Section 28

ARAV Clinical Reviews and Care in Captivity

Dan Loper, DVM;
Kim Wojick, DVM;
Karina Mathes, DVM, DECZM (Herpetology);
Shane Simpson, BVSc (hons), GCM (VP), CMAVA;
Michael Miller, DVM

Moderators
A Non-Endoscopic Technique for Prefemoral Castration of Hermann’s Tortoises

Nicola Di Girolamo, DMV, GPCert(ExAP), MSc(EBHC), PhD, Dipl ECZM (Herpetology)

Session #212

Affiliation: From the Clinica per Animali Esotici, Centro Veterinario Specialistico, Via S. Giovannini 53, 00137, Roma, Italy.

Castration may be indicated for ecological or behavioral reasons. Recently, an endoscopic technique has been described for castration of several chelonian species, including Hermann’s tortoises. The endoscopic orchietomy requires specific endoscopic skills and instrumentation. The purpose of this work is to describe a non-endoscopic technique for castration of Hermann’s tortoises. The technique was performed in six clinically healthy privately owned sub-adult Hermann’s tortoises (body weight 240-410 grams) presented for population control. All the surgeries were performed at the beginning of the summer, i.e., sexual active season. A standard left prefemoral coeliotomy with the tortoise in right lateral recumbency was performed. Stay sutures were placed on 4 orthogonal points of the coelomic membrane to allow maximal retraction. The left testicle and epididymis were easily visualized. A hemostat was placed on the cranial side of the mesorchium. The testicle was gently moved cranially while dissecting the mesorchium from the epididymis and testis with a bipolar radiosurgical scalpel. After excision of the left testis, the prefemoral incision was closed in two layers, and the same procedure was performed for the left testis with the tortoise placed in left lateral recumbency. The surgeries lasted approximately 1 hour. Of the 12 testes removed, 1 ruptured from excessive pressure while being grasped and 1 experienced minimal bleeding that resolved with placement of compressive gauze. All animals recovered uneventfully and were alive 4 months postoperatively. The main limitation of this technique is the need to perform a bilateral celiotomy.

References

Effects of Plant Protein Diets on the Health of Farmed American Alligators (*Alligator mississippiensis*)

Peter M. DiGeronimo, VMD,
Nicola Di Girolamo, DMV, MSc,
Nicholas A. Crossland, DVM,
Fabio Del Piero, DVM, PhD, Dipl ACVP,
Robert C. Reigh, PhD, and
Javier G. Nevarez, DVM, PhD, Dipl ACZM, Dipl ECZM

Session #126

*Affiliation:* From Departments of Veterinary Clinical Sciences (DiGeronimo, Nevarez) and the Department of Pathobiological Sciences (Crossland, Del Piero), Louisiana State University School of Veterinary Medicine, Skip Bertman Dr, Baton Rouge, LA 70803, USA, la Clinica per Animali Esotici, Centro Veterinario Specialistico (CVS), Via Sandro Giovannini 53, 00137 Rome, Italy (Di Girolamo) and the Aquaculture Research Station, Louisiana State University Agricultural Center, 2410 Ben Hur Rd, Baton Rouge, LA 70820, USA (Reigh).

The objective of this prospective, blinded study was to compare plasma biochemical values and gross and histologic evaluation of kidney and liver from American alligators (*Alligator mississippiensis*) fed extruded diets with protein derived from animal or plant sources. Alligators in 2 treatment groups were fed an extruded diet with protein derived primarily from plant products for 7 (n = 20) or 10 (n = 20) months prior to harvest. A control group (n = 20) was fed a commercial diet with protein derived from animal products for the duration of the study. Plasma biochemistry panels, gross and histologic examination of kidney and liver tissues were obtained for each animal. No differences were found between alligators fed diets with animal or plant protein in either biochemistry profiles, or gross or histologic examination of kidney and liver. Plant-based diets, fed for up to 10 months, do not appear to have any ill effects on the kidney or liver of American alligators.
Carapacial Scute Pyramiding Increased by Heat in African Leopard and Spurred Tortoises

Mark L. Heinrich MS, DVM, and Kaleb K. Heinrich, MS, DA

Session #100

Affiliation: From Carlsbad Animal Clinic, Living Desert Zoo and Gardens State park, 103 E Blodgett, Carlsbad, NM 88220, USA (M Heinrich) and Department of Biology, University of Mary Hardin Baylor, 900 College St, Belton, TX 76513, USA (K Heinrich).

Abstract: Carapacial scute pyramiding (CSP) is a common phenomenon in captive raised chelonians. Several hypothetical causes have been proposed but few have been scientifically investigated. We examined the effect of nocturnally applied heat in captive-hatched African leopard (Stigmochelys pardalis) and spurred tortoises (Centrochelys sulcata) over a 2-year period.

Monthly measurements of individual African leopard (Stigmochelys pardalis) and spurred tortoises’ (Centrochelys sulcata) surface temperature, length, height, width, weight, and pyramid height of treatment (heat) and control (no heat) groups were taken over a 2-year period. These measurements were analyzed, as were air temperature and relative humidity data.

Daily environmental conditions and offered diet did not differ between treatment and control groups. Treatment and control groups were placed outside with their cohorts during daylight hours. If weather did not permit, they were exposed to the same thermostatically controlled air temperature and photoperiod inside. Therefore the treatment differed from control via the application of nighttime heat.

During the study all the tortoises’ morphometric measurements increased but values were higher in treatment groups of both species at the end of the study. Furthermore, allometric comparison between control and treatment animals when they were of similar size revealed increased pyramiding in the treatment group.

Our results indicate that growth rate and CSP appear to be directly related and both increase with excess nocturnal heat. Normal growth in turtles and tortoises is ultimately dependent on an individual species’ evolutionary history. As we learn more about a given species’ natural history we will grow closer to providing environmental factors that will be favorable for normal growth in captivity.

References

Squamous and Basal Cell Carcinoma in Reptiles

Tom Hellebuyck, DVM, PhD, Dipl ECZM (Herpetology),
Richard Ducatelle, DVM, PhD, Dipl ECVP,
Annemie Van Caelenberg, DVM, PhD,
An Martel, DVM, PhD, Dipl ECZM (Wildlife Population Health)

Session #177

Affiliation: From the Department of Pathology, Bacteriology and Avian Diseases (Hellebuyck, Ducatelle, Martel) and Department of Medical Imaging, Faculty of Veterinary Medicine (Van Caeleberg), Ghent University. Salisburylaan 133, B-9820 Merelbeke, Belgium.

The clinical behavior and histopathologic characteristics of an oral keratinizing basal cell carcinoma (BCC) and a metastatic carapacial BCC in two Hermann’s tortoises (Testudo hermanni) were compared to various cases of squamous cell carcinoma (SCC) diagnosed in squamates and chelonians. To the best of our knowledge, the occurrence of BCC has not previously been documented in a reptilian species. While human cutaneous BCC is a highly common malignant neoplastic disorder, intraoral BCC in humans and BCC in domestic animals and birds are rare.1-3 Exposure to ultraviolet (UV) radiation is the major cause of cutaneous BCC in humans.1 UV radiation may also be a predisposing factor in the development of SCC and BCC in reptiles.4 Every presumed case of SCC in reptiles should be differentiated from BCC as the predilection sites and gross pathologic features for both neoplasms are similar. In comparison to the observed SCCs, the BCCs showed a remarkably fast and highly infiltrative growth. Accordingly, an early diagnosis including reliable discrimination from SCC is essential towards the management of this neoplastic entity. SCC and BCC are curable conditions if a prompt diagnosis is accomplished and treatment is initiated in the early phase. When surgical excision is impossible, intralesional treatment may be considered for the treatment of dermal and intraoral SCC and BCC. The effect of intralesional treatment with 5-flourouracil was evaluated in the Hermann’s tortoise with an intraoral BCC but did not prove to be effective.

References


Shell Disease in Western Pond Turtles (Actinemys marmorata) in the State of Washington

Bethany Groves, DVM, Katherine Haman, DVM, MSc, Drury R. Reavill, DVM, Dipl ABVP (Avian), Dipl ABVP (Reptile and Amphibian), Dipl ACVP, and Western Pond Turtle Health Team (PAWS, Woodland Park Zoo, Oregon Zoo, University of Illinois, Washington State University, WDFW staff)

Session #249

Affiliation: PAWS Wildlife Center, 15305 44th Ave W, Lynnwood, WA 98087, USA (Groves), Department of Fish and Wildlife, 1111 Washington Street SE, Olympia, WA 98501, USA (Haman), Zoo/Exotic Pathology Service, 6020 Rutland Drive #14, Carmichael, CA 95608, USA (Reavill).

The western pond turtle was listed as endangered in Washington in 1993, at which time recovery efforts were already underway. The recovery program has largely been a success and resulted in an overall population increase from 150 animals to more than 1000 individuals at six locations in Washington. However, recent observations identified shell disease of unknown etiology affecting turtles in all six populations in Washington. Retrospective review of photographs suggests shell disease was present in western pond turtle populations as early as 2003, when photo documentation was initiated. In some individuals, the disease is severe and these turtles require veterinary care, including surgical debridement and long-term antimicrobial therapy. The use of diagnostic imaging (computed tomography) has recently enhanced our ability to document the extent and severity of shell disease and focus treatment efforts. Further, diagnostic imaging has been used to document subclinical cases; to date, 3 out of 5 apparently healthy turtles were shown to have moderate to severe shell disease. Though the sample size is small, that is a potentially staggering subclinical prevalence. Molecular diagnostics are currently underway to characterize possible primary pathogens and identify shifts in the shell microbiomes associated with shell disease status.
Composition of Cloacal Bacterial Flora in Healthy Testudo hermanni and During Cloacitis

Emanuele Lubian, DVM, GPCert(ExAP), Piera Anna Martino, Massimo Millefanti, DVM

Session #168

Affiliation: From Ambulatorio veterinario, Via Galvani 42, Gaggiano, 20083, Italy (Lubian, Millefanti), and Università degli Studi di Milano, Dipartimento di Medicina Veterinaria (DIMEVET), microbiologia e immunologia, Via Celoria 10, Milano 20133, Italy (Marino).

Abstract: This study aims to standardize the bacterial cloacal composition in healthy Hermann’s tortoise and to see how it changes during different seasons, in different places, with different sampling methods and during cloacitis. Samples were taken from selected tortoises four times during 2009. In the same year, cloacitis samples were taken from sick tortoises examined during clinical practice. This study aims to standardize the bacterial cloacal composition in healthy Hermann’s tortoise and to see how it changes during different seasons, in different places, with different sampling methods and during cloacitis. Samples were taken from 10 selected tortoises four times (April, July, September, October) during 2009 in 2 captive-bred groups. In the same year, cloacitis samples were taken from sick tortoises examined during clinical practice. Samples were taken with cloacal swab and cloacal lavage and analyzed with bacterial culture.

The conclusions of this study are that some bacteria (i.e., Bacillus sp., Enterococcus sp., E. coli, Klebsiella sp.) could be found in healthy tortoises throughout the year. Other bacteria (i.e., Pseudomonas spp., Pantoea spp., Salmonella spp., Proteus mirabilis, Acinetobacter spp.) show higher prevalence during some seasons and show lower prevalence or are completely absent in other seasons. Cloacal bacteria concentration seems to be associated with animal metabolism, so it is higher during the summer season and lower pre- and post-hibernation.

Studying the differences between cloacal swab and lavage reveal that the sensibility of the two methods is similar but we found that flushing is a better method because it allowed us to have quantitative, in addition to qualitative, results.

During the year we examined 3 tortoises with cloacitis. The bacterium isolated was always Pseudomonas aeruginosa. In one case it was associated with Proteus mirabilis. As a result, we can say that cloacitis is characterized by overgrowth of normal cloacal bacteria, which are opportunistic agents.

References


Food Intake in Leopard Geckoes (*Eublepharis macularius*) During the Reproductive Period

P. Koelle, Dr. med. vet., Priv. Doz., Cert. Spec. for Reptiles, Cert. Spec. for Fish (including Ornamental Fish), Cert. Spec. for Nutrition Consultation (Pets)

Session #142

Affiliation: From the Clinic for Small Animal Internal Medicine of Ludwig-Maximilians-University Munich, Veterinaerstrasse 13, D-80539 Muenchen, Germany.

Food intake of 8 adult leopard geckoes (3 male and 5 female specimens, 4-23 years old, average body weight: 45.2 g) was monitored during breeding season for a period of 30 days to investigate the maintenance feeding requirements of adult breeding leopard geckoes (*Eublepharis macularius*). The leopard geckoes were owned by a private keeper and kept in terraria with different temperature zones.

The animals were fed individually with forceps for the cockroaches (*Phoetalia pallida*) and kingworms (*Zophobas morio*). The kingworms were fed ad libitum on average every 4-5 days. Weender analysis procedure of the feeder insects was performed. Every insect was weighed before feeding it to the leopard geckoes before and after dusting with vitamin and mineral supplement (Korvimin ZVT®). Intake of wet weight was recorded. From these results intake of wet weight, dry matter, and caloric intake was calculated for each leopard gecko.

On average each leopard gecko ate 0.53 g insects/day (wet weight) and 0.22 g dry matter/day. Caloric intake was calculated at 36.0 kcal gross energy per leopard gecko per month. In both sexes food intake was significantly higher during the breeding season. It was higher in male specimens in comparison to female ones due to feeding gaps of several days before laying eggs in female leopard geckoes.

References

Water quality analysis is the single most important aspect of collecting a thorough history of ornamental fish and a similar emphasis should be placed on water quality of aquatic herptiles. Parameters commonly assessed in aquaculture include, but are not limited to: pH, temperature, total ammonia nitrogen, dissolved oxygen, and chlorine; each of which may negatively affect the health of inhabitants when not properly maintained. Monitoring the water quality of aquatic herptiles is a large portion of the patient history and is needed to form a complete assessment of the patient.
Axolotls for Amateurs: A Case Study of Surgical Gastric Foreign Body Removal in a Juvenile Mexican Axolotl

Marcie Logsdon, DVM

Session #172

Affiliation: From the Washington State University College of Veterinary Medicine, 205 Ott Rd., Pullman WA 99164, USA.

Abstract: A juvenile Mexican axolotl (Ambystoma mexicanum) presented for ingestion of multiple pieces of aquarium gravel. The presence of gastric foreign bodies was confirmed with transillumination of the coelomic cavity and radiographs taken with a dental radiography unit. Surgical removal of the gastric foreign bodies was successful. Immersion induction and branchial anesthesia was provided with alfaxalone. Recovery was uneventful. Despite its small size and aquatic nature, surgeries under general anesthesia can be safely and effectively performed on this species with equipment available in most veterinary hospitals.

Introduction

The Mexican axolotl (Ambystoma mexicanum) is an aquatic salamander that was originally introduced to the United States of America for use in research settings. Its neotenic and exclusively aquatic life cycle and its ability to regrow severed limbs make it a useful laboratory animal for many studies. It is also gaining popularity as a pet and many color morphs, including a genetically modified strain that contains the green fluorescent protein (GFP) are sold as pets by hobby breeders. These fascinating animals do occasionally present to veterinary clinics for treatment. When they do, special considerations for housing, anesthesia and surgery must be taken into account. However, most veterinary clinics already have the necessary equipment, or the means to improvise it, on hand. This clinical report outlines the diagnosis and treatment of a common presenting complaint in axolotls: multiple foreign body ingestion. It also discusses realistic tips and techniques for managing axolotls in a hospital setting.

Clinical Report

In June 2015 an immature Mexican axolotl (Ambystoma mexicanum) presented to the Washington State University Veterinary Teaching Hospital Exotics Department for probable foreign body ingestion. The owner had observed the axolotl swallowing a piece of aquarium gravel during feeding time. On physical exam the axolotl weighed 24 g and was missing all but the approximately 0.5 cm of the gills on its right side. This was an old injury likely sustained from other hatchlings. Transillumination of the coelomic cavity with a Finoff transilluminator yielded a large opacity in the vicinity of the stomach. Dental radiographs revealed multiple gastric foreign bodies (Fig 1). The patient was housed in dechlorinated water in a 1 L Tupperware® container in the refrigerator overnight at approximately 40°F in an attempt to decrease stress and possibly incite regurgitation of the foreign bodies.

The next morning a scant amount of feces was present, however, the axolotl had not regurgitated any of the gravel. Due to the small patient size, large number of foreign bodies, and high risk of esophageal or gastric perforation, endoscopic retrieval of the foreign bodies was not attempted and the decision was made to perform a gastrotomy.
Induction was performed by placing the axolotl into a small, 0.5 L container of his tank water containing alfaxalone (Alfaxan, Jurox Inc., Kansas City, MO, USA) at a concentration of 5 mg/L. Additional 10 mg/ml alfaxalone (Jurox) was titrated to the water directly over his gills to effect. Once the axolotl exhibited loss of the righting reflex it was moved to an improvised surgical table. The surgical table was created by inverting the lid of a small Kritter Keeper® over its base and lining it with saline-soaked gauze. This provided a moist surgery surface that would allow drainage and collect used anesthetic solution throughout the procedure. The patient was placed in dorsal recumbency with two pieces of rolled, saline-soaked gauze to help hold him in position. During the procedure branchial anesthesia was performed by manually irrigating the gills with alternating 5 mg/L alfaxalone (Jurox) solution and sterile saline to effect. Sterile saline was also applied continuously over the body to prevent desiccation during the procedure. A 30-U insulin syringe of full-strength 10 mg/ml alfaxalone (Jurox) was used as needed to apply direct brachial anesthesia. Depth of anesthesia was monitored by visual assessment of respiratory rate (gill flutters), heart rate (readily visible through the body wall), and responsiveness. The surgical site was prepped with a single pass of dilute chlorhexidine solution. A modified plastic sterile sleeve was placed over the patient and attached to the gauze using towel clamps.

An approximately 1.5 cm skin incision was made over ventral midline. The coelomic musculature and lining were elevated using thumb forceps and a small stab incision was made into the coelomic cavity. The incision was extended cranially and caudally to match the skin incision. Stay sutures of 6-0 Polyglactin 910 (Vicryl,
Ethicon, Inc., Summersville, NJ, USA) were placed full-thickness to aid in retraction. A sterile microswab was moistened with sterile saline and bent into a hook to exteriorize the stomach. The stomach was packed off and isolated from the coelomic cavity using moistened, sterile swabs. Additional stay sutures of 6-0 Polyglactin 910 (Ethicon) were placed in the stomach as well. An approximately 1 cm incision was made into the stomach and the ingested rocks were removed using DeBakey forceps. Two intraoperative dental radiographs (Figs 2 and 3) were taken to ensure that all rocks were removed. The entire surgical platform (Kritter Keeper® lid) was easily covered with a sterile plastic sheet and transported en bloc to the dental radiography unit while maintaining sterility of the surgical field. A total of 15 rocks varying in size from 3 mm to 1 cm were removed. The stomach was closed using 6-0 Polyglactin 910 (Ethicon) in a simple continuous pattern with a Lehmber over sew. A single layer closure of the coelomic membrane, musculature, and skin was performed in a simple continuous pattern using 6-0 Polyglactin 910 (Ethicon).

Figure 2. Intraoperative radiographs showing multiple foreign bodies remaining. The radiopaque strip in a piece of detectable gauze is visible as well as the line providing branchial anesthesia and a pair of hemostats that are in place holding stay sutures.
Post-operatively the patient was administered 0.23 mg enrofloxicin (Baytril, Bayer Healthcare LLC, Animal Health Division, Shawnee Mission, Kansas, USA) and 1.5 µg buprenorphine (buprenorphine hydrochloride, Par Pharmaceuticals, Cos. Inc., Spring Valley, NY) intramuscularly in the tail. The patient was recovered in dechlorinated water over a period of approximately 30 minutes.

After recovery the patient was maintained in a 1 L Tupperware® container housed in a mini-fridge with temperatures ranging from 40-50°F. Excluding the first day post-surgery, enrofloxicin (Baytril 100, Bayer Healthcare LLC, Animal Health Division, Shawnee Mission, Kansas, USA) baths of 0.3 mg/L were performed once daily for approximately three hours for four days. On Day five the patient was moved to a 10-gallon aquarium containing dechlorinated water and was allowed to warm to its preferred optimum temperature range (POTR) of approximately 64-69°F. While in hospital this temperature was maintained by twice daily rotation of cold packs that kept the temperature within the necessary parameters and also provided a gradient effect. The cold packs were made of 1 L sterile saline pour bottles filled with dechlorinated water. The patient’s appetite returned shortly after cessation of fridging. The patient’s incision healed without incident and the sutures were removed.
approximately 8 weeks post-surgery using manual restraint. This clinical report demonstrates the ability to provide an excellent standard of care for aquatic salamanders with equipment and supplies that are readily accessible to most practicing veterinarians.

References


Evaluation of Photobiomodulation in the Treatment of Epithelial Trauma in the Green Iguana (*Iguana iguana*)

Lara Cusack, DVM,
Joerg Mayer, DVM, MS,
Daniel Cutler, DVM,
Daniel R. Rissi, DVM, MS, PhD,
Stephen Divers, DZooMed

**Session #194**

*Affiliation:* From the University of Georgia, College of Veterinary Medicine, Department of Small Animal Medicine and Surgery, 2200 College Station Rd, Athens, GA 30602, USA.

The efficacy of photobiomodulation and topical therapy in the treatment of epithelial trauma in the green iguana (*Iguana iguana*) was evaluated. Sixteen healthy, sub adult green iguanas were used for the study. Under anesthesia, 3 5-mm epithelial biopsies were taken from each animal. Animals were divided into 2 treatment groups. Topical therapy wounds received either silver sulfadiazine (SSD), Tricide™, or no treatment. Laser therapy wounds received treatment with a class 4 laser at either 5 J/cm², 10 J/cm², or no treatment. Wound measurements were obtained daily for 14 days. Animals were euthanatized and the treatment sites were evaluated microscopically for ulceration, inflammation, fibrosis, presence of bacteria, and collagen maturity. At the time of submission, final statistical analysis was not completed. Final results to be discussed at the time of presentation.
Effects of a Novel Light Emitting Diode on the Production of 25-hydroxycholecalciferol in the Bearded Dragon (*Pogona vitticeps*)

Lara Cusack, DVM, Sam Rivera, DVM, MS, Dipl ABVP (Avian), Dipl ACZM, Brad Lock, DVM, Dipl ACZM, Stephen Divers, BVetMed DZooMed, Dipl ECZM (Herpetology), Dipl ECZM (Zoo Health Management), Dipl ACZM, FRCVS

**Session #197**

Affiliation: From the University of Georgia College of Veterinary Medicine, Department of Small Animal Medicine and Surgery, 2200 College Station Rd, Athens, GA, 30602, USA (Cusack, Divers), and the Department of Animal Health, Zoo Atlanta, 800 Cherokee Avenue SE, Atlanta, GA 30315-1440, USA (Rivera, Lock).

The requirement for vitamin D has been documented in multiple reptile species, with deficiencies resulting in alterations in calcium homeostasis, nutritional secondary hyperparathyroidism, and metabolic bone disease. Though vitamin D3 can be obtained directly from dietary sources or from photobiosynthetic production, there exists species variability in the absorption and utilization of oral vitamin D, making exposure to ultraviolet B radiation an essential requirement for some species. The effect of different lights to promote synthesis of 25-hydroxycholecalciferol (25(OH)D) and cholecalciferol in the bearded dragon (*Pogona vitticeps*) was evaluated. Groups containing 5 animals each were exposed to industry standard fluorescent UVB lights, no UVB lights, and a prototype LED UVB light for a period of 11 months. Weekly measurement of UV output of the lights was performed. Cholecalciferol, 25(OH)D, ionized calcium, total calcium, and phosphorus were measured at time zero, at four months, eight months, and 11 months. Radiographs were taken at each time point to evaluate bone density. Parameters were measured between groups and time points. At the time of submission, final statistical analysis was not completed. Final results will be discussed at the time of presentation.