as an oral speculum and run the cut red rubber catheter through it. Have one person vertically restrain the dragon with one hand behind the head, with their other hand they can pull down on the dewlap while you hold the maxillae. As soon as the mouth is open, insert the mouth speculum (cut to just under the length of the mouth), and hold the mouth firmly closed so the dragon can't push out the speculum with its tongue. Insert the well lubricated feeding tube through the speculum, down the esophagus, to about the first third or half of the coelom to the stomach, situated on the left. Infuse 5 mls/kg slowly over a minute, over time the volume may be increased, but start small and work up.

Blood Collection

The ventral tail vein (called the caudal vein) is the easiest blood collection site, but more difficult than an iguana. Restrain the dragon in dorsal recumbency, surgically prepare the phlebotomy site with chlorhexidine and alcohol, and in males, be far enough caudally to avoid the hemipenes. The vein is precisely on midline ventral to the vertebrae. Having another assistant stabilize the needle with hemostats once you get a flash seems to help, use heparinized syringes.

COMMON DISEASES

Constipation/Obstipation

Constipation is one of the most common presentations for bearded dragons. Clinical signs include not defecating for several weeks, tenesmus, dyschezia, dehydration and anorexia. Obstipation is a severe form of long standing constipation such that the dragon is no longer able to defecate. There are many potential causes, such as nutritional secondary hyperparathyroidism, with spinal or pelvic deformities, lack of sufficient roughage, such as dark leafy greens, folliculogenesis, and parasites, such as coccidia, amoeba or flagellated protozoans, or masses blocking the colon, such as with microsporidiosis, renal enlargement or an abscess. Bearded dragons often ingest bedding while eating, particularly sand, Sani-Chips, crushed walnut shells and occasionally, coconut coir. Over time these build up and block the colon. Bearded dragons don't readily drink from water bowls, which can lead to dehydration, this is the most

common cause of constipation. Bearded dragons have no urinary bladder; instead semisolid urates are deposited in the colon or rectum until elimination. Dehydration leads to water being resorbed from the colon and desiccated urates accumulate in the colon. These are palpable in the distal colon as an oblong to round solid painful mass. Colonic palpation may produce dyschezia; feces should be examined for indigestible substrate, urates and parasites. Palpation often cures the problem immediately, on the exam room table. If not, radiographs and bloodwork give one a better feel for the extent of the problem. Ongoing treatment, if needed, consists of rehydration by soaking in shallow lukewarm water for 30 to 120 minutes, stomach tubing with 2 mls/kg mineral oil BID, 20 to 30 ml/kg warm saline or water enemas, and gentle colonic palpation daily until the dragon defecates. Serial radiographs are useful to assess therapy. Nutritional support may also be indicated. Secondary hepatic lipidosis may be present in severe cases. If medical therapy isn't successful, celiotomy is indicated once the patient is rehydrated and stable.

Obesity

Bearded dragons are typically overfed and not hibernated which leads to continuous enlargement of coelomic fat pads and potentially hepatic lipidosis. Fruits and berries rich in sugars are avidly, and eventually preferentially, consumed. The history may reveal a gradual loss of interest in crickets, mealworms, and greens, less activity and eventually the dragon only eats food placed directly in front of it. The coelomic fat pads can enlarge to more than half the coelomic cavity. Treatment consists of eliminating all fruits in the diet, feeding gut loaded insects and dark leafy greens and flowers, every other day to every third day and fasting on alternate days. The goal is gradual weight loss. Increased exercise is hard to accomplish but chasing live insects helps. If healthy, dragons should be hibernated to consume excess lipid reserves.

Hepatic Lipidosis

Hepatic lipidosis is very common in anorexic dragons, especially females with follicle development, but no egg laying. History includes large amounts of fruit and non-gut loaded (i.e., starving) insects. Clinical signs, other than anorexia, are vague, lizards don't get icteric. An obese dragon that isn't eating is suspicious. Workup includes CBC, chemistry panel, fecal analysis, whole body radiographs to eliminate other causes of anorexia. Lateral radiographs and ultrasound may reveal liver enlargement or hyperechoity. The lateral liver silhouette should be less than half the dorsoventral coelomic space. Bloodwork is often unremarkable other than anemia. A definitive diagnosis can be made with a rapid laparoscopic liver examination and biopsy. Fatty livers are pale white or yellow, with swollen rounded edges and float in formalin. Treatment consists of long term nutritional support via stomach tube until the patient is eating well on its own. This may take weeks. Stomach tube 5 ml/kg LaFeber's® Emeraid™ Nutri-Support™ (LaFeber Co., Cornell, IL) BID to QID until the patient is eating well, usual six to eight weeks. Multiple small feedings are better than less frequent larger feedings. Emeraid Nutri-Support has a source of vitamin K activity and vitamin B₁₂. Other supplements, such as L-carnitine (250 mg/kg PO q 24 hrs), methionine (50 mg/kg PO q 24 hrs), taurine, S-adenosylmethionine (30 mg/kg PO q 24 hrs), lactulose (0.5 ml/kg PO q 24 hrs), and *Silybun marianum* (extract from milk thistle, 4-15 mg/kg PO q BID to TID) can also be used, however no prospective clinical trials have been conducted to evaluate efficacy of any of these drugs in reptiles.

NSHP

Calcium deficiency is common in young growing dragons fed unsupplemented insects, vegetables and fruit. Clinical signs include anorexia, stunting, sprawl, inability to lift the body and proximal tail while ambulating, soft mandible or maxillae, kyphoscoliosis, lordosis, fibrous osteodystrophy and tremors. Treatment includes nutritional support (5 ml/kg LaFeber's® Emeraid™ Nutri-Support™ (LaFeber Co., Cornell, IL) or Oxbow Carnivore Care (Oxbow Animal Health, Murdock, NE) via stomach tube twice daily), calcium supplementation (1 ml/kg calcium glubionate orally BID for 1 to 3 months), vitamin D (400 IU IM, repeat in 1 week), with or without calcitonin injections (50 IU/kg IM, repeat in 1 week), once normocalcemic, or one week after starting calcium supplementation. Wright recommended ¼ tablet/kg daily fruit favored calcium carbonate antacid (TUMS Ultra 1000, GlaxoSmithKline, Moon Township, PA) ground into powder and mixed with salad or peach baby food and given by syringe. The calcium carbonate in TUMS is more biologically active (i.e., more calcium absorbed) compared to calcium

glubionate resulting in more than double the calcium dose. Radiographs can be evaluated every 6 weeks to track response to therapy.

Adenovirus

Bearded dragon adenovirus, formerly called agamid adenovirus 1, is widespread among bearded dragons, most cases remain subclinical. Several studies found apparently healthy dragons were positive by cloacal swab PCR for bearded dragon adenovirus (1/22, 5%, 3/26, 12%, and 22/31, 71%). Clinical disease often strikes young dragons that fail to thrive, non-specific clinical signs such as anorexia, lethargy, diarrhea and weight loss may be present. Acute death or multiple deaths may have occurred. Older and immunocompromised animals are also affected, concurrent infection with dependoviruses has been reported. Neurologic signs, such as ataxia, circling, head tilt, opisthotonus, paresis, or hind or front limb weakness, are suspicious for adenovirus. Necropsy may reveal severe hemorrhagic hepatitis and enteritis, pancreatitis, encephalopathy, splenitis, esophagitis and pneumonia. Ballooning basophilic intranuclear inclusions and widespread hepatic and intestinal necrosis may be present on histopathology. Many dragons are persistently infected and asymptomatic, it is unknown how long adenovirus is shed. Most adenoviruses are spread through fecal-oral contamination. Adenovirus is stable in the environment, resistant to disinfection but susceptible to disinfectants that also work against parvovirus. PCR's on cloacal swabs and screening incoming dragons to established valuable collections are recommended. There are no established treatments, acyclovir is ineffective, cidofovir is used in mammals, but there are no pharmacokinetics for cidofovir in reptiles.

Egg Yolk Coelomitis

Older obese females not in breeding situations can undergo multiple cycles of folliculogenesis and resorption. Free yolk in the coelom can be lavaged out if caught early enough, while still liquid, but once an inflammatory response sets in and the yolk solidifies treatment is not practical. Euthanasia is recommended.

Parasites

Both coccidia, *Isospora amphiboluri*, and pinworms, are prevalent in bearded dragons and may cause anorexia, lethargy and diarrhea. A recent study showed coccidia initially infects the proximal SI then spread distally to the colon over time. Sulfa drugs seem poorly effective at eliminating coccidia, sulfadimethoxine at 50 mg/kg PO x 21 days reduced oocyst shedding, but did not eliminate coccidia in all animals. Ponazuril at 30 mg/kg PO and repeated in 48 hrs seems effective at stopping oocyst shedding. Raiti, 2012, recommended the same dose SID x 7 days, skip 2 weeks, then repeat SID x 7 days, recheck a fecal 2 weeks post treatment. Pinworms probably are innocuous in small numbers but in massive numbers are associated with unthriftiness, impaction and cloacitis. For pinworms 100 mg/kg fenbendazole PO once seems effective. Both parasites have a direct fecal-oral lifecycle so it is important to remove feces daily, clean the cage well, discard bedding and scrub the dragon's ventrum and back half with warm soapy water. Both parasites are commonly present, the authors treats for coccidia first, then eliminates pinworms later. Follow ups fecal examinations are recommended 6 weeks post-treatment for pinworms and then q 6 months.

Cryptosporidia is sporadically diagnosed and may be endemic in large bearded dragon breeders supplying the pet industry. Much like in leopard geckos, there are carriers, while others succumb to disease with stress, such as suboptimal husbandry, shipping, poor nutrition, or immunocompromise from concurrent disease, such as adenovirus or parasites. Clinical signs include severe enteritis, diarrhea and cachexia. Fecal, colonic wash or cloacal PCR swabs are recommended for diagnosis. Recently a new treatment was effective in eliminating experimental cryptosporidia infection, 100 mg/kg paromomycin SID x 7 days, then 2x/week for 6 weeks, then 360 mg/kg q 48 hrs x 10 days (Gossett, *et al*, 2011). The higher dose was needed to eliminate cryptosporidia based on histopathology.

Raiti reported that entamoebiasis, although uncommon, is extremely pathogenic in bearded dragons, patients often presenting moribund. *Entamoeba* trophozoites can cause hepatic and intestinal granulomas. Diagnosis is often post-mortem with histopathology. The author treats with 50 mg/kg metronidazole EOD for 5 to 10 treatments, repeated fecals or colonic washes are useful to confirm *Entamoeba* elimination.

Snake mites (*Ophionyssus* spp), lizard mites (*Hirstiella trombidiformis*) and even Trombiculid chiggers, are rarely seen. Elimination includes thorough cage cleaning with hot soapy water, eliminating substrates and spraying the entire cage (inside and out) and cage furniture with 0.29% fipronil spray, repeat in 3 weeks. The lizard should also be thoroughly sprayed, avoid the eyes and mouth, repeat in 3 weeks.

Aneurysms

Aneurysms, arising from the internal carotid artery or the aorta are not uncommon in bearded dragons. They are obvious as large unilateral fluctuant swelling on the dorso lateral neck or dorsal to the temporal muscles. Aspiration easily yields copious whole blood, much like phlebotomy of a large vein, and a Doppler ultrasound probe will reveals a loud pulse. Aneurysms may also be found inside the cranial coelomic cavity. The etiology is unknown, trauma, hypertension, or genetic predisposition are suspected. Surgical removal is extremely challenging as the origin is often far proximal to the swelling. In the only successful surgical case reported, MRI and CT were performed prior to surgery to map the origin and boundaries and the dragon required a transfusion but went on to live another 18 months. Another case died several days after acute onset of listlessness, weakness, and pallor of the entire integument from rupture of a coelomic aneurysm. Yet another died 8 months post diagnosis.

Prolapse

Colonic prolapse can be secondary to straining from parasites, GI foreign bodies, urates, constipation or calcium deficiency. Radiographs and fecal examination are indicated. The prolapse should be gently reduced under anesthesia as soon as possible. After reduction, two anterior to posterior simple interrupted monofilament sutures should be placed a Q-tip's width apart to prevent re-prolapse for 3 weeks. Fluid and nutritional support, antibiotics, and pain medications are indicated.

Pneumonia

Bacterial and fungal pneumonias are more common in colder months. Clinical signs of dyspnea include orthopnea, tachypnea, labored breathing, lethargy and anorexia. Radiographs, tracheal wash with aerobic culture and sensitivity and antibiotic treatment for 3 to 6 weeks are indicated. Pending culture the authors starts with 20 mg/kg ceftazidime SC q 72 hrs.

CANV

The *Chrysosporium* anamorph of *Nannizziopsis vriesii* causes a rapidly fatal necrogranulomatous contagious diffuse dermatitis in many reptiles, but especially bearded dragons, known as yellow fungal disease. Diffuse skin lesions are yellow to yellow brown with hyperkeratosis and ulceration and can spread systemically to lung, liver, spleen and coelomic fat pads. Superficially the lesions can resemble multiple stuck sheds. Dragons can die quickly without aggressive antifungal, fluid and nutritional support. Diagnosis is by PCR or histopathology, culture is not recommended unless the laboratory has fungal expertise. One study compared 2 antifungals, 5 mg/kg itraconazole PO q 24 hrs eliminated CANV by 27 days but had 71% mortality (5/7 dragons), presumably to itraconazole hepatic toxicity. Another, voriconazole, at 10 mg/kg PO q 24 hrs eliminated CANV by 47 days, with only 14% mortality (1/7 dragons). Gently cleaning the affected surface with chlorhexidine scrub and applying silver sulfadiazine cream may also help, but not as a sole therapy.

Periodontal Disease

All agamids seem prone to periodontal disease and osteomyelitis, especially of the mandible. The acrodont tooth of agamids is covered by a thin layer of epithelium, instead of gingival tissue, which seems to predispose to bacterial colonization. Clinical signs include yellowing of the mandible (normal mandible is pearly white), brown calculus along the caudal mandibular and maxillary labial surfaces, gingivitis, osteomyelitis and granulomas ventral to the mandible. Treatment consists of radiographs to evaluate the extent of osteomyelitis, curettage of infected bone, surgical removal of granulomas, long term antibiotics based on aerobic culture and sensitivity as well as pain medications, such as long term meloxicam at 0.2-0.5 mg/kg PO SID.

Neoplasia

Squamous cell carcinomas in bearded dragons have a predilection for proximity to a mucocutaneous junctions (11/12, 92% in one case series), particularly the periocular tissues (9/12, 75% in the same case series). Surgical removal is more difficult with periocular tissue involvement, eyelid tumors are easier to remove, either may require enucleation. One eyelid SCC was treated successfully in an 8 month old bearded dragon with cryotherapy. Malignant nerve sheath tumors also seem to be a common tumor, appearing as SC masses on the feet or near limbs. Gastric neuroendocrine carcinomas are yet another common tumor in young bearded dragons with clinical signs of anorexia, weakness, vomiting, hyperglycemia, anemia, and weight loss. A palpable anterior coelomic mass, may be present. These tumors originate in the gastric mucosa, penetrate the gastric serosa and readily metastasize, primarily to the liver, or other organs, such as the kidneys. Diagnosis may be aided by clinical signs, contrast radiography, esophageal endoscopy or ultrasound. These tumors may secrete somastatin, making them somatostatinomas. Other malignant tumors have also been documented in dragons including leukemias, lymphomas, carcinomas, sarcomas, and melanomas, benign tumors are less reported.

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