

Reproductive challenges in pet birds and reptiles

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The objective of this presentation is to describe normal reproductive structures and function in reptile and avian species, and primarily focus on clinical diagnosis and management of common reproductive disorders in captive birds and reptiles.

Reptiles

Our understanding of normal reptile reproductive strategies and, conversely, reproductive disorders is complicated by the fact that there is an enormous diversity of species across the Class Reptilia, one of the most phylogenetically diverse animal Classes with four main Orders: Chelonia (turtles, terrapins, tortoises), Squamata (lizards), Serpentes (snakes), and Crocodylia (alligators, crocodiles, caiman, gharial). Reproductive activity tends to be seasonal in most reptile species, but may exist year around, particularly in tropical species. While most reptile species require sexual intercourse to produce offspring, some species are parthenogenic (e.g., Komodo dragons, whiptail lizards, boa constrictors, etc.); that is, the occurrence of unisexual lines whereby reproduction occurs without any involvement of males or their sperm. In addition, females can lay infertile eggs when a male is not present.¹ Most reptile species are oviparous (i.e., egg layers), but a few species give birth to live young (i.e., ovoviviparous and viviparous; for example, skinks, horned lizards, boas, adders, and some chameleons to name a few).¹

Sex differentiation is commonly temperature dependent and establishing sex through sexually dimorphic phenotypes ranges from relatively simple (e.g. many chelonians and lizards) to difficult (some snake species, skinks, monitor lizards, etc.). Determining sex of a reptile can be particularly challenging in younger animals. Methods include phenotypic characteristics (e.g., concave plastron in chelonians, femoral pore size in some lizards, longer forelimb nails in aquatic turtles, longer tails in aquatic turtles, cloacal spurs in boid snakes, eversion of hemipenes in lizards and snakes), use of snake probes, imaging modalities (e.g., ultrasonography, computed tomography[CT] scan), or use of endoscopy (cloacoscopy versus coelioscopy).

Anatomically, female reptiles have two ovaries, two oviducts, and the reproductive tract exists into the cloaca; in some snakes, the left oviduct is vestigial and nonfunctional. Females of some reptile species can store semen from a male for more than one reproductive season. Males have two testicles and either a phallus (chelonians and crocodylians) or hemipenes symmetrically positioned on each side of the cloaca (snakes and lizards). The phallus and hemipenes are intromittent organs used exclusively for reproduction, and there is no direct connection to the urinary system.¹

Common reproductive disorders: diagnosis and management

Males

Hemipenile plugs are very common in some captive male lizard and snake species.²⁻⁴ Hemipenile plugs are slightly elongated structures protruding from the tip of the hemipene. The exposed portion tends to be dry, while the remainder within the hemipenile orifice tends to be moist with a caseous consistency.³ These plugs are generally composed of hard waxy plugs of seminal fluid and cellular debris that build up in the inverted hemipenes.³ Chronic build-up and retention of these plugs appear to cause discomfort, and many clinicians will mistake these plugs for necrotic prolapsed hemipenes. Fortunately, hemipenile plugs are relatively easy to remove by grasping the material with a forceps and gently pulling the plug straight out of the orifice. Rarely do retained hemipenile plugs require surgical intervention, which may include resection of the hemipene or hemipenes. Recurrence may occur in the future.

Prolapse of the phallus or hemipenes is a common male reptile condition, which may have no significant consequences with natural resolution, or may become a medical problem if prolonged. Prolapse may occur under normal conditions in which males become sexually aroused and develop erect phalluses or hemipenes, or under disease conditions, such as the presence of uroliths, neurologic

dysfunction, chronic constipation amongst others.¹⁻⁶ Under normal conditions, the erectile tissues will regress and the prolapsed organ(s) will retract into normal position. Under abnormal conditions, the organs may remain prolapsed and the tissues become edematous and necrotic due to vascular compromise and excoriation. In cases in which the tissues remain viable, the phallus or hemipene may be moistened and the erectile tissues reduced back into normal anatomical position. Medical management may also include a mu-opioid analgesic (e.g., morphine or hydromorphone) and anti-inflammatory drugs such as meloxicam or carprofen.⁷ In chronic cases in which tissues are no longer viable, a phallectomy (amputation of the phallus or hemipene) may be necessary. It is important to remember that the reproductive organs of male reptiles are not connected to the urinary tract, so that amputation will not affect ability to pass urine; it will only affect reproductive ability. If only one hemipene needs amputation in snakes or lizards, the remaining hemipene can function as a viable reproductive organ. Phallectomy in chelonians or crocodylians will permanently affect the ability to reproduce.

Orchidectomy. Elective castration of male reptiles is uncommon, primarily due to the fact that testicles are intracoelomic and the procedure is invasive. Surgical removal of a testicle or testicles may be necessary in cases of testicular tumors, or in a last-ditch effort to alter aggressive behavior or hypersexual behavior in pet male reptiles.^{1,2,5} More recently there is interest, but no published evidence, of administering gonadotropin releasing hormone (GnRH) agonists (e.g., deslorelin implants or leuprolide acetate depot) to hyper-aggressive or hypersexual reptiles in order to attempt to change these behaviors.⁸

Females

Preovulatory follicular stasis is a common reproductive disorder in female reptiles. Typically, it is associated with non-ovulation of preovulatory follicles or absence of regression of these follicles, which causes follicles to continue to enlarge or remain static.²⁻⁴ It commonly occurs under conditions in which social or environmental cues are not present, husbandry is inappropriate, or the female has other health problems. It is clinically manifested as hyporexia or anorexia and lethargy, and requires medical or surgical intervention. With chronicity, manipulation and palpation of the coelomic cavity can contribute to rupture of the large follicles causing yolk coelomitis. Imaging modalities (e.g., CT scan and/or ultrasonography) are necessary to make a diagnosis of follicular stasis, and serial imaging over a period of time may help with the diagnosis and surgical planning. Medical management is generally considered futile. Surgical management of this condition is common and includes ovariectomy and/or ovariosalpingectomy, with bilateral ovariectomy being more straightforward than ovariosalpingectomy. These procedures are described in the published literature.¹⁻⁶

Dystocia can occur in female reptiles under a variety of conditions. It is, typically, defined as retention of some or all eggs or fetuses during parturition. Dystocia is typically categorized as either non-obstructive or obstructive.^{3,6} Nonobstructive dystocia is most commonly associated with poor husbandry (e.g., inappropriate temperature, humidity or substrate, lack of ultraviolet light source, starvation or obesity, etc.), or infection/inflammation of the oviduct (salpingitis). Obstructive dystocia is associated with the presence of abnormally large eggs or fetuses, old injuries to the bones of the pelvic canal, uroliths, or other pathologic conditions. Imaging modalities (e.g., CT scan, radiographs, and/or ultrasonography) are necessary to evaluate number and sizes of eggs and fetuses, as well as some pathologic conditions. It is important to remember that ectopic eggs can occur, especially in chelonians, and may be localized within the urinary bladder or the coelomic cavity, which may require endoscopy, cloacoscopy and/or surgical intervention.^{3,6} Medical therapy can be instituted in cases of nonobstructive dystocia, and includes supportive care (fluids, calcium gluconate, anti-inflammatories), and oxytocin, which stimulates oviductal contraction. The administration of calcium gluconate to stimulate the oxytocin receptors is recommended before starting the hormone treatment.^{3,6} The efficacy of oxytocin for facilitating parturition is variable depending on the species, and its use can lead to oviductal rupture and may increase the possibility of any retained eggs being expressed into the urinary bladder, if present. More invasive therapeutic approaches include percutaneous ovocentesis of larger eggs, and surgical intervention and removal of retained eggs or fetuses (salpingotomy, ovariosalpingectomy).

Salpingitis is inflammation or infection of the salpinx (oviduct), which can interfere with reproduction. Diagnostic tests include imaging (ultrasonography, CT scan), biopsy with histopathology, cytology, microbial culture and antimicrobial sensitivity. Surgical intervention may be necessary and would include salpingectomy and ovariosalpingectomy.

Yolk coelomitis occurs when follicles or eggs rupture outside of the reproductive tract, causing yolk to be present in the coelomic cavity.¹⁻⁶ Imaging (CT scan, ultrasonography) may be useful in making the diagnosis of coelomitis, and celiocentesis with cytology may provide supporting evidence of the presence of yolk in the coelom. Chronic yolk coelomitis can cause significant inflammation, adhesions and fibrosis, and surgical treatment is complicated and, generally unrewarding. Prognosis of yolk coelomitis in any female reptile should be considered poor.

Neoplasia of the reproductive tract is not common in male or female reptiles.⁹ Testicular tumors (seminoma, Sertoli and Leydig cell tumors) are most commonly presented in the published literature. Ovarian tumors include teratomas, dysgerminomas, granulosa cell tumors, amongst others. Leiomyomas and leiomyosarcomas of the oviduct have been reported in female reptiles.

Ovariectomy and ovariosalpingectomy. Elective ovariectomy of female reptiles is uncommon due to invasiveness of the procedure. Ovariectomy and/or ovariosalpingectomy may be necessary in cases of follicular stasis, dystocia, and reproductive neoplasia. Surgical removal of the ovaries may also occur in an effort to prevent future egg laying. More recently, there is interest, but little published evidence, of administering GnRH agonists (e.g., deslorelin implants or leuprolide acetate depot) to dampen reproductive hormones through negative feedback mechanisms and prevent egg production.⁸ One publication indicated that reproductive activity was suppressed in a female green iguana after administration of a deslorelin implant, and hyper-aggressive behavior diminished in a bearded dragon after administration of deslorelin.⁸

Birds

Most detailed information on reproduction in birds exists for few species. Anatomically, males have bilateral testes and females of most bird species have a functional left ovary and oviduct, with regression of the right side of the reproductive tract. Some species of raptors and ratites have functional right and left reproductive tracts. While most male bird species do not have a phallus, many Anseriforms exhibit quite large phalluses. In most birds, copulation occurs with mutual cloacal eversion (“cloacal kiss”) and transfer of semen from the male ejaculatory papilla to the female cloaca. Bird species with a phallus will intromit the phallus into the female cloaca. Female birds can store sperm for up to several months. Reproduction may be seasonal in some species, such that reproductive tissues of both males and females are stimulated by appropriate hormones, become active (follicles develop in the ovary and testicles grow), and sexual behavior commences. Seasonally dependent reproduction is associated with a variety of environmental cues, such as changing photoperiod and the presence of other birds. Females will lay infertile eggs without a male present.

Common reproductive disorders: diagnosis and management

Males and females

Cloacal prolapse and flaccid cloaca are among the most common clinical conditions in pet birds, particularly cockatoo species due to excessive reproductive behavior. Other causes of cloacal prolapse include: dystocia, coelomitis or coelomic mass, or inflammation/infection of the reproductive tract. Many of these cases are associated with chronic sexual behavior, during which the bird’s focus of sexual attention is commonly a bonded human. This is considered a “rule out” diagnosis in which all potential medical causes are ruled out leaving sexual behavior as the primary focus. For non-behavioral causes, the underlying problem must be diagnosed and appropriately treated. If the tissues prolapsed appear viable, the prolapsed tissue can be cleaned and replaced and two sutures placed for a period of 7-10 days. If the tissue is necrotic, identification of the organ is imperative, as surgical resection will be necessary. For sexual behavioral causes, medical and surgical management are combined to try to control this condition, but eliminating the problem is almost impossible. Typically, the first step is subcutaneous administration

of a GnRH agonist (e.g., deslorelin implant or leuprolide acetate depot) in order to try to dampen the behavior, with the hope that the cloacal prolapse will resolve.^{8,10,11} In cases in which the prolapse does not resolve or the cloaca is chronically flaccid, non-inflammatory metallic sutures (stainless steel or Niobium wire) must be placed for months at a time and then replaced every 6-12 months as needed. Niobium is used in human jewelry and is considered hypoallergenic.

Chronic and inappropriate reproductive behavior may lead to cloacal prolapse or flaccid cloaca, but is commonly associated with feather destructive behavior (i.e., feather-picking) and self-mutilation. In these cases, behavior modification is recommended using positive reinforcement paradigms, but is extremely difficult and time consuming, requiring constant and long-term commitment by the caregiver. Several husbandry-related changes are suggested, including diet changes to reduce fat content and changing the way the caregiver handles/pets the bird to avoid sexual stimulation. Gonadotropin releasing hormone agonists are used to try to alter or prevent the behaviors, which may have a seasonal component.^{8,10-12} Antianxiety and antidepressant drugs have been tried, but published documentation is sparse and, generally, anecdotal.

Males

Neoplasia (testicular tumors) is more common in some species (e.g., budgies) and have been identified as seminomas, Leydig and Sertoli cell tumors, adenocarcinomas, leiomyosarcomas and lymphosarcoma.^{13,14} Clinical signs may include coelomic distension and a variety of ill bird signs (fluffed feathers, anorexia, depressed behavior, etc.). Diagnosis may be made using imaging modalities with ultrasound-guided aspiration and cytology. In male budgies with hormone-secreting testicular tumors, the normally blue cere may turn brown and a unilateral hind limb lameness may be observed. Treatment for most avian neoplastic diseases is considered difficult and unrewarding. Surgical excision of a reproductive tumor is theoretically possible, but with an overall poor prognosis, surgical intervention may be futile. Medical management through chemotherapy is not well studied and would carry a guarded to poor prognosis. Our clinical service has used a GnRH agonist (deslorelin implant, 4.7 mg) in a male budgie with a testicular tumor and unilateral hind limb lameness to attempt to shrink the tumor, which reestablished limb function. Regular replacement of the implant provided an added two years to the budgie's life.

Phallus prolapse (waterfowl) is not uncommon in waterfowl species, and may be associated with hypersexual behavior, trauma, or phallus infection. Continued trauma to the prolapsed organ may result in tissue necrosis. Medical management may include cleaning, lubrication, and reinsertion of the phallus with or without cloacal sutures, antimicrobials, and nonsteroidal anti-inflammatories (e.g., meloxicam).^{13,14} With chronic prolapse and tissue necrosis, phallectomy may be necessary, which will eliminate reproduction, but not interfere with urination.

Females

Chronic egg laying is a common problem in companion birds, such as psittacines, backyard chickens and waterfowl, with caregivers opposed to this behavior in one group (psittacines) and taking advantage of it in the other (chickens, ducks).^{13,14} Most commonly chronic egg laying refers to a non-seasonal pattern in which there are regular, year-round, clutches. Chronic egg laying can cause disease-related issues, such as hypocalcemia and other nutritional deficiencies, weight loss, pathologic bone fractures, and predisposition to dystocia and ectopic egg formation. It can also be psychologically disturbing to the caregiver. Husbandry recommendations may include changing the diet by reducing fat and carbohydrate intake, decreasing the photoperiod, and avoiding sexually stimulating the bird through touching. Since surgical ovariectomy is risky in adult females, administration of GnRH agonists (deslorelin implant or leuprolide acetate depot) to diminish reproductive hormones and reproductive behavior is a commonly used medical approach.^{8,10-12} Gonadotropin releasing hormone agonists must be regularly administered, and there is anecdotal evidence in some species that the duration of effect may decrease after each successive administration.

Dystocia/egg-binding can occur in female birds at almost any time in life and does not appear to be clearly associated with primiparity or multiparity, although there may be a predisposition in older primiparous birds. Clinically, birds in dystocia become hyporexic, fluffed, regularly strain, and lose interest in perching. With chronicity, the bird becomes exhausted, obtunded and can pass away. The physical examination may provide evidence of a palpable egg, but sometimes the egg remains in the oviduct more cranially and imaging is necessary to demonstrate the presence of an egg. Differentiating an ectopic egg from an intra-oviductal egg can be challenging even with imaging. Ultrasonography and/or CT scan may help identify if the egg is within the oviduct or vagina. In cases in which the female bird remains active, alert and responsive, initial medical therapy may help with oviposition, unless the egg appears massive. Medical therapy includes subcutaneous fluids, calcium gluconate, oxytocin and placing the bird in a warm incubator (85-90°F). If this does not have any effect within several hours with repeated oxytocin administration, or if the bird is presented in a depressed, weakened state, the bird should be sedated or anesthetized and the egg either extracted *in toto* using caudal external pressure and lubrication, or broken down through transcloaca ovocentesis. Percutaneous ovocentesis is only an option when the egg cannot be visualized per cloaca and in emergent situations. Surgical intervention is rarely necessary when an experienced clinician is involved in the case. Surgical intervention includes salpingotomy, extraction of the egg through the surgical site and surgical closure.

Ectopic eggs can occur when the calcified or partially calcified egg is expressed directly into the coelomic cavity. Making the diagnosis can be difficult and multiple imaging modalities may be necessary (radiographs, ultrasonography and CT scan).¹⁵ An ectopic egg requires surgical exploration of the coelomic cavity and extraction of the egg. The coelomic cavity may need flushing with warm sterile saline after the egg is removed.

Yolk coelomitis occurs when an ovum is ovulated or ruptured into the coelomic cavity. Yolk adheres to internal organs and causes inflammation and adhesions. With chronicity, ascites is a common sequela. Ultrasonography can be useful in diagnosing coelomitis and celiocentesis with cytology may provide supporting evidence of the presence of yolk in the coelom. Treatment is generally unrewarding and the prognosis is poor. Administration of GnRH agonists may help stop follicular and egg development, which may help the bird feel better and provide extra months of life. Nonsteroidal anti-inflammatories may help with discomfort.

Salpingitis refers to inflammation or infection of the oviduct, and most commonly occurs as an ascending bacterial infection from the cloaca. Clinical signs will be nonspecific for oviduct inflammation/infection, so ultrasonography and/or CT scan may help define the problem. A CBC may be indicative of inflammation through the presence of a leukocytosis, which is also nonspecific to organ system. With a definitive diagnosis, antimicrobial and anti-inflammatory medications will likely be necessary.

Neoplasia of the reproductive tract is not uncommon in female birds.^{13,14} A variety of tumor types have been documented in the literature, including: adenomas and adenocarcinomas, leiomyomas and leiomyosarcomas, granulosa cell tumors, and lymphosarcoma.^{13,14} Clinical signs may include coelomic distension and a variety of ill bird signs (fluffed feathers, anorexia, depressed behavior, etc.). Diagnosis may be made using imaging modalities with ultrasound-guided aspiration and cytology. As with males, surgical excision of a reproductive tumor is theoretically possible, but with an overall poor prognosis, surgical intervention may be futile. Medical management through chemotherapy is not well studied and would carry a guarded to poor prognosis.

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