Common reproductive pathologies in reptiles
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Abstract
An overview of common reptile reproductive pathologies encountered in clinical practice is presented. Male and female reproductive tract infections and neoplasms are reviewed, as well as dystocia, egg yolk coelomitis, and hemipene impactions and prolapse. The information presented draws from the author’s own cases as well as literature citations.

Keywords: Reptile, reproduction, pathology, neoplasia, infection, dystocia

Introduction
This paper will discuss some of the more commonly encountered clinical problems involving the reproductive system in reptiles. In the author’s practice the female reptile’s reproductive system appears more prone to disease than that of the male. Pathology reviewed will include egg retention (dystocia), egg yolk coelomitis, bacterial infections (salpingitis, oophoritis, and hemipene/penis infection), hemipene impactions, hemipene prolapse, and neoplasia (of the ovaries, oviducts, and penis/hemipenes).

Egg retention (egg binding, dystocia) in female reptiles
Female reptiles are frequently presented for egg retention, wherein ovarian follicles develop but the eggs are not laid within a reasonable period of time.1-4 The normal interval between breeding/ovulation and egg-laying varies between species. Some reptile ‘dystocias’ are pre-ovulatory,1,2 wherein the egg cycle is stalled during follicular development in the ovary, resulting in large follicles that fail to ovulate (follicular stasis). This is most common in lizards but has been documented in tortoises as well.1,2,5 The follicles are not shelled which may make them more difficult to detect via palpation and radiography.

Some reptiles eventually complete the ovulatory cycle and lay shelled eggs; others may reabsorb the yolks and the developing eggs disappear. When neither of these events occurs within a reasonable time interval, then an abnormal ovulatory cycle may be suspected. Some reports indicate that reptiles without a breeding partner are more likely to have arrested follicular development.6 The exact timeframe wherein a normal ovulation becomes problematic is not always clear; besides species differences, there is the tendency of many snakes and chelonians to hold follicles or mature eggs for some time without clinical signs of illness.3 In general, reptiles that are active, alert and appear stable may be allowed some time to resolve a preovulatory dystocia. Barring successful resolution of the problem, ovariectomy or ovariosalpingectomy are viable treatment options.

Post-ovulatory dystocias are common in reptiles.1-4 Once the eggs have ovulated and passed through the shell gland, they must be laid or removed surgically; reabsorption is no longer possible. In the author’s experience, a post-ovulatory animal with shelled eggs present (as evidenced via visual inspection, palpation, radiography or ultrasound) usually undergoes oviposition within one to three weeks. Carrying the eggs for a more prolonged period of time is suggestive of abnormal egg retention.

Firm diagnosis of dystocia is often problematic. Females may demonstrate restlessness and digging behavior in their habitat (attempts to find a nesting site). Visible abdominal enlargement is often noted, especially in lizards. Egg binding often is accompanied by partial or total anorexia, either due to malaise or simply the distension of the coelomic cavity by the egg mass. It should be noted, however, that the above signs are also seen with normally gravid animals.3,7

True dystocias may be suspected when gravidity becomes unusually prolonged, or if other signs develop. Abdominal contractions and straining without successful egg-laying may be seen. Cloacal discharge or prolapse of cloacal tissues can occur. The affected animal may become lethargic and weak, a key sign that the reproductive process may be abnormal.3 Producing only a portion of a clutch (with confirmation of retained eggs or young within the gravid animal) also suggests dystocia. Reptiles with the above signs usually require more aggressive treatment; those which have laid a partial clutch may warrant intervention within 48 hours.3

As a side note, viviparous animals such as boas and Jackson’s chameleons (Chamaeleo jacksoni) may also retain their young, often the entire clutch. Many species have prolonged gestations, making determination of dystocia difficult. Telltale signs may include malaise, straining or attempts to pass young unsuccessfully, passage of a partial clutch, or cloacal discharge. Palpation is less useful at defining fetal masses than eggs; radiographs will visualize and allow counting of fetal skeletons. Ultrasound can identify fetuses and also assess their viability via detection of fetal heartbeats.3
Potential causes of dystocia are numerous, but can be categorized into two main groups: behavioral and physiologic. Behavioral egg-binding may occur when a female reptile is inhibited from normal egg-laying behavior, due to stress or lack of a proper oviposition site. Many species excavate a pit or underground chamber in which eggs are deposited. Cage habitats often fail to accommodate for this behavior, and the animal may refuse to deposit eggs in an exposed location on the floor surface. Other potential stresses such as recent caging changes, noise and disturbances near the habitat should all be investigated as potential causes of dystocia.

Physiologic causes of egg retention include weak or absent oviduct contractions (oviduct inertia), congenital or acquired anatomic defects of the reproductive tract, trauma to eggs within the gravid female, and oversized or malformed eggs. These physiologic dystocias may be further categorized as ‘obstructive’ or ‘non-obstructive’ to help determine appropriate treatment modalities.

Oviduct inertia is often idiopathic, and behavioral egg retention is a differential diagnosis when no underlying physiologic cause can be identified. Environmental parameters should be carefully evaluated; air temperatures lower than the species’ preferred range may reduce oviduct contraction and impair oviposition. Temperature readings must be made with accurate thermometers placed in shielded locations (completely shaded from heat sources such as lamps) to assess ambient temperature. Nutritional imbalances or deficiencies have been implicated in many cases of reptile dystocias, and a thorough dietary history should be taken. Low serum calcium levels, for instance, may reduce strength of oviductal contractions.

Oviduct inertia may also be caused by disease such as bacterial oophoritis and salpingitis, or other illness unrelated to the reproductive tract. A complete blood count (CBC) and serum chemistry evaluation may aid the clinician in detecting organic causes of oviduct inertia.

Defects or anomalies of the reproductive tract may also lead to inability to pass ova down the oviducts and through the cloaca. Congenital or acquired strictures of the oviducts or lower reproductive tract are examples of disease conditions which may impair oviposition. Prior episodes of dystocia, especially those requiring surgical intervention, may increase the risk of stricture and repeated egg retention. Masses such as abscesses or neoplasms in the oviduct can also lead to dystocia.

Anomalies of the eggs may also lead to dystocia. Occasional oversized eggs are produced, possibly due to presence of double yolks or other developmental defects. Fusion of two or more eggs is occasionally seen as well. These anomalies of shape and/or size may inhibit the passage of ova down the reproductive tract.

Male turtles that breed aggressively have been reported to occasionally traumatize the eggs of gravid females; the penis may fracture one or more eggs, producing sharp shell fragments and oviduct lacerations. This can lead to life-threatening dystocia.

Treatment of dystocia varies depending on the etiology and duration. Thorough history, physical examination, radiographs and ultrasonography are all useful tools in diagnosis and characterization of dystocias. Turtles with dystocia may be more difficult to diagnose on examination, due to the difficulty of palpating eggs within the shell. Digital palpation is sometimes possible via the inguinal (prefemoral) fossa or via the cloaca. In addition turtle egg shells are more mineralized than those of most lizards and snakes, making radiographic visualization easier.

Traumatized or malformed eggs may require surgical intervention, i.e. a celiotomy with salpingotomy or ovariosalpingectomy. Aspiration of oversized eggs, either percutaneously or via the cloaca, may also be performed to collapse egg(s) and allow passage via the cloaca. This may be useful in turtles as an alternative to aggressive plastral celiotomy which requires cutting the shell. Surgical management of turtle dystocias can sometimes be accomplished via cutaneous incision cranial to the rear leg (the inguinal or pre-femoral fossa). This allows salpingotomy and egg removal but not ovariectomy.

Oxytocin may resolve dystocia in some females with shelled eggs. This therapy is best utilized in patients lacking detectable egg or anatomic anomalies (i.e. non-obstructive dystocias), and who have not been egg-bound for a prolonged period. Pretreatment with parenteral calcium is usually unnecessary unless low serum calcium levels or metabolic bone disease are documented; when indicated, commonly cited doses of calcium gluconate range from 10-100 mg/kg intramuscularly or intracoelomic. The response to oxytocin is variable, with some animals producing eggs within minutes, and others having no response at all. In general, the response to oxytocin is more consistent in chelonians than in lizards and snakes. Placing the patient in a quiet covered enclosure, or back in the normal habitat with egg laying sites available, may facilitate oviposition. Arginine vasotocin has also shown potential usefulness and efficacy in stimulating oviposition in reptiles.

Even if eggs are not laid, the drug may help move the most caudally positioned egg down to the cloaca, where it can then be removed manually. Extraction may be facilitated via aspiration of the egg contents or manual fragmentation with forceps (if the egg is old and hardened). Once the most caudal egg is removed, the remaining eggs may pass without further assistance, or additional oxytocin injections may be used to move additional eggs.
down to the cloaca where they can be manually removed one at a time. The author has achieved good results with this technique in some chelonians, and others have reported success as well.2

Published reptile doses for oxytocin are variable, but commonly range from 1-20 IU/kg.3,4,14,15 The author gives up to three doses at 60 to 90 minute intervals, dosed incrementally at 2 IU/kg, 5 IU/kg, and 10 IU/kg if no effect is seen from the prior dose. Lack of response after three doses usually indicates that oxytocin will be ineffective. However, the author usually sends the patient home to observe in its familiar habitat overnight (with proper egg laying sites available). Some animals lay eggs within 24 hours of oxytocin administration once they are relaxed.

Manual manipulation of retained eggs toward the cloaca has been utilized by laypersons and veterinarians to resolve dystocia in snakes. Although this method can be effective when performed carefully, it entails significant risks including rupture of ova or oviducts.3 Retained eggs may be adhered to the oviduct wall, and both ova and oviduct integrity may be compromised by disease, making the structures more fragile than in the normal animal. Thus manual manipulation of eggs cannot be recommended as a safe option in most dystocia cases.3

**Egg yolk coelomitis in female reptiles**

Lizards appear to be most prone to this condition, and most cases seen by the author have occurred in green iguanas (Iguana iguana) and leopard geckos (Eublepharus macularius). Bearded dragons (Pogona vitticeps) and chelonians have also been documented with yolk coelomitis.2,3 The pathology most commonly involves females with large unshelled egg follicles which begin to leak yolk from the ovaries. In many cases the exact etiology is unproven, but a likely cause is trauma (such as falling) while gravid, which ruptures one or more follicles. The author has seen several cases wherein the owners recalled the animal falling while showing nesting behaviors, and then becoming lethargic and listless after the trauma.

Dystocia or urolithiasis may also lead to rupture of mature ova and damage to the oviduct, sometimes resulting in yolk leakage into the coelomic cavity.16 Aggressive breeding attempts by male turtles may fracture eggs in gravid females, leading to yolk coelomitis in some cases.4

Bacterial salpingitis and oophoritis can lead to leakage of yolk into the coelomic cavity, and the author has seen yolk coelomitis secondary to oviduct adenocarcinoma in an iguana. The released yolk material incites a strong inflammatory ‘foreign body’ reaction in the coelomic cavity.3,16 This can rapidly produce severe illness, with signs including malaise, lethargy, anorexia, and abdominal distension. A CBC and serum chemistries may reveal a leukocytosis with left shift; serum calcium levels may be elevated consistent with ovulation.17 Egg follicles may be palpable, but the distension of the body cavity with yolk often precludes accurate palpation. Ultrasonography can verify presence of follicles or ova, and a simple abdominocentesis is often diagnostic: aspiration of the coelomic cavity typically yields small to copious amounts of bright yellow viscous fluid consistent with egg yolk. Microscopy reveals fat droplets and sometimes white blood cells in the yolk material.

Treatment involves celiotomy and removal of the egg follicles (typically via an ovariosalpingectomy).3,4 The free yolk material in the coelomic cavity must be completely removed as well, or the severe inflammatory response will persist and can result in fatality.4,16 Warmed saline lavages aid in removal of the material, which often adheres to the serosal surfaces. Reptiles lack a diaphragm, and the yolk material may pool anywhere in the coelomic cavity, including cranially in the thoracic area. Positive pressure ventilation to completely fill the lungs will aid in displacing the yolk material caudally into the abdominal region, where it can be readily removed. Although some authors in the past reported a high mortality rate with yolk coelomitis,4 the author has achieved a high cure rate with early detection and aggressive treatment of this condition in iguanas, and other current literature has noted similar success.3

**Bacterial infection of the reptile reproductive tract**

Bacterial salpingitis (oviduct infection) or oophoritis (infection of ova) are occasionally seen in female reptiles.2,4,7 In the author’s experience this occurs most commonly when ova are present within the oviducts. The author has usually encountered salpingitis when a concurrent bacterial oophoritis was present; egg or follicle retention and degradation of yolk material may be factors predisposing to salpingitis.8 Conversely, preexisting salpingitis may in theory predispose to oophoritis, and determining which condition preceded the other may be problematic.

Other factors which reduce immune competence, such as concurrent disease or husbandry problems, may increase risk of oviduct infection.7 Definitive diagnosis may be difficult, as many cases lack a cloacal exudate. Detection of egg masses in the coelomic cavity (via palpation, radiography or ultrasonography), coupled with leukocytosis and signs of malaise, should increase the index of suspicion. Aspiration of the body cavity may yield an inflammatory exudate or free egg yolk.
The most effective treatment in the author’s hands has been ovariosalpingectomy and broad spectrum antibiotic therapy. In valuable breeder animals, removal of infected ova via salpingotomy may be attempted. Oxytocin may induce oviposition, but can be ineffective even in healthy female reptiles. With oophoritis or salpingitis, adhesions may form between the ova and the oviduct, and the integrity of the oviduct wall may also be compromised. These factors make use of oxytocin in diseased animals more risky, as the oviduct may easily rupture, allowing dissemination of infection into the coelomic cavity. Surgery probably offers the highest success rate and safety margin in such patients.

In male reptiles, infection of the penis or hemipenes is occasionally encountered. Infection may be induced by trauma (especially during breeding), sexually transmitted disease (such as mycobacterium), or potentially by poor husbandry conditions causing immune suppression, such as low environmental temperature, dirty cage conditions, or dietary deficiencies. Hemipene impactions (see later discussion) may also predispose to infection in some lizard species.

Treatment includes debriding or amputating any necrotic tissue, manual cleaning and application of appropriate antibiotic topical preparations, and systemic antibiotics effective against gram negative aerobic bacteria (such as quinalones administered per os or IM). Culture and sensitivity testing of bacterial isolates from the lesion is ideal to guide selection of appropriate antibacterial drugs.

**Hemipene impactions in lizards and snakes**

Lizards such as green iguanas and leopard geckos are prone to impaction of the hemipene recesses with material consisting of hardened glandular secretions, keratinized cells, and sperm. Impaction can cause swelling and distension of the hemipenes, and inability to extrude the organs when breeding. Similar impactions are also occasionally seen in snakes. The affected animal may be nonsymptomatic, or may demonstrate lethargy, straining, or swelling and eversion of the cloacal mucosa. The hemipene bulges in the ventral tail base may appear unusually prominent. The tips of the impacted hemipene material may be visible at the lateral aspects of the vent opening, and may look like traces of dried feces or necrotic tissue adhered to the mucosa. Primary or secondary infection of the impacted hemipene structures may be present.

This condition might be induced by factors such as low temperature or low environmental humidity, which may contribute to retention and hardening of the normal glandular secretions. In the author’s experience impactions occur most commonly in reptile species with moderate to high humidity requirements, suggesting that dry cage conditions may be a factor.

Treatment is via gentle extraction (with forceps and digital massage) of the impacted material, and treatment with broad spectrum antibiotics (such as quinalones) if the tissues appear severely inflamed or infected. Resolution of existing husbandry problems is paramount as well.

**Prolapse of the hemipenes/penis**

Occasional prolapse of a hemipene (in snakes and lizards) or penis (in turtles) occurs. Underlying causes can include trauma to the organ, infection, hemipene impaction, straining while constipated, neurologic deficits to the retractor penis muscles or cloacal sphincter, neoplasia, and other factors. Breeding-related traumas are not uncommon. Husbandry problems such as cool environmental temperatures predispose to both sepsis and straining to eliminate wastes, which may promote penile prolapse. If caught early, the prolapsed organ may be cleaned and replaced in situ. The everted tissues, once cleaned, can be lubricated with an antibacterial cream such as silver sulfadiazine prior to reducing the prolapse. The vent may need to be sutured partially closed to prevent immediate re-prolapsing; provided that the patient can eliminate wastes, the sutures may be left in for weeks or even months with negligible negative effects.

In many cases the prolapsed penile tissue is traumatized, dry and necrotic, and must be amputated. With lizard or snake hemipenes this is easily accomplished with absorbable suture ligature of the base of the organ, followed by scalpel excision of the necrotic portion. In these cases the contralateral hemipene may still be viable and the animals can breed successfully in the future. The turtle penis is vascular and often more substantial in thickness; the blood supply and corpus cavernosum on each side should be ligated separately with transfixing horizontal mattress pattern absorbable suture. The reptile penis does not contain a urethra, and amputation does not interfere with urination. Antibiotics should be used to prevent secondary infection (or to control preexisting infection); broad spectrum drugs are indicated to cover many of the enteric bacteria as well as surface opportunists. Good postoperative husbandry, as always, is essential.

**Neoplasia of the reptile reproductive system**
Neoplasia in reptiles is occasionally encountered in older individuals, especially in the female reproductive system. Literature reports are sparse compared to the data compiled for many common mammalian species. To date various ovarian and oviduct neoplasms have been reported. Turtles have been diagnosed with ovarian dysgerminomas, oviductal leiomyosarcoma and cloacal polyposes. Ovarian adenocarcinoma and ovarian teratoma have been seen in lizards, and various ovarian and oviductal tumors have been documented in snakes, including hemangiomas, granulosa cell tumors, fibromas, leiomyosarcoma, tubular adenoma, and carcinomas. A four-year-old green iguana (Iguana iguana) and a very large ovarian adenocarcinoma in a 12-year-old boa constrictor (Boa constrictor) with metastasis to the mesentery.

Affected individuals may exhibit nonspecific lethargy and malaise, loss of appetite, and gradual weight loss. Some individuals have detectable abdominal distension or palpable masses in the coelomic cavity. Radiographs, ultrasound, needle aspiration of masses and exploratory surgery may confirm the presence of neoplasia. Total excision of the masses, when possible, may be curative. Chemotherapeutic regimens in reptiles are in need of further study but may be attempted. Metastatic neoplasms carry a poor long term prognosis. Surgery may nonetheless improve quality of life for an extended period in some cases; the boa ovarian adenocarcinoma treated by the author had visibly metastasized, but the owner reported the snake doing well two years postoperatively.

Occasional neoplasia involving the testes, penis or hemipenes may be seen in male reptiles. Reported testicular neoplasms include interstitial cell tumor in the desert tortoise (Xerobates agassizi), and also in the Komodo dragon (Varanus komodoensis). Seminoma was documented in an American alligator (Alligator mississippiensis). Snakes have been diagnosed with seminoma, Sertoli cell tumor, and interstitial cell tumor.

The author has seen one case of squamous cell carcinoma involving a hemipene of a 4.5-year-old green iguana. Such neoplasms may be aggressive and invasive, and attempted excision (via penile amputation) failed to cure the author’s patient. Other treatment modalities such as chemotherapeutics or radiation therapy may be attempted when appropriate to the type of neoplasm.

References