EXOTIC ANIMALS MEDICINE
INVITED SPEAKERS PROCEEDINGS
EMERGING ISSUES OF AUSTRALIAN HERPETOFAUNA - CAPTIVE AND WILD, WHAT’S THE DIFFERENCE?

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Introduction

In Australia, as in the UK, Europe and North America, reptile keeping is growing rapidly as a hobby and as a serious business enterprise. Consequently, veterinarians with an interest in reptiles are increasingly being asked to give advice on a wide range of issues apart from the treatment and care of pet reptiles. In addition to pet-based practice clinicians may be asked to provide advice for AECs (Animal Ethics Committees), researchers, zoos and herpetologists. Such individuals or institutions assume that veterinarians will have experience handling and treating a wide range of species. The author has been involved in field research both within and outside Australia and will explain handling and sampling techniques that have been adapted for the great variety of species seen in his practice in Sydney, Australia. In particular, handling techniques adapted for Australian elapids, DNA and blood sampling techniques for rare species and husbandry methods for hospital care will be highlighted. Emerging diseases in Australia such as Ferlavirus and Sunshine virus infection in pythons, Adenovirus infection of bearded dragons and the CANV (*Chrysosporium anamorph of Nannizziopsis vriesii*) will also be discussed.

Emerging diseases

Adenoviral infection in bearded dragons

Adenoviral infection in bearded dragons was first reported in New Zealand in the early 1980's; a little over a decade later it was reported in the USA and is now considered endemic in that country. Recently an outbreak of the disease in a breeding collection of bearded dragons was reported in Australia. Lizards aged from 6-10 weeks were presented with neurological signs, poor growth and occasional death. A histological diagnosis of adenoviral infection was made based on the presence of the intranuclear inclusion bodies and hepatic necrosis. Anecdotal reports of multiple young lizards with neurological signs suggest that adenoviral infection in bearded dragons may be more widespread than previously reported.

Sunshine virus – a novel paramyxovirus found in Australian snakes

In 2008, an outbreak of neuro-respiratory disease in a collection of 70 Australian pythons from the Sunshine Coast of Queensland was reported. Histological findings in snakes that had died were consistent with a paramyxoviral infection. This was confirmed by PCR analysis. However, phylogenetic analysis of this paramyxovirus identified it as a distant
relative to the proposed ferlavirus genus. This new paramyxovirus was tentatively named Sunshine virus, after the geographical location of the first isolate. Developed at Murdoch University, Western Australia, the PCR testing for this virus has been successfully used to detect Sunshine virus in cloacal swabs, oral swabs, combined cloacal-oral swabs, brain, lung, liver, kidney and formalin-fixed paraffin-embedded archival tissues.²

**Yellow fungus disease in bearded dragons**³

In 2008-2009 an outbreak of deep fungal dermatitis was reported in four captive Coastal bearded dragons, *Pogona barbata*, in an outdoor enclosure in a zoo in Australia. PCR on cultured fungus confirmed the genus as *Chrysosporium* sp. in one case. As a result *Chrysosporium* anamorph of *Nannizziopsis vriesii* (CANV) infection was thought to be the cause of death in all four animals. A separate case of CANV infection was diagnosed in a “wild caught” pet Coastal bearded dragon. These are the first reports of the CANV in terrestrial reptiles in Australia, and the first reports in *P. barbata*.

**Marine turtles**

Seven species of marine turtles occur worldwide, six of which occur in Australian waters. One of these species, the Flatback (*Natator depressus*), is endemic to Australian tropical continental shelf waters while the other five occur throughout the world including breeding populations in Australia. New South Wales (NSW) populations of marine turtles appear to belong to a single eastern Australian stock for each species. Six marine turtle species have been recorded in NSW, the Loggerhead, Green, Leatherback, Hawksbill, Olive Ridley and Flatback turtles.

**Coccidiosis**⁴

Coccidiosis in free-living green turtles (*Chelonia mydas*) was first described in 1991, from an epizootic affecting large subadult and pubescent animals in south-east Queensland and northern NSW.⁶,⁷ Subsequent epizootics and sporadic cases have been recorded in Queensland and NSW.⁷,⁸ The organism responsible, *Caryospora cheloniae*, is a coccidian in the Phylum Apicomplexa, Family Eimeriidae. Coccidiosis in free-living green turtles results in both sporadic mortalities and epizootics. The disease appears to be enzootic in the Moreton Bay region of south-east Queensland, with relatively unknown factors predisposing the population to epizootics.⁷ There is an apparent seasonality to coccidiosis in free-living *C. mydas*, with most cases recovered during the warmer months of September to February.⁷,⁹ Drought conditions have been speculatively linked with epizootics. Consequently, algal blooms of *Trichodesmium erythraeum* in seagrass beds could allow a heavy build-up of infective stages of the coccidian parasite in the seagrass feeding grounds.⁸

**Trematodes moving south**

The incidence of pathogenic trematodes in marine turtles appears to be increasing in turtles in the more southern Australian waters (K Rose, pers comm).
Myxozoan parasites in captive and free living frogs\textsuperscript{10,11}

Recently Myxozoan parasites have been found in several threatened species of Australian frogs, including \textit{Litoria castanea} and \textit{L. booroolongensis}. Researchers have postulated upon the potential role that these parasites may play in wild and captive populations of declining frogs worldwide.

References

A nearly 9-year-old male bearded dragon, 267g body weight, was presented to the clinic because of problems with breathing for the last two weeks. Physical examination revealed a low activity, a moderate reduced nutritional status and a stomatitis. Radiography showed no abnormalities. Blood analysis revealed a low total protein (TP=28 g/L) concentration.

A faecal sample at the local clinic showed mild oxyurids and mild non-specific coccidia. The bearded dragon received fluid infusions with vitamins, marbofloxacin, meloxicam and forced feeding. The therapy of stomatitis was done with chlorhexidin, gentamicin- and heamodialysate ophthalmic ointment. Coccidia were treated with toltrazuril, while the oxyurids were not treated.

After three months, the animal reappeared with a subcutaneous abscess due to mild to moderate Pseudomonas aeruginosa. Anaesthesia was performed using butorphanol and alfaxalon. The abscess was surgically removed and the animal received marbofloxacin according to the antibiogramm, meloxicam and fluid therapy. This time, the faecal examination at the local clinic revealed severe flagellates, which were treated by metronidazole.

After one year, the bearded dragon visited the clinic again. The physical examination showed severe dehydration, an anaemic oral mucosa, a moderate reduced nutritional status, a low activity and crusts in both corners of the mouth. An examination to detect Devriessea agamarum was negative. Blood analysis showed a low packed cell volume (PCV= 0,17 L/L), a low uric acid (UA= 71,38 μmol/L) concentration and an elevated concentration of glucose (Gluc = 36,5 mmol/L). A faecal sample at the local clinic revealed severe oxyurids, severe flagellates and mild non-specific coccidia. The faecal sample was also submitted to the Institute of Parasitology and revealed severe oxyurids, moderate nyctotherus and severe choleoeimeria. Oral treatment consisted of 2 cycles of fenbendazole, metronidazole, toltrazuril, calcium, forced feeding and a probiotic. The bearded dragon also received cloacal flushings, subcutaneous fluid infusions and marbofloxacin. The therapy of Choleoeimeria was based on sulfonamide, but without positive effect.

This is the first report of choleoeimeria in a bearded dragon in Austria. It describes the difficulties in diagnosis and treatment of these parasites.
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A 4-year-old female bearded dragon, 264g body weight, was presented to the clinic because of diarrhoea, anorexia and apathy for the last 6 days. The physical examination revealed a low activity, cachexia, dehydration and a mild anaemic oral mucosa.

The animal was hospitalized. Radiography showed gas in the colon. A faecal examination revealed moderate trichomoniasis. Plasma chemistry analysis showed elevated phosphorus (P=2.27 mmol/L) and uric acid (UA=333.09 μmol/L) concentrations. Haematological analysis revealed a leucocytosis (tWBC=150x10³/μl) with 20% of heterophils, 19% of monocytes and over 50% of lymphoid round cells, leading to the diagnosis of leukemia or lymphoma stage V.

The supportive therapy consisted of subcutaneous fluid infusion, cloacal flushing, bathing, marbofloxacin, meloxicam, metronidazole and forced feeding. Despite this supportive treatment, the bearded dragon’s condition deteriorated until she died after 10 days.

Necropsy confirmed cachexia, anaemia, necrotising colitis and a malignant lymphoma (in liver, kidneys and lungs) with leukemia.

This is the first reported case of malignant lymphoma with leukemia in a bearded dragon in Austria.

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CHELONIAN ENDOSCOPY

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Endoscopy has been used diagnostically for over twenty years in reptiles, although more detailed descriptions and objective evaluations have only recently been conducted. For chelonians, endoscopy of the coelom (coelioscopy) and the cloaca (cloacoscopy) has reduced the need for more invasive surgical approaches such as plastron osteotomy. Endoscopy should be performed under adequate levels of sedation, local anesthesia, or general anesthesia, depending on the extent of the procedure. Rigid endoscopes in the range of 1.9 to 10mm diameter are used for chelonians depending on the size of the patient. Flexible endoscopes are of use for examination of the gastrointestinal, urinary, and respiratory tracts. Insufflation of the coelom may be needed for some procedures, but many procedures can be accomplished without insufflation. In some cases, the surgeon may choose to use sterile saline for insufflation.

Esophagoscopy, gastroscopy, and tracheoscopy are accomplished per os as in other species. Flexible or rigid endoscopes may be utilized depending on the size of the patient. Adequate sedation and a secure oral speculum are required to avoid damage to the endoscope, as many turtles have very powerful jaws. The esophagus of most turtles is fairly smooth, while that of marine turtles is lined with keratinized papillae that may damage some endoscopes. Use of an overtube for marine turtles may be prudent. The esophagus of turtles generally passes down the right side of the neck prior to turning sharply left into the stomach. Navigating this turn can be difficult, and requires patience and gentle manipulation. In the author’s experience, traversing the pylorus in turtles is very difficult and has not yet been achieved. Endoscopy of the trachea can be done through an endotracheal tube for larger specimens, but may need to be done by direct insertion of the endoscope into the trachea for smaller specimens. The tracheal bifurcation can be visualized, and depending on the size of the turtle and endoscope, the bronchi and anterior lung field can be examined. Distal bronchial lavage is useful for collection of cytologic and microbiologic specimens.

For coelioscopy, the turtle is positioned with consideration of normal chelonian anatomy and the goals of the procedure. For best visualization of more dorsal organs such as the lung, gonad, or kidney, positioning the patient in lateral or oblique recumbency may be useful. Laparoscopic-assisted oophorectomy of chelonia has been performed with the patient in dorsal recumbency. The hind limb of the turtle is positioned in extension to expose the pre-femoral fossa, and a craniocaudal skin incision is made in the center of the pre-femoral fossa. An inappropriately located incision may result in exposure of the anterior femur, posterior surface of the kidney, lung, or pelvis, or may simply result in tunneling along the carapace or plastron. The size of the incision is dependent on the goal of the procedure. Longer incisions often provide better visualization of the coelomic aponeurosis, resulting in faster access to the coelom, and less frustration for the surgeon. The subcutaneous connective tissue and fat are
dissected to expose the tendinous aponeurosis of the transverse and oblique abdominal muscles, and the aponeurosis and coelomic membrane are incised to enter the coelom. Some surgeons prefer to use blunt dissection for much of the pre-femoral approach, including blunt penetration of the aponeurosis and coelomic membrane, but the author prefers a combination of blunt and sharp dissection, with incision of the aponeurosis and membrane made sharply under direct visualization. In the author’s experience, blunt methods may fail to penetrate the coelomic membrane, resulting in an obscured endoscopic examination. If properly performed, incision of the membrane and introduction of the endoscope into the coelom should result in a perfectly clear view of the viscera. Closure of the coelomic aponeurosis and peritoneum is performed using absorbable suture in a simple interrupted or continuous pattern. Skin closure may be performed using suture or skin staples. In very small turtles with very small incisions, incisions may be closed with surgical tissue glue. Full access to water may be provided for aquatic turtles 24-48 hours after coeliotomy. Skin healing is often complete within 4 – 8 weeks. Coelioscopic or cystoscopic examination of the gonad may provide accurate gender identification in sexually immature turtles. Immature follicles are visible on the ovary of immature females of most chelonian species, while the testicle tends to be smoother and more vascular. Management of retained eggs, ectopic eggs, oviduct prolapse, elective oophorectomy and orchiectomy can be achieved using endoscopic methods. Eggs that are positioned within the pelvic canal or distal oviduct may be visualized and manipulated by cloacoscopy. Infusion of saline through the infusion/instrument port of the otoendoscope or endoscope dramatically enhances visualization by distending the cloaca. Using similar techniques, egg removal from the chelonian bladder has been successfully performed per cloaca.

References


In captive reptiles, the most frequent complications of reproduction seen in veterinary clinical practice are: low sexual activity in females and/or males, very aggressive behaviour of males during the mating period (biting females and aggressive attacks to the reptile owners), extremely high activity of female reptile ovaries (POFS, pre ovulatory follicle syndrome) and egg binding syndrome (POES, post ovulatory egg stasis).

In veterinary practice with reptiles surgical ovariectomy has been commonly used to treat or to prevent the POFS in captive female lizards. In female chelonians, classical surgical approach to treat broad spectrum of reproductive tract diseases (e.g. oophoritis, salpingitis, follicular stasis, retained eggs, dystocia, ectopic eggs, and oviduct prolapse) have been based on transplastral osteotomy. New advanced methods have been established and presented for clinical use recently. Minimal-invasive method of pre femoral coelioscopic-assisted oophorectomy in chelonian females has been established by INNIS and his team in 2007 (INNIS et al. 2007). Similar method for coelioscopic orchiectomy has been performed by INNIS and his co-workers in 2013 in a group of male turtles by (INNIS et al. 2013).

Concurrently with the continual development of modern minimally-invasive surgical methods, advanced non-surgical techniques for management of reproduction in reptiles have been performed (KIRCHGESSNER at al. 2009, KNEIDIGER 2009). The important prerequisite for any study focused on successful hormonal management of reptile reproduction in captivity is to understand of how gonadal activity in reptiles is regulated by the hypothalamus-pituitary-gonadal axis and other hormones (PHILLIPS et al. 1987). Multiple molecular forms of GnRH are present in the reptilian brain (LANCE 1998). Chicken-II GnRH (cGnRH-II) has been found in lizards along with chicken-I (cGnRH-I), salmon (sGnRH), and several uncharacterized GnRH-like molecules. Implantation of osmotic pumps containing chicken II (cGnRH-II) analogue or mammalian GnRH I induced a five-fold increase in plasma estrogens and elicited receptive behaviours in female iguanas: this chicken hormone was about twice as potent as the mammalian form. While both FSH-like and LH-like hormones have been found in chelonians and crocodilians, only FSH-like variants are detectable in squamate reptiles. However, some reptiles have at least a small portion of LH-producing cells in the adenohypophysis and may respond exogenous treatment with FSH or LH in similar fashion. Reproductive activity in female lizards is associated with increases in circulating concentrations of the primary sex steroids: 17-β oestradiol (E₂), testosterone (T) and progesterone (P₄). The androgen testosterone (T) is important as a precursor for oestrogens and has a wide biological significance in reproductive activity of females. Plasma concentrations of T vary significantly through the female reproductive cycle.
and exhibit an apparent surge in association with ovulation (BENTLEY, 1998). The follicular phase is characterized primarily by the production of oestrogens by the developing follicles, while $P_4$ is produced by the corpora lutea during the post-ovulatory phase. Weiss et al. (2002) found that oestradiol concentration in plasma of reproducing female lizard peaks during vitellogenesis, and declines after ovulation. Peak plasma concentrations of $E_2$ precede ovulation, and the ovulatory surge is stimulated via a positive feedback action of $E_2$ at the level of the hypothalamus. Following ovulation a corpus luteum, the site of formation of progesterone ($P_4$, BENTLEY, 1998), is formed. Ovulation marks the transition from the oestrogen-dominated follicular phase to the progesterone-dominated luteal phase. The difference between ovulatory and anovulatory cycles appeared to be associated with $P_4$. In ovulatory cycles, a marked increase in $P_4$ was noted at the time when $E_2$ was declining and $T$ increasing, whereas in anovulatory cycles, $P_4$ peak maximum values were significantly lower than in ovulatory cycles (KUMMROW et al. 2010b). In veiled chameleon females three main reproductive stages were identified by the use of magnetic resonance imaging method: the previtellogenic stage (with the absence of visible follicular structures); the vitellogenic stage (with the presence of round follicular structures); and the gravid stage (with the presence of eggs in oviducts). The reproductive cycle length from oviposition to oviposition is about 112 – 152 days (KUMMROW et al. 2010a). In a group of captive chameleon females $E_2$ rose during vitellogenesis stage and peaked in late vitellogenesis period, $P_4$ rose during the late vitellogenic stage, peaked in mid-gravidity and fell to baseline values at oviposition. $T$ levels varied during the pre- and vitellogenic stages, and then mirrored $P_4$ with a distinct peak during the time of ovulation and gravidity (KUMMROW et al. 2010a). Ovulation did occur with the decreasing estrogen:progesterone ratio. The influence of the first anovulatory ovarian cycle on the outcome of the subsequent cycle in female veiled chameleons is supposed. Several females underwent ovulatory cycle after one or even two anovulatory cycles. It was observed that about 50% female veiled chameleons that did not lay eggs through the normal reproductive period contained large masses of ovarian follicles at the time of necropsy or ovariectomy, some of which were atretic based on histopathologic examination (KUMMROW et al. 2010b). In a study by NOUEL (2005) the concentrations of steroid hormones in plasma of female green iguanas were measured, investigating a relation to POFS. The proximate stimulus for the induction of vitellogenesis was the presence of circulating estrogens, produced by the ovary from the maturing follicles. Ovarian development and vitellogenesis were associated with elevated plasma concentrations of oestradiol and upregulation of hepatic oestrogen receptor would signal readiness for vitellogenesis. High plasma $E_2$ concentrations in vitellogenic female green iguanas were associated with mobilization of maternal reserves to fuel vitellogenesis; this was evidenced by high plasma levels of calcium, phosphorus, phospholipids, cholesterol, triglycerides, and proteins. Insertion of silastic implants containing $E_2$ into non-reproductive females resulted in mobilization of reserves as seen in vitellogenic females. Similarly, exogenous $E_2$ induced hypercalcemia, hyperproteinemia, and liver hypertrophy in ovariectomized lizards.

In companion exotic animal practice, different experimental projects have been done to manage reproductive disorders (e.g. to stimulate or to suppress effectively sexual activity, to improve a quality of semen for artificial insemination, to decrease a percentage of embryonic

In the study of KNEIDINGER (2010) a group of female green iguanas received deslorelin implants whereas control females have only been sham operated. All females were housed together with males to meet the requirements for active reproduction. Blood samples were collected from the females within the period of reproductive season. The steroid hormone concentrations of $P_4$, total oestrogens (unconjugated 17β-oestradiol and oestrone combined), T and androstenedione in plasma were measured by using competitive enzyme immunoassays (EIAs). The females were closely monitored, and the state of reproduction was also controlled by radiography to detect follicles. In females of the control group $E_2$ reached a peak during vitellogenesis (1.16 nmol/l), $P_4$ reached a peak in late gravidity (12.75 nmol/l). Testosterone displayed a maximum during vitellogenesis (1.50 nmol/l). Androstenedione showed two surges, the first correlated with oestrogens and testosterone, the second surge occurred after oviposition (maximum at 1.61 nmol/l). In females with implants that did not show any reproductive activity oestrogens and progesterone fluctuated only slightly ($E_2 0.06 – 0.40$ nmol/l; $P_4 0.00 – 1.75$ nmol/l). Testosterone ranged between 0.28 nmol/l and a maximum of 2.04 nmol/l. Androstenedione demonstrated two peak values and reached from 0.09 – 3.70 nmol/l. The females that laid eggs had a peak for oestrogens progesterone during vitellogenesis and late gravidity, respectively. No similar increases have been observed in the females with GnRH implants.

The aim of previous study with captive male green iguanas was to evaluate the effect of mammalian leuprolide acetate, a synthetic GnRH agonist (0.2 and 0.4 mg/kg IM) on the testosterone levels (KIRCHGESSNER et al. 2009). This treatment did not reduce the male testosterone levels, but it has been speculated that leuprolide acetate would be more effective if administered prior to the breeding season. In the present study (GRUNDMANN et al. 2013) deslorelin implants were used to suppress the male sexual behaviour and plasma hormone levels in captive male green iguanas. The implants were administered during the expected quiescent reproductive phase. The sexual behaviour and plasma testosterone levels have been not suppressed by deslorelin implants and seasonal dynamism of gonadal activity expressed as significant differences in plasma testosterone concentrations have been detected for all male green iguanas.

The results of studies with green iguana females, green iguana males, veiled chameleon females and female red-eared terrapins indicate:

- In reptiles, the function of endocrine system is strongly influenced by environmental cues. Temperature and/or photoperiod are the environmental factors most likely to be involved. In seasonally breeding reptiles, there may be a refractory period during which the ovary is unresponsive to environmental cues. However, in captivity under high temperatures and long days, breeding activities in female green iguanas initiated
in similar period of the year like as in nature conditions. GnRH implant could temporarily suppress the female green iguana reproductive endocrine system, inhibiting development of follicles and production of gonadal hormones (oestrogens and progesterone), preventing reproductive activity.

- GnRH implant did not influence the male green iguana reproductive/aggressive behaviour and plasma testosterone levels.
- In female chameleons, high temperatures, long days and high energy diet can initiate the breeding activity earlier and maintained for longer than environmental conditions permit in the field. GnRH implant did not suppress effectively the female veiled chameleon reproductive activity.
- Stress and social conditions, including sexual composition of the group and male reproductive status, would influence ovarian activity in captive red-eared terrapins.

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The aim of the present study was the suppression of the reptile reproduction activity using the GnRH agonist deslorelin (Suprelorin® 4.7 mg). In many species it suppresses the pituitary-gonadal-axis activity and leads to reduced reproduction activity including the male sexual behaviour and plasma hormone levels.

Subject to this study were captive male green iguanas (Iguana iguana). Prior to the experiment, blood samples were collected from thirteen adult healthy iguana males twice within their quiescent reproductive phase (May, June). Plasma concentrations of testosterone (T) were measured using a competitive enzyme immunoassay (EIA), validated by using a high performance liquid chromatography assay (HPLC). The GnRH implants were administered subcutaneously to eight iguana males (experimental group A). Five iguana males were sham operated (control group B). All animals (A, B) were kept under experimental conditions, separated but together with an adult healthy female. The aggressive and/or sexual behaviour of iguana males was observed daily. Blood samples for hormone analyses (T) were collected during the expected active mating period (September, October, December, February) and in refractory period (July).

The sexual behaviour of male green iguanas A and B was comparable and did not differ significantly within the study. A typical rhythm of gonadal activity expressed as significant differences in plasma T concentrations was detected for all adult male green iguanas (A, B) in accordance with the seasonal type of reproductive activity. However, plasma T concentrations in group A did not differ significantly from T concentrations in group B within the whole study.

These observations are different from previous results with GnRH implants in adult female green iguanas. Further investigations are therefore needed to determine the reasons for different reaction of female versus male green iguanas to GnRH implants.

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OVARIAN PATHOLOGY IN FEMALE VEILED CHAMELEONS

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The most common health complications observed in captive female veiled chameleons (Chamaeleo calyptratus) are related to pathology of reproduction (KNOTEK et al. 2008). Young females seem to be particularly prone to dystocia and pre-ovulatory follicular stasis (POFS, CUADRADO et al. 2002, KNOTEK et al. 2008, KUMMROW et al. 2010b). Three main reproductive stages identified in veiled chameleon females by the use of magnetic resonance imaging method were: the previtellogenic stage (with the absence of visible follicular structures); the vitellogenic stage with the presence of round follicular structures, and the gravid stage with the presence of eggs in oviducts (KUMMROW et al. 2010a). The reproductive cycle length from oviposition to oviposition is about 112 – 152 days (KUMMROW et al. 2010a). Female veiled chameleons suffering from the classic form of POFS are typical with highly elevated concentrations of calcium ions and phosphorus. The close contacts of the female chameleon with the male or the preventive surgical therapy (e.g. ovariectomy) are the two most common options recommended for the effective management of POFS in veterinary clinical practice.

The aim of the present study was to investigate the ovarian pathology in two groups of two–to three years old female veiled chameleons kept under the same experimental conditions (UVB lighting, optimal temperature and air humidity regime, feeding). Within the study period of three years (2010-2013), in intact females (group A) that have died necropsies have been performed to analyze their ovarian pathology as well as the morphology of the other organs. Females of the group B underwent surgical treatment (ovariectomy) because of weakness and chronic body weight loss, anorexia, unusual results of plasma chemistry assays and apathy. Blood cell counts, white blood cell differentials, hematocrit, plasma concentrations of haemoglobin, total plasma protein, glucose, uric acid, bile acids, calcium and phosphorus were determined.

The most common finding observed on ovaries in the both female veiled chameleon groups was the chronic form of ovarian inflammatory disease (oophoritis).

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Seven species of marine chelonians exist at present: the loggerhead turtle (Caretta caretta), the leatherback turtle (Dermochelys coriacea), the green turtle (Chelonia mydas), the flatback turtle (Natator depressus), the hawksbill turtle (Eretmochelys imbricata), Kemp’s ridley turtle (Lepidochelys kempii), and the olive ridley turtle (Lepidochelys olivacea). Marine turtles live in tropical to temperate zones of the oceans across the globe, and often undergo extensive seasonal migrations for foraging and reproduction. Female marine turtles lay several large clutches of eggs on warm beaches, often on biannual to triannual cycles. Except for nesting forays, adult marine turtles do not leave the ocean once they have hatched from their eggs. All marine turtle species are threatened or endangered at this time. While there are some natural factors that affect sea turtle populations, the major threats to sea turtles are anthropogenic. Nesting habitat is reduced due to human development of nesting beaches. Many sea turtles are accidentally captured by fishing nets, entangled in fishing ropes, and caught on longline fishing hooks each year. Sea turtles are often hit by boat engine propellers. Toxins generated by humans, such as heavy metals and pesticides are present in marine turtles, and may be affecting reproduction and immune response. In some areas, turtle eggs and adult turtles are illegally harvested for food. Oil spills have also affected sea turtles in some areas.

As a result of the above factors, marine turtles are often found debilitated at sea or stranded on beaches. Such turtles may be brought to rehabilitation centers that provide veterinary care in hope of later releasing the animal back to the wild. Sea turtles are often resilient patients, and rehabilitation of turtles can be a rewarding experience. Facilities should ensure that they obtain the necessary legal authorization within their state, country, and region, in order to work with marine turtles. The level of facility sophistication may vary based on location and budget, but facilities must at minimum be able to provide clean seawater, adequate space, appropriate food, and appropriate therapy for turtles.

Initial assessment of marine turtles includes standard principles of physical examination. The respiratory rate is observed, heart rate is documented by Doppler, ultrasound, or ECG; and cloacal temperature is obtained. A systematic physical exam is conducted for all major body systems. Limited palpation of viscera may be accomplished via the pre-femoral space. Injuries are documented, hemostasis is achieved, and fractures are temporarily stabilized. Turtles that are apneic should be intubated and ventilated with oxygen or air. Bradycardia is often responsive to atropine. Fluid therapy and other supportive care are best selected based on assessment of blood data, but can be selected in the absence of data if it is not available. Commonly used fluids include lactated ringer’s solution, saline, or other balanced electrolyte solutions, most commonly delivered subcutaneously. Other drugs that may be used initially based on clinical findings include sodium bicarbonate, doxapram, potassium chloride.
furosemide, calcium gluconate, analgesics, and antimicrobials. Commonly used analgesics include morphine, butorphanol, buprenorphine, tramadol, meloxicam, carprofen, and flunixin meglumine. Doses for these drugs are not well established by pharmacokinetic studies, and are often selected based on clinician experience. Antimicrobials are generally selected to provide coverage against common gram negative bacterial infections, based on fairly robust pharmacokinetic data. Commonly selected drugs include third generation cephalosporins, aminoglycosides, advanced penicillins, and quinolones. Gram positive infections, when diagnosed by culture, are often managed with ampicillin or amoxicillin/clavulanate. Fungal infections, such as fungal pneumonia are common in sea turtles thus many clinicians also select antifungal therapy most often including itraconazole or terbinafine.

Standard diagnostic techniques can be used for marine turtles. Blood can be collected from the external jugular vein, and used for hematology, plasma biochemistry, blood gas analysis, blood culture, etc. Fecal samples may be examined for parasites. Cytology of exudates, wounds, etc. can be performed. Tracheal wash is useful for assessment of pneumonia. Dorsoventral, lateral, and anteroposterior radiographic views are very useful for assessment of the lungs, GI tract, foreign bodies, and skeletal system. Ultrasound, CT, MRI, and endoscopy are used routinely when available. GI contrast studies, iohexol clearance tests, and nuclear scintigraphy methods have been described.

Anesthesia is most commonly induced in marine turtles with propofol, or a combination of dexmedetomidine and ketamine, delivered intravenously. Anesthesia is maintained via intubation and ventilation with sevoflurane or isoflurance. Local anesthesia with lidocaine is useful for some procedures. Anesthetic recovery may take several hours. Common surgical procedures in marine turtles include removal of foreign bodies, tissue biopsy, fracture repair, reproductive management, and excision of fibropapillomas. Standard sterile surgical methods are used. Access to the coelom for gastrotomy, enterotomy, etc. is most often achieved via the pre-femoral space, but axillary approaches have also been described. Long bone fractures are repaired using standard methods such as circlage, external fixation, pins, or plates. Many methods for shell fracture repair have been described, but in principle any method must provide apposition, stability, and visibility for assessment. Wires, hooks, plastic strips, tape, fiberglass, acrylic, epoxy, etc. may all be successfully utilized.

Fibropapillomas are associated with a herpesvirus. They can be fatal if they affect large parts of the turtle’s body. Excision is variably successful. Cold-stunned (hypothermic) marine turtles may be found seasonally in some regions. They are managed by gradual warming over several days, stabilization of metabolic status, and management of secondary problems, such as pneumonia.

References

PAECILOMYCES INFECTION IN A HERMANN'S TORTOISE: A STUDY CASE

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Presented case deals with a case of adult female Hermann's tortoise (Testudo hermanni), which was presented to the clinic with a history of refusing food, with very restricted activity and bilateral enophthalmus. Palpation through the cloaca revealed the presence of solid substances on the left and right side of caudal coelom. Radiographic examination confirmed the limited range of the right lung field, flatulence and contents in the digestive tract. Blood tests established anaemia with leucopenia, hypoglycemia, and hypophosphatemia. Conservative therapy, consisted especially in rehydration and parenteral nutrition, was performed for two weeks. Examination using computed tomography revealed a consolidation of middle and caudal part of the right pulmonary lobe, dense spherical mass in the cranial part of the right lung pulmonary lobe and hepatomegaly with the presence of multiple hyperdense spherical substance in the hepatic parenchyma. Part of these substances was surgically removed and designed for laboratory examination. Histological finding was granulomatous mycotic hepatitis with hyperplasia of melanomacrophage centers. Bacteriological findings from granulomas were negative, mycological examination revealed pure colonies of fungi of the genus Paecilomyces. There are discussed the factors of etiology and possible treatment options of granulomatous mycotic hepatitis.
Green iguanas are common pets. Adult animals usually live in bad conditions, outside of terrarium. Too low temperature and humidity and inadequate diet are the main causes of chronic renal failure, renal secondary parathyroidism and gout.

Ill animals become depressed and eat less, or are anorectic. Signs of hypocalcemia such as muscle tremors (digits and large muscles), seizures and tetany are common. Enlargement of kidney causes difficulty in defecation, less often stranguria. We can observe paralysis of hind legs and tail. Enlarged kidneys are well palpated via cloaca. In biochemical test one can very often observe increase of plasma phosphorus. In acute renal diseases calcium is normal or increased, in chronic renal diseases this is decreased. In classical treatment one uses fluid therapy, oral phosphate binders, antibiotics, allopurinoll if hyperuricemia is present, and improvement of living conditions (humidity, temperature, diet). During my study, I prepared diet based on Chinese medicine and herbalist knowledge. I used diet for 14 adult iguanas (8 males, 6 females), 9 to 13 years old with chronic renal failure. Three iguanas died in the first week of therapy. General condition of the remaining patients improved.

**Diet**

1\textsuperscript{st} day  
Part of long boiled broccoli (longer then 15 minutes), 7-8 seeds of row fenugreek (*Trigonella sp.*), a little grated zucchini, dill, a few slices of leek;

2\textsuperscript{nd} day  
Grated carrot whit grated celery stalk with the addition of some raw sesame seeds and some drops of olive oil, some green tops of parsley, small slice of onion;

3\textsuperscript{rd} day  
Two ground hazelnuts whit the addition of one ground clove (*Syzygium aromaticum*), grated kohlrabi, half of fig;

4\textsuperscript{th} day  
Grated zucchini whit pinch of licorice root (*Glycyrrhiza glabra*), boiled green been (3-4), some small grapes without skin;

5\textsuperscript{th} day  
Grated white radish (diakon), Chinese cabbage, dill, chive;
Additionally fresh herbs can be used: nettle (*Urtica dioica*), marjoram (*Origanum majorana*), coriander (*Coriandrum sativum*) and leaves of cherry each day.

I use this formula min. in 3 cycles, 5 days each. Usually, at the beginning I used assistance feeding. After four or five days iguanas began to excrete large amounts of uric acid. Animals started to be more active. They could defecate without any problems. After the next few days paralysis disappeared, iguanas movements returned to normal. They started to eat without assistance. Phosphorus level in serum decreased significantly after two weeks of diet. I recommend a diet for 4-5 weeks, then one can give other plants, but once a week one should add seeds of fenugreek, claves, liquorice. Nettle and cherry leaves play very important role.

In the Middle Ages cloves was used to treat gout by German herbalists. In Chinese medicine, aromatic and irritating cloves or ding xiang have warming qualities. They warm kidney and spleen and are used to treat hiccough. They normalize kidneys yang. Coriander seeds were found in a study on rats to have a significant hypolipidaemic effect, resulting in lowering of levels of total cholesterol and triglycerides. Fenugreek seeds have nutritional properties, are anti-inflammatory, cholagogue, antispasmodic, they improve gastric and intestinal tonic to improve absorption of food, regulate bowel movements, stimulating regeneration of all tissues, activating hematopoiesis. They are diuretic, anti-allergic, anabolic. In traditional Chinese medicine, liquorice is commonly used in herbal formula to "harmonize" other ingredients of diet.

Diet may be an alternative treatment for chronic renal failure in green iguanas. At present I try to introduce diet elements to tortoises therapy.

<table>
<thead>
<tr>
<th>Name/ sex / age</th>
<th>1st biochemical blood test</th>
<th>2nd biochemical blood test</th>
<th>3 weeks later</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boris/ male/11 y.</td>
<td>ALP – 52.10 U/L</td>
<td>ALP – 19.50 U/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AST – 164,20 U/L</td>
<td>AST – 34.50 U/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TP – 5,40 g/dl</td>
<td>TP – 5,90 g/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urea – 3,30 mg/dl</td>
<td>Urea – 1,90 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uric acid – 0,7mg/dl</td>
<td>Uric acid – 0,7mg/dl</td>
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<tr>
<td></td>
<td>Ca – 8,10 mg/dl</td>
<td>Ca – 11,50 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P – 10,3 mg/dl</td>
<td>P – 4,3 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GLDH – 243,1U/L</td>
<td>GLDH – 63,3U/L</td>
<td></td>
</tr>
<tr>
<td>Helmuta/ neutred female/13y.</td>
<td>ALP – 28.30 U/L</td>
<td>ALP – 32.10 U/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AST – 86,00 U/L</td>
<td>AST – 74,30 U/L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TP – 4,90 g/dl</td>
<td>TP – 5,20 g/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urea – 1,70 mg/dl</td>
<td>Urea – 1,30 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Uric acid – 1,3mg/dl</td>
<td>Uric acid – 0,9mg/dl</td>
<td></td>
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<tr>
<td></td>
<td>Ca – 7,10 mg/dl</td>
<td>Ca – 9,20 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P – 6,80 mg/dl</td>
<td>P – 4,30 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GLDH – 12,8U/L</td>
<td>GLDH – 2,4U/L</td>
<td></td>
</tr>
<tr>
<td>Kajtuś/male/10 y.</td>
<td>ALP – 5,30 U/L</td>
<td>ALP – 9,10 U/L</td>
<td></td>
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<tr>
<td></td>
<td>AST – 8,20 U/L</td>
<td>AST – 12,40 U/L</td>
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<tr>
<td></td>
<td>TP – 4,50 g/dl</td>
<td>TP – 5,40 g/dl</td>
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<tr>
<td></td>
<td>Urea – 1,80 mg/dl</td>
<td>Urea – 1,30 mg/dl</td>
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<td>Uric acid – 0,8mg/dl</td>
<td>Uric acid – 0,9mg/dl</td>
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<td></td>
<td>Ca – 7,70 mg/dl</td>
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<tr>
<td></td>
<td>P – 8,60 mg/dl</td>
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<tr>
<td></td>
<td>GLDH – 1,1U/L</td>
<td>GLDH – 43,6U/L</td>
<td></td>
</tr>
</tbody>
</table>
Leon/ male/9 y. | ALP – 182.10 U/L  
AST – 14,20 U/L  
TP – 3,40 g/dl  
Urea – 3,30 mg/dl  
Uric acid – 0,4mg/dl  
Ca – 5,10 mg/dl  
P – 16,3 mg/dl  
GLDH – 286,1U/L  
| Died after on day. 

Tab. 1 The results of biochemical blood tests before starting the diet, and after three weeks on the diet

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Introduction

There is much more to Australian mammals than koalas, kangaroos and Tasmanian devils. Echidnas, quolls, possums, gliders and bats are seen regularly in the Sydney-based practice of the author. Handling, anaesthetic and sampling techniques will be shown for a range of the more unusual Australian mammal species, including monotremes, carnivorous marsupials, possums and gliders. Some emerging diseases of Australian wildlife will be discussed with particular emphasis on Eubenangee virus in wallabies, coccidiosis in echidnas and viral diseases of bats. A recent outbreak of Eubenangee virus infection in wildlife parks and research facilities resulted in the deaths of hundreds of wallabies. Coccidia affecting captive and free living echidnas have recently been described in more detail. Earlier this year, as the result of a bite from a bat Lyssavirus claimed its third human victim in Australia.

Interesting species

The platypus (*Ornithorhynchus anatinus*) is arguably the only extant venomous mammal. Care must be taken to avoid being punctured by the spur of male platypuses during handling. Short beaked echidnas (*Tachyglossus aculeatus*) are “spiky” to handle as well but not venomous. Nonetheless, handling and anaesthesia of this genus does not come without its problems. Sampling techniques unique to monotremes will be described.

The tiger quoll (*Dasyurus maculatus*) is the second largest carnivorous marsupial. Little known outside Australia its distribution did extend along the eastern seaboard of Australia but is now diminishing due to habitat destruction. Quolls feed on a variety of small mammals, birds, reptiles and invertebrates and the occasional domestic chicken. Unfortunately like most Australian carnivorous mammals their life is short and frenetic. Breeding in mid-winter females usually produce up to six young which feed from a shallow pouch that develops from marginal skin folds. The author has extensive experience caring for free living and captive quolls.

Emerging diseases

**Eubenangee virus in wallabies (Tammar Sudden Death Syndrome)**¹²

Epizootics of sudden death in tammar wallabies (*Macropus eugenii*) occurred at research facilities and zoos in New South Wales, Australia, in late 1998 and at one Queensland
research facility in March 1999. More recent outbreaks (2010 – 2011) have occurred in research facilities and wildlife parks within NSW. The mortality rate is high (38-60%). The majority of animals died without premonitory signs. A small proportion of wallabies exhibited increased respiratory rate, or were discovered in lateral recumbency, moribund and with muscle fasciculations. Gross necropsy findings included massive pulmonary congestion, mottled hepatic parenchyma and subcutaneous oedema throughout the hindlimbs and inguinal region. Many animals also had extensive haemorrhage within the fascial planes and muscles of the hindlimb, inguinal region, ventral thorax, dorsal cervical region and peri-renal retroperitoneal area. The disease agent appears to be a previously unrecognised orbivirus in the Eubenangee serogroup.²

**Coccidia and echidnas**

The short-beaked echidna (*Tachyglossus aculeatus*) is one of five extant species of monotreme, found only in Australia and Papua New Guinea. Short-beaked echidnas are reported to suffer from enteric and systemic coccidiosis, however, current understanding of these diseases, including the species responsible, is very limited. A recent study demonstrated that coccidial oocysts are common in healthy adult echidnas, and that one *Eimeria* spp. is limited to wild individuals.³ It was shown that the prevalence of coccidial infection was 89% (48/54) in samples from healthy long-term captive echidnas, 83% (5/6) in short-term captive echidnas and 60% (6/10) in wild echidnas. Under captive conditions *Eimeria echidnae* does not appear to be pathogenic. Sub-adult and adult wild and short-term captive echidnas shed oocysts of both *E. echidnae* and *E. tachyglossi*. The lack of coccidia in juvenile echidnas means these animals are likely immune naïve and should not be placed in environments heavily contaminated with oocysts.³

**Bat diseases**

The suborder Megachiroptera consists of one family, the Pteropodidae, which is represented by five genera in Australia, *Pteropus* and *Dobsonia* (flying foxes), *Nyctimene* (tube-nosed fruit bats) and *Syconycteris* and *Macroglossus* (blossom bats). Numerous species of Microchiroptera are present in Australia, comprising the families Emballonuridae, Megadermatidae, Rhinolophidae, Hipposideridae, Vespertilionidae and Mollosidae.⁴

In Australia bats are frequently presented for veterinary attention. Due to the presence of Australian Bat Lyssavirus (ABL) in bats it is extremely important for animal rescuers, wildlife carers and veterinary staff to exercise caution and to observe strict procedures when handling these animals.

**Australian Bat Lyssavirus (ABL)⁵**

ABLV (Family *Rhabdoviridae*, genus *Lyssavirus*) is present in the Megachiroptera and Microchiroptera, causing neurological disease. Since November 1996, three people have died as a result of ABLV infection after being bitten by bats. ABLV has only been reported from Australia, and confined to the mainland, along the northern, eastern and south-eastern
coastlines. It is probable that ABLV also occurs in bats in south-east Asia. Rabies, a closely related lyssavirus, occurs throughout the world, except on some islands, including Australia.

Precautions need to be taken with the handling and veterinary care of both Megachiropteran and Microchiropteran species. Differential diagnoses to be considered when examining a bat with neurological signs include, Angiostrongylus cantonensis, lead poisoning, trauma, tick paralysis (Ixodes holocyclus), Toxoplasma gondii and other neurological disease (e.g. bacterial meningitis).

Hendra virus

Discovered in 1994, and originally termed Equine morbillivirus, Hendra virus (Genus: Henipavirus) is a serious zoonotic disease in Australia. Occurring naturally in flying fox populations, the virus is not highly contagious but if transmitted to horses and humans it can be lethal. It is thought to be transferred to horses through contaminated urine, faeces or foetal fluids. Hendra virus is now an endemic disease in Australia. All known cases in horses (more than 30) have occurred in Queensland or northern New South Wales. Recently a vaccine has become available, under permit, for accredited veterinarians to administer to horses.

References

EVALUATION OF A NOVEL LEMUR SEDATION PROTOCOL

Marie Kubiak BVSc CertAVP(ZooMed) MRCVS

Prosimian primates of the Superfamily Lemuroidea are native to Madagascar but are frequently kept in zoological collections and, less frequently, maintained privately as companion animals.

Although not naturally aggressive animals they are capable of inflicting injuries with long, sharp canines or strong clawed hands and feet. Sedation is required for full clinical assessment, sample collection and to facilitate diagnostic procedures such as radiography or ultrasound.

Previous published studies document successful sedation with variable protocols in ring tail lemurs. Larsen et al (2011a,b) report administration of Telazol (tiletamine/zolazepam) followed by supplementation with either medetomidine alone (0.04mg/kg), combined medetomidine (0.04mg/kg) and butorphanol (0.2mg/kg) or ketamine (10mg/kg) and medetomidine (0.04mg/kg). All protocols resulted in sedation but some animals required additional supplemental doses to maintain sedation and prolonged recoveries were seen, particularly where Telazol was hand-injected.

Williams et al (2003) reported a combined protocol of medetomidine, butorphanol, and midazolam (0.04 mg/kg, 0.4 mg/kg, and 0.3 mg/kg respectively) which gave good sedation and was preferred over a medetomine, butorphanol ketamine combination due to longer duration and potential for greater reversibility. Neither combination resulted in cardiovascular or respiratory depression.

Use of this combination in two black and white ruffed lemurs resulted in incomplete sedation and rousibility and was inadequate for further procedures including radiography and blood sample collection. A novel combination of midazolam (0.5mg/kg), buprenorphine (0.03mg/kg) and medetomidine (0.1mg/kg) was extrapolated from existing domestic exotic mammal sedative protocols utilised in the author’s clinic to provide a deeper plane of sedation.

Three black and white ruffed lemurs (aged 2yrs-5yrs) were administered this combination by hand injection into the quadriceps muscles. Onset of sedation was 4-12minutes and lasted a minimum of 35mins. Sedation acheived was adequate with good muscle relaxation, no spontaneous movements, retention of a slow palpebral reflex and no response to painful stimuli. All animals were intubated and provided oxygen at 2l/min. Respiration was spontaneous throughout anaesthesia with spO2 maintained over 95% and ETCO2 below 60mmHg. Following completion of procedures, the medetomidine was reversed using 0.5mg/kg atipamezole and lemurs were responsive and ambulatory within 30minutes of reversal. All animals were returned to their arboreal enclosures within 4hrs and showed no adverse effects or prolonged sedation.
This combination was also administered to three ring-tailed lemurs (aged 1yr-4yrs) and gave a similar plane of sedation with no adverse effects.

A combination of midazolam, butorphanol and medetomidine appears safe in these species with no cardiovascular or respiratory depression, moderate analgesia provided and sedation sufficient for blood sample collection, radiography and intubation. No supplemental doses were required to achieve sedation, and sedation was adequate in all six animals for non-invasive procedures. For surgical procedures in lemurs (caesarean section, fracture fixation, wound repairs) the same protocol has been adopted with subsequent additional administration of Isoflurane in inspired O2 for extension of anaesthesia. Recovery was rapid following reversal of the medetomidine and no excitation phase was seen on induction or recovery.
ANGIOSTRONGYLUS VASORUM INFECTION IN A RED PANDA (AILURUS FULGENS) - A CASE REPORT

Marie Kubiak BVSc CertAVP(ZooMed) MRCVS

A two year old adult male red panda (Ailurus fulgens) was noted to be acutely dyspnoeic by the zoo keeping staff. He was caught from the enclosure, and was weak, poorly responsive and clear fluid discharge was noted from the nares and mouth. The animal died shortly after capture, before any therapy could be initiated.

No previous symptoms had been noted and routine faecal examination (culture, zinc sulphate flotation and direct analysis) had been unremarkable.

Gross post-mortem examination showed slight reduction in body condition, pale mucous membranes, ascites with clear yellow fluid, a thickened region of duodenum, a single pale splenic nodule and severe pulmonary changes. The lung tissue was replaced with extensive pale, gritty nodules interspersed with haemorrhage and no grossly normal tissue remained.

Lung culture yielded a heavy growth of coagulase positive Staphylococcus spp. and heart blood culture was negative.

Abdominal fluid had a protein level of 32g/l and a nucleated cell count of 0.2 x 10^3/ul suggestive of a modified transudate. On cytology, 50% of cells noted were erythrocytes with lymphocytes, large mononuclear cells (histiocytes or reactive mesothelial cells) and few neutrophils. No infectious pathogens were identified on fluid examination.

Histopathology showed inflammation and necrosis to variable degrees within the liver, kidney and spleen. Lung tissue demonstrated a marked inflammatory process associated with abundant adult and larval nematodes. Arterial thrombi, vasculitis and osseous metaplasia were also noted.

A diagnosis of verminous pneumonia was made, with secondary pyogranulomatous pneumonia, arteritis and thrombosis. The adult nematodes were identified as Angiostrongylus vasorum.

Angiostrongylus vasorum is now accepted as endemic in the UK within canid populations. Another case of lungworm in red panda has been reported in the UK in 2009 (Patterson-Kane et al). Routine faecal examination prior to clinical disease in both cases did not provide evidence of infection, but sensitivity of standard faecal parasitology for Angiostrongylus vasorum is low.

The female red panda maintained in the same enclosure remains asymptomatic and radiographs taken showed no evidence of pulmonary infiltrates or metaplasia. Prophylactic anthelmintic therapy comprising fenbendazole (50mg/kg once daily for 7 days in food) every 3 months has been initiated to prevent future clinical disease.
Food stations have been moved into a covered enclosure to prevent potential contamination by wild molluscs and to allow close monitoring of food intake and general health.


CLOACAL, CHOANAL AND ENVIRONMENTAL SAMPLES FROM HEALTHY GREEN IGUANAS: A COMPARATIVE ANALYSIS

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3Clinic for Avian, Reptile and Fish Medicine, Vetmeduni Vienna, Austria

To analyze the composition and source of aerobic bacterial microflora in captive green iguanas (Iguana Iguana), choanal, cloacal and water tanks biofilm samples from 20 healthy individuals were collected between November 2012 and March 2013.

Samples for bacteria culture were collected from choanae, cloacae and water tanks biofilm from November 2012 to March 2013. Twenty captive green iguanas (nine females and eleven males) aged 10 to 14 years were included in the study. These animals were acquired from the Zoo Brno, Czech Republic and maintained in fifteen indoor terrariums for over 9 years at the Avian and Exotic Animal Clinic, VFU Brno on 12h light/12h dark regime at a temperature between 24 ºC and 35 ºC. The substrate used in this study was paper, which was exchanged at least three times a week. The iguanas kept in tanks had a permanent access to water for drinking, bathing, defecation and urination. The tanks were every second day, cleaned by scrubbing the surfaces with a brush and then rinsing with water before refilling. Cabbage, dandelion, carrots, cucumbers and apples were the main food provided to the animals. Clinical examination was regularly performed and iguanas were healthy at the time of the study. Eight individuals were kept in pairs. Samples were collected by using sterile transport swabs with Amies gel medium (Copan Innovation, Italy) which were gently rubbed along the choana and inserted into the cloaca. Water tank samples were isolated by wiping the biofilm. Then, the samples were immediately submitted to the Department of Infectious Diseases and Microbiology, VFU Brno. Samples were cultured on blood agar (Columbia Agar Base, Oxoid, Basingstoke, Hamshire, UK) and on MacConkey agar (Oxoid, Basingstoke, Hamshire, UK) and aerobically incubated at 37 ºC for 24 hours. Cultures with mixed populations were subcultured until a pure culture was achieved to decrease potential for competition of growth. Identification of bacterial isolates was based on their growth and colony characteristics, Gram staining, cellular morphology, catalase and oxidase reactions. Cloacal and biofilms samples were additionally placed overnight in buffered peptone water (Oxoid) at 37 ºC, and then selectively propagated in semisolid Rappaport Vassiliadis agar (Oxoid) at 41.5 ºC for 24 (48) hours. Selected colonies were then subcultivated on xylose lysine deoxychlolat agar (Oxoid) at 37 ºC for 24 hours. Final identification of bacteria was performed by mass spectrometry the apparatus MALDI TOF (Bruker) according to manufacturer's instructions. A total of 77 isolates were obtained from choana and cloaca, including 53 gram-negative bacteria, 23 gram-positive bacteria and 1 yeast. From tanks were recovered 33 isolates, including 30 gram-negative and 3 gram-positive bacteria. The most
common bacteria cultured were *Citrobacter* spp. (16/76), *Salmonella* spp. (9/76), *Staphylococcus* spp. (14/76) and *Corynebacterium* spp. (6/76) from choanal and cloacal swabs and *Pseudomonas* spp. (12/33) and *Salmonella* spp. (5/33) from biofilms. The results of the present study showed that the aerobic bacterial microflora in captive green iguanas was composed of several potential human and animal microbe pathogens. The results of this investigation demonstrate that the choanal and cloacal bacterial microflora of healthy green iguanas are composed of a diverse microbial spectrum, with several potential human and reptile pathogens. This fact reflects the importance of the immune status of the host in the development of diseases by pathogenic microorganisms because immunosuppressed individuals are not able to properly respond to an infection, thus favoring the massive proliferation of bacteria present in healthy individuals. This study also demonstrated that individuals sparing the same terrarium for many years did not necessarily harbour the same bacterial microflora and numbers. In addition, the findings in water tanks did not have correlation (except with *Salmonella* spp.) between the choanal and cloacal findings, suggesting that choanal and cloacal bacterial microflora is not totally dependent on the bacteria present in the environment. It is difficult to interpret whether green iguanas contaminate their environment with these organisms and then become infected when they are immunosuppressed or if they become primarily infected, by the bacteria present in environment.
REPTILE CARDIOLOGY

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Reptilian cardiology differs markedly from that of mammal cardiology, both in terms of the anatomy and physiology, but also in terms of the diversity displayed across the different taxa. Thus, reptilian hearts can be loosely classified as being crocodilian hearts (crocodiles, alligators, gavials and caimans) or non-crocodilian (snakes, lizards and chelonians).

In non-crocodilian reptiles, the ventricle is not physically divided but pulmonary and systemic blood flow are separated and regulated by functional plasticity. In these species, oxygenated and deoxygenated blood flowing from the aortic arches is partially mixed, the amount of mixing being determined by the degree of muscular ridge and interventricular septum development. The contraction of the muscular ridge during systole and of the interventricular septum during diastole serves to form an almost complete separation of pulmonary and systemic blood flow, particularly in monitor lizards and pythons. In cases of anoxia (e.g. prolonged diving, swallowing large preys, respiratory distress or hibernation), vasoconstriction of the pulmonary arteries/artery causes a high pulmonary outflow resistance. Together with a decreased pressure in the pulmonary veins, a right to left intracardiac shunt occurs and blood from the right atrium shifts towards both aortic arches, instead of the pulmonary trunk. This ensures bypass of the lungs and blood perfusion to vital organs during anoxia.

The cardiac anatomy and physiology in crocodilian species differs from non-crocodilian reptiles but resembles that of mammals. Indeed, the ventricles are physically divided by an intraventricular muscular septum with divided pulmonary and systemic circulation. During apnea however, the crocodilian heart is able to function in a manner similar to that of reptiles with a right to left shunt. This unique versatility is made possible by the foramen of Panizza, an interventricular septal opening that connects the left and right aortic trunks, which, coupled with an active control of pressure gradients in the ventricles, allows for mixing of oxygenated and deoxygenated blood. Whilst the degree of shunting is known for many species, the functional mechanisms and physiologic role of cardiac shunting have been discussed extensively with no final or conclusive interpretations.

Poikilotherms have long been considered to suffer little from primary cardiovascular conditions, however this idea is being challenged as our knowledge of normal anatomy and physiology improves and the use of specialist diagnostic tools become more available. These include instruments readily available in small animal medicine (auscultation, electrocardiography, radiography, ultrasound, CT) applied with minor variations in techniques.
References


MEASUREMENT OF INTRAOCULAR PRESSURE IN UTILA ISLAND IGUANAS

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Utila Island Iguana (Ctenosaurabakeri) are critically endangered and subject to conservation management both in situ and also in several zoological collections, including those within the UK. No published data exists on intraocular pressure measurement in this species.

Intraocular pressure (IOP) was initially measured within a single small population within a UK zoological collection to establish a limited reference range for this species. Data was collected for both eyes in all individuals, with the animals loosely restrained in ventral recumbency. IOP remained within the range 5-10mmHg for all animals. There was no significant difference between readings from left and right eyes. Comparison was made with readings from an applanation tonometer (Tonopen) and a rebound tonometer (Tonovet). The Tonopen was found to be unreliable but consistent readings were obtained with the Tonovet.

Additional data was subsequently collected from the same animals at different time points to establish variation in IOP throughout the day. Additional data was collected using only the Tonovet from another collection for comparison. Further comparisons were made between recorded readings to assess repeatability by individual operators and between different operators of varying experience using the tonometer.

The established ranges and statistical analysis of data will be presented.
BACTERIOLOGY AND MYCOLOGY IN REPTILE MEDICINE: SENSE AND NONSENSE

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Introduction

Apart from some exceptions, the role of bacteria and fungi in reptile diseases is poorly understood, severely hampering interpretation of clinical samples in diagnostic laboratories. One of the main problems is the lack of information regarding the pathogenicity of a given bacterium or fungus for non avian reptiles. Indeed, overviews of microorganisms pathogenic to reptiles are too often based on case reports or extrapolation of knowledge obtained in mammals or avian reptiles. Proof of pathogenicity, provided e.g. by fulfilling Koch’s postulates, is only available for a handful of bacteria and fungi (e.g. Mycoplasma agassizii from respiratory tract infections in tortoises, Devriesea agamarum from septicemic dermatitis in lizards, the Chrysosporium anamorph of Nannizziopsis vriesii (CANV) from dermatitis and systemic mycosis in reptiles). Others like e.g. several of the Chlamydiales may very well have far greater clinical importance than hitherto assumed. When dealing with infectious diseases in reptiles, it is important to keep in mind that most bacterial and mycotic diseases in reptiles should be considered secondary to e.g. viral infections or inadequate husbandry.

Suitable samples

In general, the most useful samples stem from superficially decontaminated lesions. If a pure and/or abundant culture is obtained from a lesion, it is likely involved (either primary or secondary) in the lesion observed. Samples from the oral cavity and the intestinal tract are of limited value. Since information regarding the normal microbiota in most reptile species is virtually non existing, interpretation of bacteriological or mycological cultures is highly challenging. For example, Salmonella and Candida can be considered normal inhabitants of the GI tract of reptiles, including the oral cavity. One possible exception is bacteriological / mycological examination of the oral cavity in case of stomatitis, which often yields abundant cultures of an apparently small number of bacterial isolates (e.g. Aeromonas sp.). Samples should be sent to the lab as soon as possible, cooled if possible and, for swab samples, in transport medium. Samples for PCR can be stored frozen or in ethanol.

Microbiological techniques

Samples are preferably plated on several agar containing media. In our lab, we routinely use sheep blood agar, sheep blood agar with colistin / nalidixic acid, and SAB for sample inoculation and incubate plates for reptiles for at 30°C, both at 5% CO₂ and anaerobically. Depending on the growth on these plates, but also on the results of cytology or histopathology, samples can be plated on / enriched in more selective growth media. Plates
are routinely incubated up to 5 days (bacteriology) or 4 weeks (mycology). The latter is very important since e.g. CANV sometimes requires more than 10 days to develop visible growth.

Besides cultivation, PCR is highly useful to demonstrate DNA of Chlamydiales or *Mycoplasma* sp. We perform PCR for mycobacteria only after histopathological indications of mycobacteriosis, including positive (modified) Ziehl Neelsen staining.

Finally, serology is currently only useful to detect contact of chelonians with *Mycoplasma* sp. However, only few laboratories provide this test.

**Entry control**

The origin of a newly acquired reptile may provide valuable clues regarding the possible presence of bacterial pathogens and new animals are preferably acquired from a long term breeding colony with a history of absence of bacterial disease (e.g. the absence of upper respiratory tract disease in tortoises).

Reptiles showing clinical anomalies should not be allowed entry into a reptile colony. If positive for known pathogens such as *Mycoplasma*, *Devriesea agamarum* or CANV, animals should only be allowed after clearance of the infection. However, declaring a reptile free of previous infection should be done with caution and requires intensive treatment and repeated rounds of sampling.

In clinically healthy reptiles, entry control for bacterial and mycotic agents is currently only useful 1) to determine whether tortoises are excreting or have been into contact with *Mycoplasma* sp., preferably using both PCR on a nasal wash and serology and 2) to determine the presence of *Devriesea agamarum* in the oral cavity of lizards using bacteriology (although low numbers of the bacterium can be easily overgrown by other oral microbiota).

**Prevention and treatment**

The best prevention of bacterial diseases in captive reptiles is the combination of optimal husbandry and nutrition with proper entry control and quarantine measures. However, it is important to notice that healthy reptiles can be asymptomatic carriers of bacterial pathogens and that absence of infection is notoriously difficult to assess. As such, newly introduced reptiles may acquire bacterial disease from long term healthy terrarium inhabitants. Although recent evidence suggests that vaccination may be very useful in case of e.g. devrieseasis, it is highly unlikely that commercial vaccines will be available against even the most important bacterial diseases in reptiles. Autovaccination might provide an alternative but is relatively expensive.

Treatment of bacterial infections consists primarily of optimizing husbandry and nutrition, combined with antibacterial treatment. However, the latter is hampered by the lack of PK/PD and toxicity data of most antibacterial therapeutics for most reptile species. Besides, these characteristics may be heavily influenced by e.g. the body temperature of the patient. For
proper antibacterial treatment, it is highly recommended to isolate the putative etiological agent and, if possible, to determine its antimicrobial susceptibility.

**Pathogen pollution**

Spill over of bacterial or mycotic pathogens from captives to native reptiles should be avoided at any cost. Reptiles that are kept and bred for conservation purposes, and destined for release in the wild should be free of known pathogens and should preferably stem from specified pathogen free breeding stock to avoid the introduction of pathogens, as witnessed with *Mycoplasma agassizii* in the US (Sandmeier et al., 2009). However, again, the lack of knowledge regarding bacterial and mycotic diseases in reptiles predisposes to future scenarios, similar to that of the introduction of chytridiomycosis in a highly endangered amphibian assemblage in Europe (Walker et al., 2008).

**References**


CHARACTERIZATION OF CLOACAL AND CHOANAL FLORA FROM VEILED CHAMELEONS AND ITS RESISTANCE TO ANTIBIOTTICS

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The aim of the article is to present information on the normal choanal and cloacal aerobic bacterial flora isolated from 16 healthy captive veiled chameleons (Chamaeleo calyptratus) and its resistance to antibiotics. Clinically healthy adults of veiled chameleons kept in captivity were examined for the presence of bacterial flora from choanae and Salmonella spp. from cloacae. The females aged 2.5 years came from the same breeder and were kept in terrariums grouped in three. Before sampling three females were treated with marbofloxacin (at least 5 days, 10 mg/kg SC) and one female with ampicilin (1 dosis, 3ml IP). After treatment were kept together. Male chameleon was obtained 3 months before sampling from another breeder at the age of 4 years and was kept in an individual terrarium. All the 16 individuals didn’t have any contact with other animal species. Samples were collected by using sterile swabs with transport medium (Amies, W/CH, Copan, Italy), which were gently rubbed along the choana and inserted through the cloaca. Choanal samples were cultured onto blood agar with 5% citrated sheep blood (Columbia Agar Base, Oxoid, Basingstoke, Hamshire, UK) and MacConkey agar (MCA, Oxoid, Basingstoke, Hamshire, UK) and incubated at 20°C for five days under aerobic enviroment. Cloacal samples were placed in buffered peptone water (BPW, Oxoid), incubated overnight at 37°C and then subjected to selective isolation of Salmonella in modified semi-solid Rappaport-Vassiliadis medium (Oxoid, Basingstoke, Hamshire, UK) according to manufacturer's instructions. Identification of the obtained bacterial cultures was based on their growth, colony characteristics, Gram staining cellular morphology, oxidase and catalase reactions. Final identification of bacterial isolates was performed by mass spectrometry MALDI TOF (Bruker) according to manufacturer's instructions. Salmonella isolates were sent to the National Reference Laboratory for Salmonella of the National Institute of Public Health (NIPH) in Prague (Dr. Dědičová) for serotyping. Antibiogram were determined by the disk diffusion method on Mueller-Hinton agar (Oxoid) in accordance with the Clinical and Laboratory Standards Institute (CLSI formerly NCCLS 2008). Choanal bacterial isolates were tested with the following antibiotics: amikacin (30μg), aztreonam (30μg), cefotaxime (30μg), ceftazidime (30μg), ceftriaxone (30μg), ciprofloxacin (5μg), gentamicin (10 ppm), imipenem (10 ppm), colistin (25μg), levofloxacin (5μg), marbofloxacin (5μg), meropenem (10 ppm), piperacillin (75μg) and ticarcillin (75μg). In cloacal isolates were used amoxicillin clavulanate (30μg), ampicillin (10 ppm), cefalotin (30μg), ceftazidime (30μg), ciprofloxacin (5μg), chloramphenicol (30μg), gentamicin (10 ppm), nalidixic acid (30μg), potentiated
sulfonamides (25μg), streptomycin (10 ppm), sulfonamides (300μg) and tetracycline (30μg). Diameter of zones of inhibition around each disc was measured and recorded. Each bacterial isolate was classified as sensitive (S) resistant (R) or intermediate resistance (I) according to the instructions by NCCLS. A total of 26 isolates from choanal and 13 isolates from cloacal swabs were obtained, all of them containing gram negative bacteria. The most common bacteria cultured were *Pseudomonas aeruginosa* (34.6 %), *Aeromonas hydrophila* (15.4 %) and *Enterobacter aerogenes* (11.5 %). Thirteen individuals were positive for *Salmonella* spp., the most common serotypes being *S. Ago* (53.8 %) and *S. Blijdorp* (23 %). Sensitivities to antibiotics were tested by modified Kirby-Bauer disc diffusion test. From choanal isolates *Stenotrophomonas maltophilia*, *Pseudomonas aeruginosa*, and *Acinetobacter* were resistant to the widest range of antibiotics. The most frequently innate resistance was found in ticarcillin (21/26), meropenem (14/26), cefotaxim (11/26) and ceftriaxon (11/26). From cloacal isolates only one strain (1/13) was resistant to streptomycin.
AN UNUSUAL PRESENTATION OF CHLAMYDIA PNEUMONIAE IN A ROYAL PYTHON

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Chlamydia species, including *Chlamydia pneumonia*, are a new emerging pathogen in reptiles. *C. pneumoniae* has been reported to cause infections in snake species, as well as other reptiles and amphibia, leading to granulomatous lesions in multiple organs, enteritis, pneumonia like signs, and condition loss.

This presentation discusses an unusual case in a Royal (Ball) Python (*Python regius*) of the colour morph ‘bumblebee’. This individual had a history of a slight intermittent head tilt for about a month that acutely progressed over five days prior to presentation. The snake had also stopped eating and had started to show severe weight and body condition loss. Upon presentation the snake was often unable to upright itself with loss of the righting reflex. There were no signs of respiratory disease or discharges, diarrhoea, or other disease processes. It was elected to euthanase the snake on welfare grounds and a full post mortem was performed.

The results of this post mortem revealed severe enteritis, with granulomas in the serosa/mucosa and in the spleen. Cholestasis was present in the liver and serositis/meningitis of the brain. After extensive screening and analysis, *Chlamydia* was identified by genus-specific immunohistochemical staining in the spleen and *C. pneumonia* identified by PCR analysis.

The author feels this case shows how Chlamydia should be considered in snakes with neurological disease, as well as those showing signs of malabsorption, especially given the potential zoonosis of the organisms involved.

With thanks to:

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Nick Wheelhouse at Moredun Research Institute, Edinburgh;

Ann Pocknell at Finn Pathologists, UK.
Surgery of the head and pelvic limbs is frequently required after trauma. Some anatomical differences between birds and mammals also necessitates extra attention to surgery of the upper respiratory system in birds.

**Surgery of the head**

*Rhinolith*

Although nutrition in psittacines has improved over the past two decades, malnourished psittacines are still commonly seen by veterinarians. The resulting vitamin A deficiency leads to squamous metaplasia of the epithelial lining of the respiratory tract, giving rise to the development of rhinoliths, which may block the nares. Removal of rhinoliths is rather easy and may be accomplished by currettage and flushing. Morphologic changes to the nare, however, are permanent.

*Sinusitis*

In birds, the opening of the infraorbital sinus is located dorsally in the nasal cavity. Thus, when exsudate is present it will not drain easily, resulting in accumulation of fluid or squamous debris in the sinus. In cases of fluid accumulation, flushing may be sufficient to remove the material. Caseous material cannot be flushed out of the sinus and opening the sinus, at a location cranioventral to the eye, will be necessary. Since no bone is covering the sinus, this procedure is much easier accomplished in birds compared to mammals.

*Enucleation*

Similar to mammals, indications for performing an enucleation may include the presence of perforating corneal trauma or glaucoma. Although the procedure is almost similar to that in mammals, it is important to realize that, compared to mammals, birds have rather large eyes, of which only a small portion is visible on the outside. In addition, only a small interorbital septum separates the globes from each other. Due to a limited amount of room between the globe and the orbit, collapsing the eye is recommended to achieve visualization of all the orbital structures during enucleation. The procedure is furthermore complicated by the limited distance between the globe and the chiasma opticum, as excessive traction on the globe will easily result in traction to the contralateral optical nerve thereby resulting in blindness of the contralateral eye.
Scissors beak and mandibular prognatism

Scissors beak and mandibular prognatism are commonly seen in young, growing psittacines, but are occasionally also found in older birds suffering from some form of beak trauma.

In very young birds it is sometimes possible to realign the beak by repeated manual repositioning. Most frequently, however, some form of surgery is necessary. This may either involve the manufacturing of a prosthetic device, or the drilling of a pin through the frontal bone to which a tension/rubber band is attached which pulls the beak into the correct position again. As bone remodeling is much quicker in young birds, this procedure has a higher success rate when performed at an early age. In older birds, surgery often gives poor results. Repeated beak trimming may therefore be necessary to correct the abnormal beak growth.

Hyperextended maxilla

Birds presented with a hyperextended maxilla are unable to close their beak. The condition may result from either a luxation of the quadratomandibular joint or from a luxation of the palatine bone. When the palatine bone luxates, this structure is displaced dorsally and rostrally, thereby hooking it onto the interorbital septum and rendering it unable to slide back caudally.

Correcting the luxation is possible by inserting a needle or Kirschner-Ehmer pin transversally into the infraorbital sinus, just ventral to the jugal arch in a ventro-dorsal oblique direction. The needle has to be directed half way across the sinuses so that the tip will lie just above the palatine bone. By gently pressing the end of the needle upwards, while hyperextending the maxilla, the palatine bone is forced downwards into its normal anatomical position by the tip of the needle.

Surgery of the pelvic limbs

Fractures

Fractures most commonly occur during a crash landing. In wild birds of prey, the wings are most commonly affected due to vehicular trauma, but in companion birds the legs, especially the tibiotarsus, are most commonly fractured. In falconry birds, transverse fractures of the tibiotarsus may occur when the bird is kept on a long leash, allowing it to generate excessive force onto the leg when trying to fly away from the block or perch.

Depending on the location of the fracture and the size of the bird, either a splint or surgical approach may be used. In small birds, tape splints frequently work very well, whereas in larger birds a Robert-Jones bandage or cast may be used. In the larger birds a surgical approach may also be used. The most commonly used fixation techniques in pelvic limb fractures in birds include the use of intramedullary pins and/or Kirschner-Ehmer external fixators. In case of the latter, three different types can be distinguished. The type I-fixator only has one connecting bar on the side, whereas type II has a connecting bar on either side of the leg. In the type III-fixator a three dimensional plain is created. For extra stability, the
Kirschner-Ehmer fixator may also be connected to an intramedullary pin, referred to as a “tie-in” fixation.

_Bumblefoot_

Bumblefoot is a condition affecting the plantar surface of the bird’s feet which can be compared to bed sores in people. Although these sores may be (secondarily) infected, the most important part of the treatment generally consists of stimulation of the circulation and alleviating pressure on the affected areas. Besides a different range of bandages and/or casts, surgical debridement of the infected and necrotic tissue in combination with closure of the lesion may be required. This type of surgery can best be performed after placement of a (temporary) ligature around the tarsometatarsus to prevent heavy bleeding. Prior to placing the foot in a bandage or cast, the ligature needs to be removed to check for bleeding. Promotion of daily exercise, weight reduction to an appropriate body weight for the bird and suitable perching materials are needed to assist in healing and prevention of reoccurrence of this condition.
PLASTIC OF A BROKEN BEAK IN AN AFRICAN GREY PARROT (PSITTACUS ERITHACUS): CASE REPORT

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A 13-yrs old female African grey parrot living in a group of four individuals was presented at the clinic. Clinical examination revealed some mild alterations of the rhinotheca (small discoloration just below the growing zone as well as a little lesion of the lateral horn). According to the owner both changes has been induced by aggression of one of the other birds. Since the parrot was doing fine no further treatment was initiated by that time.

Three weeks later the patient was presented again. That time the rhinotheca was markedly altered. At the growing zone – especially in the center part - there was a lot of brittle horn and below the broken horn there was a two-cent-coin-lesion where all the horn was missing. Under inhalant anaesthesia all loose material was gently removed, taking care not to injure the growing zone. The lesion was cleaned and finally covered with a tape. This temporary cover stayed for 8 days. When removed this cover it revealed brittle material to be removed again. After cleaning, the horn lesion reached the size of one-euro-coin. Prognosis was given guarded since there was hardly new horn built in the growing zone and due to the dimension of the lesion.

One week later a first attempt to cover the lesion with a strong plastic was made in accordance with the owner. Under anaesthesia the rhinotheca was thoroughly cleaned from all broken horn again, disinfected, than covered with a special moist wound dressing followed by an artificial fingernail (both had to be fixed with a special glue on the upper beak) and a coating that is to be hardened by UV light. One week later the plastic was removed and under tissue revealed to be clean. In the upcoming six weeks the plastic was changed every other week. Within this period new fragile horn steadily re-grew at the growing zone and further the lesion lacking the horny layer became more resistant, so that finally no further covering was needed.

This case provides an impressive prove that even large lesions of the rhinotheca might heal over time when ongoing corrosion of horn is stopped e.g. by placing adequate material for stabilizing it.
ANTIMICROBIAL RESISTANCE IN REPTILIAN BACTERIA

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In the recent past years, important efforts towards the prudent use of antimicrobials in clinical veterinary practice have been made in order to optimize therapeutic effect while minimizing the development of resistance. A great number of bacterial isolates have been found in captive reptiles as potential pathogens for reptile patients as well as for the clients and veterinary staff. Potential reptilian pathogens are Acinetobacter sp., Klebsiella spp., Citrobacter freundii, Psedomonas spp., Pasteurella sp., Stenotrophomonas maltophilia, Enterobacter spp, coagulase-positive Staphylococcus sp. and beta-haemolytic Streptococcus sp. (GOLDSTEIN et al. 1981, Berschauer and Mader 1998, Blaylock 2001, Paré et al. 2006, Hejnar et al. 2007). Resistance to antimicrobial drugs has increased, becoming a worldwide human and veterinary medicine concern, as resistance genes can be exchanged between animals and humans (BELMAR-LIBERATO et al. 2011). Clinically healthy reptiles have a normal resident bacterial population varying with both the species and anatomical area investigated (CUSHING et al. 2011). The most commonly isolated bacteria from reptile respiratory tract (Pseudomonas aeruginosa, Klebsiella pneumoniae, Stenotrophomonas maltophilia), oral cavity (Pseudomonas sp., Aeromonas sp., Providentia sp.), intestines (Escherichia coli, Pseudomonas sp.), and skin (Pseudomonas sp., Aeromonas sp., Citrobacter freundii, Stenotrophomonas maltophilia) are not usually considered pathogenic in reptiles (KEYMER 1978, HOMER et al. 1998, BLAYLOCK 2001, PARÉ et al. 2006, PEES et al. 2007, CUSHING et al. 2011), but all of them can be a source of secondary infection in immune suppressed reptiles, reptile keepers or veterinarians. Many bacteria have shown a degree of resistance to antimicrobial drugs and this is of concern as some of the reptilian bacteria could be nosocomial pathogens in human beings (HARRIS and RODGERS 2001). Multiple drug resistance has been detected in Aeromonas hydrophila and Pseudomonas aeruginosa isolated from reptiles (BARBOUR et al. 2007, COLINON et al. 2010). Research focused on plasmid-mediated resistance revealed 40% of all quinolone resistant isolates have been collected from reptiles (AHMED et al. 2007). The results of GUERRA et al. (2010) showed plasmid mediated quinolone resistance in Salmonella spp. isolates originating from different reptiles kept in Germany. Similar results have been found in different reptilian bacteria isolated in Japan (AHMED et al. 2007). The aim of the recent study (BARAZORDA ROMERO et al. 2013a) was to determine the normal aerobic bacterial flora isolated from choans and cloacas in clinically healthy captive veiled chameleons (Chamaeleo calyptratus). The most common isolated bacteria were gram negative Pseudomonas aeruginosa, Aeromonas hydrophila and Enterobacter aerogenes. The common
bacteria isolated from choans (Stenotrophomonas maltophilia, Acinetobacter spp. and Citrobacter freundii) were resistant to a broad spectrum of antibiotics. Similar study performed on captive males and females green iguana revealed Citrobacter spp., Salmonella spp., Staphylococcus spp., Corynebacterium spp. and Pseudomonas spp. as the most common bacteria isolated (BARAZORDA ROMERO et al. 2013b). The results demonstrated that reptiles sparing the same terrarium for many years did not necessarily harbour the same bacteria and suggested that bacteria isolated from reptile choans and cloacas are not necessary to be the same as the bacteria present in the environment. BZDIL et al. (2012) observed four times higher prevalence of Salmonella spp. in human isolates than in reptiles. Factors contributing to the antimicrobial resistance of reptilian bacteria include: antibiotic overuse in veterinary practice with reptiles, small mammals and birds, and antibiotic misuse such as different forms of “preventive treatment” in imported reptiles. One of the main reasons that encourage the development of antibiotic resistance in captive reptile bacteria is the inappropriate use of antibiotics to treat a broad spectrum of suspected respiratory and gastrointestinal diseases.

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CASE REPORT – NEPHROTOMY IN A RABBIT

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This paper describes a case of bilateral nephrolithiasis in a spayed female rabbit (*Oryctolagus cuniculus*). This patient was presented with nonspecific symptoms including anorexia and reluctance to move. Rabbit was treated for active *E. cuniculi* infection (IgM antibodies) by fenbendazol (20 mg/kg 2x/day for 3 weeks) before 3 months.

At the time of initial examination the rabbit was in good body condition (3/5) and showed reluctance to move, hunched posture and painful abdomen. Abdominal radiography and ultrasound revealed presence of radiopaque masses in the pelvis of kidneys, irregular kidney shape and slight nephromegaly (left kidney 4.2 × 2.4 cm; right kidney 4.8 × 3.2 cm). Ultrasound examination confirmed the presence nephrolits and dilatation of the renal pelvis. Haematology and plasma chemistry showed extremely elevated blood urea nitrogen (34.5 mmol/l) and creatinine (1010.2 μkat/l). Based on the above mentioned results, kidney failure and bilateral nephrolithiasis were determined to be the final diagnoses.

After patient stabilization and aggressive fluid therapy (blood urea nitrogen 8.6 mmol/l; creatinine 145.6 μkat/l), the intravenous pyelography (Iomeron, 12 ml/kg i.v., 300 mg/ml iod, Bracco Imaging GmbH, Germany) confirmed preservation of the filtration capacity of the left kidney. The right kidney did not excrete contrast material.

Nephrotomy of the left kidney was performed with an access through ventral midline abdominal incision. Retroperitoneal fat was dissected to mobilize the kidney and to provide access to both the convex lateral surface and renal pelvis. The renal artery and vein were temporarily occluded with vascular clamp. Longitudinal sagittal incision was made with a scalpel through the convex lateral surface of the kidney. Nephrolits were removed from pelvis and sand was flushed by catheter with saline. Ureter was catheterized and flushed with saline by catheter (3.5F). The nephrotomy was closed by apposing the two renal parenchymal flaps with gentle digital pressure while renal blood flow was restored. Suture was placed through superficial parenchyma in simple continuous pattern polyglactin 910 (Vicryl, 1M, Ethicon, France). Kidney was placed back into retroperitoneal spaces and peritoneum has been closed by simple continuous suture polyglactin 910 (Vicryl, 1M, Ethicon, France).

Nephrolit mineral analysis revealed calcite. Urine bacteriology was negative for the presents of pathogens. The patient was further treated with intravenous fluid therapy, marbofloxacine, butorphanol and itopride. The patient feed spontaneously and recovered uneventfully within 5 days after the surgery. To prevent the formation of nephrolits the ammonium chloride 0.5 g/kg q24h was administered.
Nephrotomy in a rabbit seems to be relatively easy procedure, however patient stabilization, thorough monitoring and postoperative care is essential for successful outcome.

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ATRESIA ANI AND RECTOCUTANEOUS FISTULA IN AN ADULT GUINEA PIG (Cavia porcellus)

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Introduction

Malformations of the gastrointestinal system are quite rare in pets compared to farm animals (5) with atresia ani being the most frequent (6). According to the Wingspread classification of male anorectal malformations from human medicine anal atresia is a low defect (10), that has its origin in a minor failure in the embryological development of the anal membrane (4). The etiology of this malformation is not yet clarified. Most individuals with atresia ani also have other malformations (1). The anogenital region of guinea pigs displays some characteristics like the presence of a pouch ventral to the urethral opening and a perineal sac. The anus is located caudally inside the perineal sac with hidden sphincters (2). In small mammals there are only two reports about the occurrence of anal atresia, one in a four month old dwarf rabbit (3) and one in a dead neonate guinea pig (8). While there is a frequent occurrence of rectovaginal fistulas associated with atresia ani (7, 11) anocutaneous fistulas are normally associated with trauma (9).

Case report

A four year old, male guinea pig was presented in the hospital for a routine castration. The owners cared for the animal since birth. It was kept outdoors with a male sibling. The animal was in a good general condition and there was no history of previous diseases, trauma or abnormalities. At the initial examination the perineal sac was smaller compared to other intact male guinea pigs. At the caudal end of the perineal sac a small dimple was noted, that ended blindly after 3mm. For the following examinations and the castration the guinea pig was sedated using a combination of fentanyl, midazolam and medetomidine.

The genitals and the urethra were developed normally, the catheterization of the urethra using a flexible feeding tube was unproblematic. A fistula opening was present 1cm caudodorsally of the anus. The skin around the opening was bulging but without any signs of inflammation. Slightly protruding and reddened mucosa was visible inside the opening. After instillation of a contrast agent into the fistula the caudal region of the large intestine was contrast-filled in the following radiographic examination. The intestine appeared to be normal and no other abnormalities were present. The excretion of normal faeces through the fistula was visible after the sedation and atresia ani with a rectocutaneous fistula was diagnosed. The examination of the male sibling showed a normally developed anus.

As the guinea pig had no clinical signs or associated malformations apart from the smaller perineal sac and the passage of normal faeces was possible through the fistula opening, no therapy was scheduled.
Conclusion

The characteristics of this case include the high age of the animal when diagnosing the atresia ani, the lack of any clinical signs and the formation of a single rectocutaneous fistula.

Citation Index


AN UNUSUAL *SALMONELLA* IN A GREEN TREE PYTHON

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*Salmonella* species are widely recognised to be carried by reptiles, often with little effect on the host. Occasionally certain species can cause primary or secondary disease, especially if predisposing factors exist. Due to the potential zoonosis risk, governmental advice is available to owners, and many breeders may elect to screen their collection to try to maintain as free a status as possible.

This presentation discusses an unusual case in a Green Tree Python (*Morelia viridis*) that had been recently imported post being ‘captive farmed’. This individual had a history of not eating and body condition loss over a month. It also had loose stools and there were mucosal plaques in the mouth. Several Royal Pythons (*Python regius*) in the same area were also inappetant and had loose stools, but had self resolved after 1 to 2 weeks of symptoms.

A faecal sample was taken for analysis, and the python treated with Ceftazidime injections, oral Fenbendazole, and diluted F10 mouth swabs. The python respond favorably to therapy and was eating again within two weeks, with the diarrhoea resolved.

The faecal analysis revealed an unusual *Salmonella* that appeared to be urease positive. This *Salmonella* is currently undergoing phenotypic analysis to try to identify it and the presentation will report on these findings.

With thanks to: HPA, UK.
ADVANCED MAMMALIAN SURGERY

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Small exotic mammals, including ferrets, rabbits, guinea pigs, chinchillas and rats have become common companion animals. Correlated to the increase in ownership is a subsequent rise in small pet mammal presentations to veterinary practices. This article addresses the advanced surgical management of malignant tumours and large liver masses in pet ferrets, thoracotomy and rhinotomy in pet rabbits.

Apart from possible surgical procedures commonly performed in dogs and cats, the clinical should be familiar with species specific diseases and treatment options in commonly kept pet small mammals. For example some types of neoplasia in ferrets have different prognosis in comparison with dogs and cats, e.g. mast cell tumors, often malignant (and fatal) in the dog, are constantly benign, do not have metastases and after simple excision are associated with a good prognosis.

Thorough history, clinical examination and laboratory analyses (haematology, plasma chemistry, urine examination) should precede each surgery. In case of severe stages of some diseases (nonresponsive rhinitis to the treatment, otitis in rabbits), the use of advanced imaging modalities (CT, MRI) is recommended, as the use of radiography is not always sufficient. Moreover, based on above mentioned imaging methods, a surgeon could plan the optimal surgical approach, medical protocol and determine more exact prognosis. Older ferrets and rabbits are commonly presented with more than one disease, so treatment of all diseases and patient stabilization is necessary.

Successful outcome of more advanced surgery in small exotic mammals rely, apart from exact diagnosis and concurrent disease, on IV access, patient intubation, use of multimodal anaesthetic and analgesic protocols, and thorough perioperative and postoperative patient monitoring. Dedicated postoperative care is also of high importance, especially when ferrets and rabbits need to be forced.

Malignant tumours in ferrets

Surgery remains the mainstay of cancer therapy and aggressive surgical resection provides the highest cure rates of any treatment modality. The most commonly seen malignant tumour in ferrets, which could be treated by advanced surgical methods are spinocellular sarcoma, preputial gland adenocarcinoma, and adrenal gland carcinoma.

Wide surgical resection is curative for many skin tumours. Appropriate preoperative planning maximizes surgical cure rates and facilitates reconstruction. However, some malignant
tumours could grow aggressively into other surrounding tissues. Authors removed spinoceellar carcinoma, in which whole thoracic wall was included, the skin, subcutis, intervertebral muscles and ribs were affected. At the end, lateral thoracotomy with partial rib cage excision was performed. Tumours of the anal region (anal sac adenocarcinoma, squamous cell carcinoma, spindle cell carcinoma) belongs to ones, which are locally invasive and could be successfully treated with removal of the primary tumour mass. Special care need to be taken to do not damage rectum and anal sphincter. In case of preputial adenocarcinoma, penile excision supplemented with perineal uretrostomy is recommended, as these tumours quickly metastasize to regional lymph nodes. Chemotherapy and/or radiation therapy for these tumours were not described for ferrets, however use of similar drugs as in dogs and cats (Fossum 2012) and consultation with veterinary oncology specialist is recommended.

**Liver and ductus choledochus surgery**

Surgery of the liver and ductus choledochus (DC) is complicated by fact that hepatic tissue is friable and lumen of DC is in ferrets 1-2 mm. Partial or complete lobectomy is in general indicated in cases when disease involves only a portion of a liver lobe or whole (Fossum 2012). In ferrets, common indications involve hepatic cystadenoma or other non-lymph proliferative tumours. Liver surgeries should be performed with caution to haemostasis and careful dissection and preservation of caudal vena cava and portal vein. Authors (VJ, KH) have good experience with the combined approach from linea alba and lateral abdominal wall incision caudal to the last rib. Choledochotomy due to cholelithiasis could be (Hauptman et al. 2011) performed by isolated incision through the DC or could be performed with total gallbladder excision.

**Thoracotomy in rabbits**

Thoracotomy in rabbits is indicated in cases of mediastinal tumours (thymoma, mediastinal lymphoma, thymic carcinoma) or lung abscesses (Harcourt-Brown 2002). Medial sternotomy is the preferred approach of authors (VJ, KH) to the mediastinal masses with the preservation of at least three caudal sternebras. A careful soft tissue dissection with small swabs is necessary. Partial pericardioectomy and/or pleurotomy are sometimes necessary. Placement of intrathoracic catheters is not a standard technique used in rabbits as this species has a very narrow thoracic cavity and almost all the gas is expelled by assisted ventilation during the tightening of the last knot.

**Rhinotomy in rabbits**

Rhinotomy is in rabbits indicated in cases of chronic sneezing, non-responsive upper respiratory disease or in cases of neoplastic disorders. Based on computed tomography findings a dorsal (“true”) or lateral (mostly “sinusotomy”) is performed. Care should be taken do asses even middle ear cavity as some of patients have concurrent otitis media/interna (even subclinical). Intubation during the procedure, thorough nasal or paranasal recessus flushing, and wound marsupialization/or intranasal catheter placement is necessary to reach optimal therapeutical outcomes. For exact diagnosis and proper therapeutical protocol,
bacteriology, antibiotic sensitivity testing and histopathological examination should be performed in all cases.

References and further reading


This paper describes a case of suspectly diagnosed hyperadrenocorticism in three years old male guinea pig (Cavia aperea f. porcellus). This patient was presented at the Avian and Exotic Animal Clinic with a history of bilateral, non-pruritic hair loss on the abdomen, flanks and along the scapulas. The owner had also noted an increased activity, water intake, decreased appetite, weight loss and slight faecal output.

Clinical examination revealed good body condition (3/5), complete alopecia on the ventral abdomen, ventral parts of the hind limbs and ventral parts of the forelimbs. In the alopecia expansion places, the skin appeared to be thinner. Skin scrape examination excluded presence of parasites. Except for high eosinophils level (16%), the main haematological and biochemical findings were within reference ranges. Additional plasma parameter was analyzed. The value of plasma cortisol was extremely elevated (1066.0 nmol/l). Abdominal ultrasound examination revealed enlargement of adrenal glands (left adrenal 1.4x0.6, right adrenal 1.3x0.63 cm), which were hypoechoic to the kidney parenchyma and normal echostructure. According to the results, mentioned above, diagnosis of suspected ACTH-dependent Cushing’s syndrome was established.

Initial therapy and stabilization consisted of fluid therapy, ranitidin, metoclopramide, ivermectine (repeated for 10 days) assisted feeding and supportive care. After 3 days of hospitalization, patient’s conditions improved and follow-up therapy with ketoconazole has started. The initial dosage was 25 mg/kg twice a day. On 13 days follow-up examination, patient showed normal appetite, weight gain, normal faecal output and hair regrowth. 55 days after initial therapy, the guinea pig was completely overgrowth with new hair, but plasma level of cortisol was out of reference ranges (>1379.5 nmol/l). The dosage of ketoconazole was raised to 30 mg/kg twice a day. This high value of cortisol we have not been able to diminish with ketoconazole treatment.

Hyperadrenocorticism is well known disorder in dogs. The first choice screening tests are the low-dose dexamethasone suppression test, the ACTH stimulation test and urinary cortisol:creatinine ratio test. These screening tests for assessing pituitary-adrenal function have not been established for small mammals. Guinea pigs are considered to be corticosteroid-resistant species. Therefore they may not respond to the low-dose dexamethasone suppression test like dogs. Increasing dexamethasone dosage may lead to gastrointestinal ulcerations. Also there are not known reference ranges of this test for small
mammals. The ACTH stimulation test has been used for the diagnosis Cushing’s syndrome in guinea pig few years ago. In our case, using this test would be unnecessary whereas plasma level of cortisole was so high, that it was out of reference range. Urinary cortisol:creatinine ratio test is considered to be convenient and high sensitive. In rodents, performance of this test is technically difficult.

Pituitary-dependent hypercortisolism is in dogs generally treated with highly satisfactory results by trilostane. Trilostane tablets are administered per orally, at the same time a day with food. Producer cautions against splitting or crushing tablets. Also the lowest concentration of the tablet is 10 mg/kg on the market. Based on these knowledges mentioned above, we decided to use safer protocol, an alternative method, ketoconazole. Using this drug we achieved normalization of clinical appearance.

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Zeugswetter, F., Fenske, M., Hassan, J., Kuenzel, F. Cushing’s syndrome in a guinea pig. The Veterinary Record, 2007; 160: 878-880


Viral infections can cause severe problems in birds, not only in poultry, but surely also in breeding colonies of non-galliform birds. The problems can be acute mortality in specific age groups or long lasting subclinical infections, leading to incidental losses.

This presentation will shortly go over the viral infections of pigeons, passerines and psittacines and highlight the main clinical and pathological findings, diagnostic possibilities and management approaches. The newly emerging infections are avian bornavirus, reovirus, Usutu virus and West Nile virus.

This overview is based on the experience and examples we had in the Diagnostic Pathology Laboratory NOIVBD and recent publications in the period 2005-2013.

The classical viruses

These include adenovirus mostly causing hepatitis and mortality in pigeons, but also occasionally seen in other birds.

Circovirus infections are described in many pet birds in all parts of Europe. Originally, it was diagnosed as psittacine beak and feather disease (PBFD) but also many reports are dealing with non-psittacine species, predominantly pigeons (*Columba livia*). Circovirus infections are typically accompanied by a plethora of concurrent viral, bacterial, or fungal infections. Many authors suggest that circovirus infections result in acquired immunodeficiency.

The most frequently diagnosed herpesviruses are herpesvirus 1 in pigeons and psittacine herpesvirus (= Pacheco’s Disease). Typical is the inclusion body hepatitis and the diagnosis is based on the combination of the histopathology and a pan-herpesvirus PCR of liver tissue.

Paramyxovirus, other than NCD in poultry, is mostly seen in pigeons as serotype 1 paramyxovirus. The other paramyxovirus that causes high mortality as well in psittacines as in passerines is paramyxovirus type 3.

Avian polyomavirus (APV) infection is widespread in birds, including Galliformes and Psittaciformes but it can also affect Passeriformes and Falconiformes. The most common target organs found in the pathology are the liver with necrotic foci and hemorrhages and the kidneys with glomerulus lesions.
The occurrence of typical poxvirus infections in pigeons is strictly correlated with the availability of vectors responsible for the transmission of the disease. In captive passerines, avian poxvirus as a septicaemic problem is almost exclusively seen in canaries and other *Serinus* spp.

**Emerging viral infections**

**Avian bornavirus**

Proventricular dilatation disease (PDD) is a long known fatal inflammatory disease predominantly of psittacine birds caused by a recently discovered avian bornavirus.

It primarily affects the autonomic nerves located in the upper and middle digestive tracts. The disease is characterized by lymphoplasmacytic infiltrations, mainly in the nerves and ganglia of the peripheral nerves and central nervous system. These infiltrations lead to central nervous system abnormalities such as ataxia, abnormal gait, proprioceptive defects, eye-lesions and by affecting the nerves in the gastrointestinal tract to dysfunctions including dysphagia, regurgitation and the passage of undigested food in faeces.

Recently, a novel virus (avian bornavirus [ABV]) was discovered in parrots suffering from PDD and this virus in considered to be the cause of the disease. Avian bornavirus is present all over Europe, US and even proven in free-living parrots in Brazil.

Until recently, nine ABV genotypes have been identified which infected psittacine birds, wild waterfowl or canaries. In canaries and finches sequence analysis identified additional several distinct ABV genotypes, which differ markedly from the genotypes present in psittacine birds and waterfowl. In contrast to the mammalian BDV which has a general preference for the central nervous system, ABV may be found in many tissues, at least in the later stages of the infection. Despite the fact that clinically healthy birds may be infected with ABV, studies have demonstrated a correlation between ABV infection and clinically present PDD. Transmission studies have fulfilled Koch’s postulates. With the detection of the avian bornavirus several serological (western blot, Elisa, indirect immunofluorescence assay) and antigen detecting tests (rt-PCR and Realtime-PCR) were developed for in-vivo and post-mortem diagnosis. In clinical situations viral RNA could be demonstrated in blood, faeces, cloacal and choanal swabs of infected birds. For the clinical diagnosis and detection of infected birds in a collection the serological method (elisa for P40) seems to be the most reliable and cheapest methods with a high specificity and sensitivity.

**Reovirus**

In Europe and Canada numerous psittaciformes died showing severe spleno- and hepatomegaly with multifocal acute necrosis. The first reports are from 2000 and the virus is considered a psittacine reovirus. However since 2008 no new outbreaks have been diagnosed in Europe.
**Usutu virus**

Usutu virus is an African mosquito-borne flavivirus, member of the Japanese encephalitis antigenic group. This avian virus is transmitted by arthropod vectors (mainly mosquitoes of the *Culex pipiens* complex. Usutu virus has recently been introduced to Europe and is spreading through Austria, Germany, Hungary, Italy, Spain and Switzerland, causing disease in birds and possible humans. Like West Nile virus, Usutu virus may become a resident pathogen in Europe. In 2001, Usutu virus was responsible for mortality of blackbirds (*Turdus merula*) and great grey owls (*Strix nebulosa*) in the city of Vienna and surrounding villages. This was the first time that Usutu virus had emerged outside Africa and caused fatalities in warm-blooded hosts. The major macroscopical finding was hepatosplenomegaly; histologically, neuronal necrosis, myocardial lesions, and coagulation necrosis of the liver and spleen were observed. The diagnosis is confirmed by immunohistochemistry and in-situ hybridization. This virus seems to be spreading slowly over Europe, but is affecting mainly wild birds.

**West Nile Virus**

West Nile virus is not (yet) fully established in Europe. It was detected in Italy in late summer 2008 in horses and birds in the Po valley. In a survey in Italy WNV was detected in equines and dogs, and, to a lesser extent in cattle and wild birds. Up till now few human cases with mortality have been reported in Italy, Greece, Albania and Rumania. Recent outbreaks were identified on all major birds’ migratory routes crossing the Mediterranean region.

**Reference list available on request**
SCREENING FOR BACTERIA OF WILD BIRDS FROM THE SOUTH MORAVIAN REGION

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TAV Project (Training Centre for Avian Medicine) has started in October 2012 as an international joint project of Clinic for Reptile, Avian and Fish Medicine, University of Veterinary Medicine Vienna, Austria (leading partner) State Veterinary Institute Jihlava, Czech Republic (the first partner) and the Avian and Exotic Animal Clinic, Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic (the second partner).

The aim of the project is to perform laboratory examinations of about 500 cloacal swabs and triple swabs (conjunctival, chonal and cloacal swabs) taken from living wild birds. The cloacal swabs for bacterial assays were taken by the use of Copan ESwab with 1 ml of Amies medium; triple swabs for viral, chlamydial, mycoplasmal and ureaplasmal assays were collected by the use of Copan Universal Transport Medium 1 ml (UTM-RT). Tissue biopsies from dead wild birds (e.g. spleen, liver, bone marrow, brain, crop and oesophagus) were frozen (- 80 °C) and transported to laboratory. The examinations were focused on isolation Salmonella spp. (S. enterica serovars typhimurium, enteritidis, hadar, virchow and infantis), Campylobacter spp. (C. jejuni), MRSA (Methicillin resistant Staphylococcus aureus), and Escherichia coli. Triple swabs and tissue biopsies were examined with PCR for: Chlamydophila psittaci, West Nile Virus, AIV (Avian Influenza Virus), Cryptococcus neoformans, Cryptosporidium spp., Giardia duodenalis, Mycobacterium avium, Paramyxovirus, Coxiella burnetii.

The field trips and sample collection were organized under cooperation with staff members of rescue stations for wild animals (the Czech Society for Ornithology) - Rescue Centre Brno, Park Lužánky Brno, Airport Brno Túťany, Marefy/Bučovice urban area, Jihlava and Lechovice urban area.

Almost 260 samples from living birds were collected within the period January – May 2013 and new samples will be collected within June – September, October-December 2013.

The results are ready for reading at the homepage of TAV. This project is partially supported by the EU fund for European Territorial Co-Operation Austria Czech Republic 2007-2013, project TAV M00226.
Richardson’s Ground squirrels (Urocitellus richardsonii) are a species of North American sciuromorph that are infrequently kept exotic pets within the United Kingdom.

The author’s practice cares for the animals within a private rescue dedicated to Richardson’s ground squirrels and a high incidence of neoplasia was identified within the population of 14 unrelated animals.

A range of neoplasms including elodontoma (3), giant cell sarcoma (1), hepatic carcinoma (3), hepatic adenoma (1), lipoma (4) and splenic myelolipoma (1) were identified. The elodontomas were confirmed by radiography or computer tomography and the soft tissue neoplasms were confirmed on histopathology. All soft tissue neoplasms were identified in female animals, and the three elodontomas were identified in male animals giving a marked difference in neoplasm incidence and type of neoplasms identified between the sexes. Neoplasms were identified in all seven adult females, and in three of the seven adult males over a 24 month period.

Average age at diagnosis in female animals was 38 months, and 27 months in males. Mean survival time following diagnosis of a neoplasm was 5 months in females and 9 months in males. The values for individual neoplasms are shown in Table 1.

<table>
<thead>
<tr>
<th>Neoplasm</th>
<th>female</th>
<th>male</th>
<th>Mean age at diagnosis (months)</th>
<th>Mean survival time (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatic adenoma</td>
<td>1</td>
<td>0</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>Hepatic adenocarcinomas</td>
<td>3</td>
<td>0</td>
<td>48</td>
<td>2.33</td>
</tr>
<tr>
<td>Giant cell sarcoma</td>
<td>1</td>
<td>0</td>
<td>30</td>
<td>&gt;9</td>
</tr>
<tr>
<td>Lipoma</td>
<td>4</td>
<td>0</td>
<td>35.33</td>
<td>4</td>
</tr>
<tr>
<td>Elodontoma</td>
<td>0</td>
<td>3</td>
<td>25.67</td>
<td>14</td>
</tr>
<tr>
<td>Myelolipoma</td>
<td>1</td>
<td>0</td>
<td>47</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1, sex distribution and longevity for individual neoplasms in Richardson’s Ground squirrels
A 2-years-old intact male African pygmy hedgehog was presented with an acute onset of paralysis, lateral recumbency, tremor and tachycardia. According to the owners, the hedgehog was a day before without any signs of illness, had a normal appetite, normal faecal output and coordination without pathological findings. Clinical examination revealed paralysis, inability to close the hood, bilateral exophthalmos, body trembling, self-mutilation of hind limbs, buoyancy movements under anaesthesia examination. Haematological and plasma chemistry analyses showed only slightly elevated creatine kinase. Remaining parameters were within reference ranges. Radiography of the spine and head did not show any pathology. Patient’s initial therapy consisted of subcutaneously administered fluid therapy, marbofloxacine, metoclopramide, ranitidine, assisted feeding and B vitamins and Ialgugen cream (Natrii hyaluronas, sulfadiazinum argenteum) was rubbed on toes abrasion of the hind limbs. Immediately after therapy, patient became more active and improving of the movement was notable. Whereas the hedgehog was able to stand and move without falling consistently, the whole body tremor, wobbling and head tilt was present. Dorsal abrasions of the paws resulted from the animal dragging its limbs due to paraparesis. The patient was able to feed itself after dip its nose to the food. At the three months follow-up examination showed deterioration of the clinical conditions. The hedgehog became completely dysphagic and cachectic. Euthanasia was followed by post-mortem examination. Histopathological examination of all tissues, brain and spinal cord included, revealed vacuolization of the white matter tracts of the brain stem, cerebellum and telencephalon hemispheres.

Wobbly Hedgehog Syndrome is well known disorder, described in North America’s pet African pygmy Hedgehogs. It is a common cause of progressive paralysis. Unfortunately the diagnosis can by determined only by post-mortal histopathologic examination of CNS tissues, which reveals vacuolization of the white matter tracts of the cerebrum, cerebellum, brain stem and spinal cord. There appear to be a loss of myelin first, then secondary degeneration and loss of the axon, followed by neuronal degeneration. As in presented patient, conditions of this disease occur mostly in young hedgehogs at the age of 2-years. There is a wide range of clinical signs. In the early stage, mild ataxia, wobbling, stumbling, head tilt, off balance or in-coordination could be observed. Signs are usually relapsing and
remitting in this stage. With progression, clinical signs become more severe and may include exophthalmos, seizures, tremor, muscle atrophy, falling consistently to one side, self-mutilation and paralysis ascending from hindlimbs to forelimbs. Progressive paralysis usually indicates terminal stage of disease. Many hedgehogs with tetraplagia can live for several months if the appetite is still maintained and the owners choose supportive care and hand-feeding. In the contrast, in our patient, the onset of clinical signs was more rapid and severe, but after supportive care and assisted hand-feeding, patient’s conditions improved noticeably. It could live with some help till significant health deterioration. Unfortunately there is no specific treatment for this disease. The recommended therapies are supplementation with vitamin E, selenium, vitamins B or calcionate syrup. Antibiotics (as we also administered) are used to treat or prevent concurrent infections. The aetiology of the disease is still unknown. It is possible that the familial pattern of the disease is a reset of an inherited susceptibility to an infectious agent, possibly via genes encoding viral receptors. It is also possible that vertical transmission of an infectious agent mimics an inherited trait.

References:


Anorexia is a common reason for presentation of rabbits for treatment and the differential diagnosis list is long. Diagnosis is a problem solving exercise with clinical examination and radiology as the key diagnostic tests. Meanwhile effective supportive treatment to prevent or treat gut stasis is important.

**GUT STASIS** is always a risk in an ill rabbit. It is a potentially fatal condition that is triggered by stimulation of the sympathetic nervous system, which inhibits gut motility and reduces appetite. Left untreated, gut stasis can result in death after 3-4 days. At the outset slow gut motility and reduced food intake decreases the absorption of sugars, starches or volatile fatty acids from the digestive tract and results in a negative energy balance so adipose tissue is broken down as an energy source instead. This releases free fatty acids that are transported to the liver where they are oxidised as an energy source. Oxidation of free fatty acids releases ketones and causes ketoacidosis, which is a problem for rabbits because they lack some renal metabolic pathways that correct acidosis. Large amounts of free fatty acids in the liver also create a metabolic bottleneck that results in fatty infiltration and hepatic degeneration, which ultimately causes liver failure and death. Fat rabbits or those with a high energy demand, such as pregnant or lactating does are most susceptible to death from hepatic lipidosis.

**CLINICAL SIGNS OF GUT STASIS** are: (i) anorexia (ii) reduced or absent faecal output, perhaps with small hard faecal pellets (iii) progressively quieter demeanour (iv) firm small stomach, both radiographically and palpably (v) reduced amount of ingesta in GI. Without treatment, a number of other problems can develop. Gastric ulcers are common. Slow gut motility also results in fermentation of the intestinal contents and accumulation of gas, especially in the caecum and proximal colon. Gas distension causes pain, which decreases gut motility and reduces gut motility further. Gas shadows can be seen radiographically.

Good nursing, food, fluid and medication will prevent and treat gut stasis. A comfortable, stress free environment with tempting foods is important. Syringe feeding provides food and fluids and effective analgesia in combination with prokinetic and anti-ulcer treatment is effective.

**INITIAL ASSESSMENT** of the anorectic rabbit is required as soon as it is presented and a decision is required about the level of diagnostic tests and treatment that are required. In general, the rabbit will fall into one of three categories (i) cold, shocked and moribund (ii) depressed and unresponsive or (iii) alert and responsive. The initial treatment and approach to treatment differs between these three groups.
CLINICAL HISTORY is an important part of the differential diagnosis. It is important to ascertain whether a rabbit is kept as a house rabbit or whether it lives in a hutch or shed with or without companions. House rabbits are more likely to be exposed to toxins such as lead paint. Rabbits in hutches are more likely to be exposed to extremes of temperature or the attention of predators such as cats or foxes. Establishing when the rabbit last ate normally is important. A sudden loss of appetite can indicate a traumatic incident, acute infection, intestinal obstruction or other abdominal catastrophe. A gradual loss of appetite is more indicative of gut stasis. A partial loss of appetite or reluctance to eat may indicate dental disease. Faecal output is also important. A healthy rabbit passes copious quantities of hard faecal pellets overnight and periodically throughout the day. Caecotrophs are not normally seen. Any deviation from this pattern is abnormal.

CLINICAL EXAMINATION: The demeanour of the rabbit can be assessed with the rabbit in its carrier while the owner is giving the clinical history and the weight of the rabbit can be assessed as it is lifted out of the carrier. A fat or obese rabbit is at greater risk of dying rapidly from hepatic lipidosis whereas an emaciated or thin one is more likely to be suffering from a chronic condition that is causing anorexia. After the rabbit has been placed on the table, its general condition can be assessed before examining the perineum, limbs, face, ears and eyes. A chronically unwell rabbit or one that has dental problems or musculoskeletal pain may not be grooming effectively, especially in the perineal area. Epiphora or dacryocystitis also suggests underlying dental disease, which may or may not be the cause of anorexia.

Abdominal palpation should be done gently because the thin-walled viscera are easily traumatised. It is possible to rupture distended organs or abdominal abscesses so care is necessary, especially during palpation of a painful abdomen. The abdomen feels full in rabbits that are eating well and empty in rabbits that are not eating. The liver is only palpable if it is enlarged and the spleen is never palpable. Both kidneys can be identified as mobile structures. The stomach is palpable behind the ribs on the left, it can only be palpated if it is enlarged or the rabbit is thin. In rabbits with gastric dilation, the stomach can be palpated as an enlarged, balloon like structure. It may be small and hard in rabbits with gut stasis. The caecum is sometimes identifiable as a doughy mass in the ventral abdomen, which is normal. If it is impacted the caecum is felt as a hard sausage-like structure. The bladder is palpable in the caudoventral abdomen and rabbits with urinary tract problems often raise their hindquarters and void urine in response to palpation of the bladder. The uterus is not palpable unless it is enlarged due to pregnancy, neoplasia or pyometra. Abdominal masses may be neoplasms, impacted organs, abscesses, foetuses or areas of fat necrosis.

Auscultation may reveal increased or abnormal respiratory sounds although it is difficult to locate the source, which may from the trachea, larynx, pharynx or nasal passages. Any dysrhythmia or murmur is significant. Muffled respiratory sounds or heart sounds can indicate fluid in the chest or the presence of a mass, such as an abscess or thymoma. Raising the body higher than the head is useful as it can induce marked exophthalmos in rabbits with congestive heart failure or mediastinal masses.
Oral examination is vital. Healthy dentition can often be established from an owner's description that their rabbit eats a lot of hay and by palpation or the mandible and conscious oral examination. If dental abnormalities are detected, it is important to decide whether they are the cause of the current anorexia or not. Examination under anaesthetic is required if there is any doubt about dental disease as a cause of anorexia.

**DIAGNOSTIC TESTS:** Radiography is often indicated for the anorexic rabbit and ultrasound can be useful. Radiographs often reveal the cause of anorexia, such as kidney or ureteral stones, aortic mineralisation or collapsed disc spaces. Gastric dilation without gas in the caecum is indicative of an intestinal foreign body, so surgery may be indicated. Gas in the caecum is generally a good prognostic sign as it indicates that any obstruction is not in the small intestine and can probably pass through or the rabbit has gut stasis or some other medical condition. Blood and urine sampling is also useful to detect acidosis, uraemia, lipaemia, anaemia or other abnormalities that can help in the differential. Although a full haematological and biochemical profile is ideal, it is not always possible in every case. A good compromise is to take sufficient blood to fill a micro-haematocrit tube and for blood glucose measurement with a glucometer. Only a few drops are required and much useful information can be ascertained about the rabbit's stress and pain levels, hydration status and presence or absence of lipaemia. A stained fresh blood smear can yield additional information. An I-stat result is helpful for moribund rabbits.
PERIODONTAL MICROFLORA ASSOCIATED WITH ODONTOGENIC ABSCESSES IN RABBITS AND ITS POSSIBLE ZOONOTIC POTENTIAL

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Periapical abscesses are relatively common disorder of pet rabbits. The aim of this article is to discuss possible zoonotic potential of the bacterial microflora identified from odontogenic abscesses in rabbits.

Rabbits presented with facial swelling had been submitted for clinical examination with history of anorexia, weight loss and/or excessive salivation. All animals were clinically examined and in all cases blood haematology, plasma chemistry and skull radiography were performed. Based on clinical and imaging methods findings final diagnoses were established as periapical abscesses of odontogenic origin. After stabilization, all rabbits underwent surgery under general anaesthesia. Affected tissue, including teeth, bone and soft tissues were excised and submitted with pus for microbiology and antibiotic sensitivity testing. The surgical wound was marsupialized and let to heal by secondary intention.

The most frequently isolated anaerobic bacteria were Bacteroides sp., Prevotella oris, Actinomyces sp. and Fusobacterium nucleatum. Six multi-resistant microbes were found in 5 rabbits which included Escherichia coli - 2x, Enterobacter cloacae - 2x, Proteus vulgaris, Pseudomonas sp and Streptococcus beta - haemol. Group G.

The most important bacteria responsible for osteomyelitis of the jaw in humans are Prevotella spp., Porphyromonas spp., and Fusobacterium spp. (anaerobic Gram negative rods), Actinobacillus actinomycetemcomitans, Haemophilus spp. (facultative anaerobic gram negative rods), Actinomyces spp., Propionibacterium spp., Corynebacterium spp. (facultative anaerobic gram negative rods).

Some of these bacteria (e.g. Actinomyces spp.) may have zoonotic potential. Higher risk groups include people on immuno-suppressive treatments, diabetics, alcoholics, HIV-infected people and pregnant women. Nosocomial infections are one of the most common complications of hospitalization and lead to increased morbidity and mortality. Most of the hospital-acquired infections fall into one of the following categories: pneumonia, surgical site infections, catheter-related infections and urinary tract infections. These infections prolong hospitalization and require more extensive diagnostics and treatment. Multi-resistant bacteria
often contaminate the environment of the colonized or infected patients, and survive for long periods.

High compliance with infection control measures and a prudent and more restrictive use of antibiotics are the key measures to prevent these epidemics. Appropriate and targeted use of antibiotic is necessary treating any animal. Caring for the health of animals is the first important step in preventing zoonoses. Practicing good personal hygiene and wearing protective clothing (face mask, protective gloves, etc.) is a must in minimizing the risk of pathogen transmission between rabbit osteomyelitic lesion and operating surgeon and surgery hall stuff.

Acknowledgement

This paper was supported by grant project IGA No. 114/2013/FVL.
Guinea pigs are commonly used as laboratory animals; however, over the past few years, they have become increasingly popular as pets. The aim of this article was to present disease prevalence in 400 pet guinea pigs.

Between January 2008 and March 2010, 400 guinea pigs (Cavia porcellus, 223 males and 177 females) were examined at the clinic. The body weight of guinea pigs ranged between 70g and 1.66 kg (average 0.84± 0.21 kg) and their age ranged between 7 days and 9 years (average 2.36 ± 1.39 years). All animals that were examined at the clinic presented various signs of disease or were presented for regular health check.

Clinical examination included assessment of behaviour, body condition, examination of fur, eye and ears, palpation of lymph nodes, auscultation of cardiovascular system and respiratory system and palpation of the abdominal cavity. The oral cavity was examined with a paediatric laryngoscope. Blood for haematological and plasma chemistry analyses was obtained from cranial vena cava. Tissue samples or swabs were submitted for bacteriology, mycology and computed tomography was also performed.

Prevalence of health disorder in guinea pigs is summarised in Table No. 1. The most common disease in guinea pigs was acquired dental disease (35.25 %, 141 animals from 400 guinea pigs), skin alopecia and hair loss (24.75 %, 99/400) and gastrointestinal disease (10.75 %, 43/400). Other common disorders included ovarian cystic disease, eye disorders and Trixacarus caviae infection. Only 20 guinea pigs from a total of 400 animals were healthy.

The life span of pet guinea pig is usually 5 to 6 years. In this study the oldest animal had 9 years. The most commonly encountered disorders are associated with oral cavity, skin and gastrointestinal system, so a really thorough clinical examination should be performed in all cases, conscious oral cavity examination included.

Acknowledgement

This paper was supported by grant project IGA No. 114/2013/FVL.
Table No. 1: Prevalence of health disorder in 400 guinea pigs

<table>
<thead>
<tr>
<th>Organ/tissue disease</th>
<th>n = 400</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin disease</td>
<td>99</td>
<td>24.75</td>
</tr>
<tr>
<td>T. caviae</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>Trichofolliculoma</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>others</td>
<td>55</td>
<td>13.75</td>
</tr>
<tr>
<td><strong>Dental disease</strong></td>
<td><strong>141</strong></td>
<td><strong>35.25</strong></td>
</tr>
<tr>
<td>Iatrogenic malocclusion</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>Syndrome of dental disease</td>
<td>111</td>
<td>27.75</td>
</tr>
<tr>
<td>Odontogenic abscesses</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td><strong>Gastrointestinal disease</strong></td>
<td><strong>43</strong></td>
<td><strong>10.75</strong></td>
</tr>
<tr>
<td><strong>Respiratory disease</strong></td>
<td><strong>17</strong></td>
<td><strong>4.25</strong></td>
</tr>
<tr>
<td>Rhinitis</td>
<td>11</td>
<td>2.75</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Heart disease</strong></td>
<td><strong>5</strong></td>
<td><strong>1.25</strong></td>
</tr>
<tr>
<td><strong>Reproductive disease</strong></td>
<td><strong>60</strong></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td>Ovarian cystic disease</td>
<td>36</td>
<td>9</td>
</tr>
<tr>
<td>Dystokia, Pyometra</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td><strong>Urinary tract disease</strong></td>
<td><strong>15</strong></td>
<td><strong>3.75</strong></td>
</tr>
<tr>
<td><strong>Skeletal disease</strong></td>
<td><strong>18</strong></td>
<td><strong>4.5</strong></td>
</tr>
<tr>
<td><strong>Eye disease</strong></td>
<td><strong>42</strong></td>
<td><strong>10.5</strong></td>
</tr>
<tr>
<td>Ear disease</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Haemoproliferative disease</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Status ante finem</td>
<td>11</td>
<td>2.75</td>
</tr>
<tr>
<td>Healthy animals</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>
SPECIAL CONSIDERATIONS OF THE BIRD PATIENT

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Birds can live a long time

Many parrots live 20 to 50 years—with larger birds generally living longer. Parrots can form very strong bonds with their owners. When this occurs, they may have difficulty adjusting to a new owner and this stress alone can lead to anorexia and immunosuppression-associated diseases. Bird ownership should never be considered a short-term commitment. The sick bird should be assessed as to age; a 25-year-old bird may not be ‘old’ even though this is an advanced age to vets used to dealing with small mammal patients. A sick 10 year old Amazon parrot has potentially many years ahead and this should perhaps form part of the decision making process with the owner with regard to investment in treatment vs. longevity.

Birds are hotter than mammals

The internal temperature of birds is 41°C rather than the standard 37°C of mammals. This fact, coupled with the fact that sick birds are often hypothermic, requires the use of incubators that provide 29°C (85°F) temperature with 70% humidity to support the bird patient. The clinician MUST note however that Birds cannot sweat, regulating their body temperature can cause problems for birds confined in a hot area and should be carefully monitored.

Birds bite (but remember handling can kill)

Smaller birds such as cockatiels certainly hurt when they bite yet rarely cause significant injury. However the larger parrots such as African greys and larger can damage fingertips and even amputate. Raptors tend to have less of a bite but dangerously strong talons that can penetrate though the skin of the unprotected hand and damage muscle and tendon of the handler. Vets and vet nurses should be trained in the correct handling of birds to prevent damage to themselves. However, also very importantly, handling techniques should protect the health of the bird and not further damage it. The use of thick welders gloves, for example, may make the handler feel safe from the parrot bite yet may block the handler’s sensitivity such that the bird is held too tightly and expires in the hand.

Special instrumentation required for birds

Specific equipment required to treat the bird patient include a range of small endotracheal tubes, small catheters and blood tubes. Radiosurgical equipment is of great benefit to operating on these small patients. A range of small surgical instruments, such as ophthalmologic or bespoke avian equipment, is necessary. Incubators, oxygenation chamber and small weigh scales are also invaluable to avian medicine. Anaesthetic monitoring equipment e.g. capnography, pulse oximetry, respiratory monitor, electrocardiography, etc.
should be able to measure the rapid heart rates and low respiratory volumes of the avian patient. These considerations are shared in some regards with the small mammal and reptile patients making the ‘exotic animal clinic’ start up facilities more economically practical.

**Birds have air sacs and pneumatic bones – birds can fly**

The placement of air sac tubes is a standard technique in avian medicine and permits the bird to breath via the air sac to the lungs and bypass the trachea. The respiratory structure that allows birds to efficiently extract oxygen from the air (a much more efficient system than mammals), therefore a bird presenting with respiratory signs of disease has already lost a large amount of ‘redundancy’ before presentation. ‘Lack of flying’ would be an early warning of respiration system compromise or other illness yet one often missed in the pet bird confined to a cage or room. This point should be appreciated by the clinician who considers birds to be ‘weak’ when actually they are physiologically very ‘strong’ but presenting at a very late stage and therefore rapidly decompensating to the vet.

This interesting anatomy can sometimes cause problems too; infection of the air sacs can spread into the connecting bones. The fact that the air sacs connect to some bones must be noted when intraosseous catheters are placed to avoid introducing fluids into the respiratory system; a consideration not required in the mammal patient.

**Speed of diagnosis vs. supportive care**

The bird patient will often present with an acute manifestation of a chronic or more long standing disease condition. Captive birds, even well handled pet birds, still retain the behavioural characteristics of their wild cousins in hiding signs of disease and displaying only subtle signs if they are strong enough to do so. Therefore rapid recognition of a bird that is ‘on the edge’ is vital otherwise delay and well-intended physical examinations may result in death of the animal. A though history is paramount though may often just conclude ‘the bird isn’t right’. Husbandry should be assessed, including diet, as unfortunately errors in these areas are still a major cause of captive bird illness. A minimum database of blood sample and radiography, taken under general gaseous anaesthesia, is often the safest and most important first step.

**The ‘worst case scenario’ list**

It is important to recognise the signs that indicate the bird has very poor prognosis, when even brief handling for treatment or tests may result in death. These are; dyspnoea (gasping for air), inability to bite, weakness, inability to grasp with the feet, abdominal swelling, blood in the faeces, ‘fluffed up’ appearance. Anorexia, easily combined with a lack of faecal material in the droppings, is of grave concern as the bird may be severely hypoglycaemic and emaciated, with smaller birds dying more quickly of inanition (failure to eat) that larger birds. In these cases the owner should be warned of the poor prognosis, the bird not handled but, if possible, the bird is placed into an oxygenated chamber whilst still in the carrier. Conversation with the owner may conclude that euthanasia may be the only treatment option;
otherwise any treatment and investigation must be approached with extreme care and minimal handling.
Twenty-five bearded vultures which are part of an international reintroduction project are housed in the Richard Faust Bearded Vulture Breeding Centre, Haringsee. Normally only animals from road accidents are used for feeding. Accidentally some meat of a shot deer was fed to the vultures in autumn 2011, just on the verge of the start of their breeding season.

It is well known that ingestion of lead can cause severe intoxication with fatal consequences (HELANDER et al., 2009; HUNT et al. 2006, SHIMMEL and SNELL, 1999).

It was not clear which bird received the contaminated parts. As a precautionary measure all bearded vultures had to be examined including X-ray and blood lead determination.

In two of the X-rays small parts of metal dense foreign bodies could be detected. In both cases the blood lead level was increased, in one case the level of concern of 40µg/ml was almost met. The radiography of the pellet of one vulture was positive whereas the X-ray of the bird itself showed no dense particles and also the lead concentration of the blood was beyond the level of detection. Increased blood lead concentration was found in one male bearded vulture without any suspicious particles in the radiography indicating that blood lead levels might be threatening even after shedding the particles with pellet or faeces.

The results show that big attention has to be paid to the feeding of raptors concerning lead exposition because even adelomorphic particles of lead can cause threatening blood lead levels.


The aim of the study was to determine the antibiotic sensitivity or resistance in bacteria isolated from *M. undulatus* patients of the Clinic for Avian, Reptile and Fish Medicine (University of Veterinary Medicine Vienna) during 2010-2012. The birds were separated in two groups: birds presented just for a check-up (A), and patients presented with a spectrum of health complications (B). According to the prevailing symptoms the group B was divided into the following subgroups: behavioral diseases (e.g. low activity), upper gastrointestinal disorders, lower gastrointestinal disorders, respiratory disorders, skin disorders (other than wound, mass, abscess), wound, mass (not further specified), abscess, feather disorders, musculoskeletal disorders, urinary disorders, eye disorders and endocrine disorders. Samples from choanas, crops, cloacas, sinuses, joints and abscesses were taken during the initial clinical examinations of the patients. The swabs were directly streaked out on blood agar, MacConkey agar and SGC 2 agar. Bacteria were isolated and identified according to the standard laboratory protocol. Antibiotic resistance tests were performed for amoxicillin, enrofloxacin, doxycyclin, difloxacin, meropenem, lincomycin, clindamycin, neomycin, cephalaxin and marbofloxacin. The most common health complications of patients presented were upper gastrointestinal problems (47.68%) and behavioral disorders (46.36%). Samples from the crop were performed in 77.78% birds of the group A and in 77.46% birds of the group B. *Staphylococcus* spp. and *Pasteurella* spp. were the most common bacteria isolated.

In the group A 0% of *Staphylococcus* spp. were sensitive to enrofloxacin, whereas 80% of colonies were intermediate resistant and 20% resistant. In the group B only 36.59% of *Staphylococcus* spp. were sensitive to enrofloxacin, whereas 35.37% of colonies were intermediate resistant and 28.05% resistant.

In the group A 0% of *Pasteurella* spp. were sensitive to enrofloxacin, 66.67% intermediate resistant and 33.33% resistant. In the group B 34.48% of *Pasteurella* spp. were sensitive to enrofloxacin, 34.48% intermediate resistant and 29.03% resistant.

We suggest the results important because: enrofloxacin is the most common antimicrobial agent used in veterinary practice with companion birds; 88.89% of the check-up group birds have not been treated with any antibiotics before the present study.
ADVANCED IMAGING FOR BIRDS

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Imaging techniques play an important role in avian medicine. Although many procedures are still not fully described and there is still a need of further studies and standardization of methods, the high potential of these techniques is evident.

The demands for the use of radiography in birds are comparably high. To obtain high quality images, it is essential to have the proper radiographic equipment. Within the last years, digital radiographic techniques started to replace conventional systems in many veterinary practices. Studies on the use of these techniques demonstrate the potential of digital radiography also in birds. A study conducted in birds of medium size demonstrated many advantages in comparison to conventional mammography systems (Bochmann et al. 2011).

Due to the small size of the patients and anatomical differences, especially the air sac system, there are some restrictions for the use of ultrasound in birds. However, due to its diagnostic advantages, it has become an important diagnostic tool. Ultrasonography is often used after a radiographic examination has been completed to give additional information on soft tissue structures and space-occupying processes. The ultrasound examination in birds is of special importance for the examination of the cardiovascular and urogenital system as well as the liver parenchyma. Typical findings are cardiomegaly, hydropericardium, neoplasia, cysts, egg binding, laminated eggs, and organ congestion. Sonographically guided (fine needle) biopsies are standard procedures also in birds. Ideally the birds should be fasted before ultrasonography is conducted. Anesthesia is only required in birds that are not used to handling and if stress might be a general risk. The most common coupling site is the ventromedian approach. For the examination, the bird is held in an upright position by an assistant or the owner.

Echocardiography is one of the most important imaging techniques for diagnosing cardiovascular disorders in birds. In most patients, B-mode echocardiography can be performed without sedation. From the ventromedian position two longitudinal cross sections of the heart are found: The image of the two-chamber view shows the left ventricle and the left atrium as well as the left atrioventricular valve. The four-chamber view shows both ventricles, both atria, the atrioventricular valve, and the aortic root with the aortic valve. Pericardial effusion can be visualized clearly as an anechoic structure between the myocardium and the pericardium around the heart. Altered wall thicknesses as well as decreased contractility may be clearly seen in B-Mode, as well as the dilated vessels and the congested liver parenchyma. For the assessment of the heart, the widest transverse as well as longitudinal diameter of the left and the right ventricles should be measured in systole and...
diastole. Amongst other species, reference values have been established for psittacine birds (Pees et al. 2004), birds of prey (Boskovic et al. 1995) and pigeons (Krautwald-Junghanns et al. 1995). The fraction shortening in healthy psittacines is about 23.1 ± 4.6 %. So far the number of scientific studies on spectral Doppler-echocardiography in birds is limited. PW Doppler has been used in psittacines and raptors to detect diastolic inflow into the left and the right ventricle, as well as systolic aortic outflow (Straub et al. 2003).

In birds, **Computed Tomography** (CT) examinations have a great diagnostic value. An important advantage in avian patients is the very short examination time of 1 or 2 minutes with today’s modern scanners. It is recommended that the bird should be fasted for 1 or 2 hours (psittacine birds) before the examination. Proper positioning is in dorsal recumbancy with slightly spread wings and with the hind limbs extended caudally as far as possible. If possible, the examination should be done using general anesthesia, however, in debilitated birds, also a plexiglass fixation device as described for the projection radiographic examination can be used. The main indications for performing a CT examination on an avian patient are currently abnormalities of the skeletal system and the respiratory tract. This includes clinical and radiographic indications of a spinal fracture or other changes in this region, suspicion of fractures in the cranium, especially the hyoid bone and beak apparatus, as well as soft tissue alterations in the head, including the upper respiratory apparatus or any respiratory infection. Today, CT is the most reliable and sensitive method for the diagnosis of lung disease in birds. The lung parenchyma, the trachea and the primary and secondary bronchi, the large pulmonary vessels and the air sacs can be assessed in individual scanning planes. Measurements of the lung field including density measurements enable the diagnosis of problematic lung conditions in the early stage of the disease process.

In comparison to other imaging techniques, today, **Magnetic resonance Imaging** (MRI) is rarely used in the avian patient. The main problem is the long examination time, and the problematic anesthesia during the examination. MRI is primarily advantageous in the diagnosis of soft-tissue changes. The choice of an as small as possible coil is important for the image quality. Superficial coils are suitable in small birds. Although small slice thicknesses are necessary in small patients as birds are, it is difficult to use slice thicknesses of less than 1-3 mm. A problem for the examination might be caused my metal implants (metal rings, microchips). These chips cause large-scale signal extinction and the affected region as well as structures close to this region cannot be evaluated. The main indications for MRI are alterations of the parenchymateous organs as well as the CNS including the eye (Krautwald-Junghanns et al. 2011).

**REFERENCES**


A STUDY INTO CT SCANNING IN DIFFERENT TORTOISE SPECIES

Iain Cope BSc(VetSci)(Hons) CertAVP(ZooMed) BVM&S MRCVS

CT scanning is becoming the imaging tool of choice in exotics, allowing fast and accurate imaging of species, often without the need for anaesthesia. The images taken can be viewed in 2D cross sections or in a 3D reconstructed image allowing a sense of true space, shape, and location of lesions.

This talk will present the findings of an ongoing study into the use of CT imaging in different tortoise species, aiming to highlight the advantages and disadvantages of this technique, specific species variations, and comparisons of disease processes within these species.

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