How to Spay Your Dragon

Lindsey M. Elswick

Mississippi State University

College of Veterinary Medicine

Class of 2021

Clinicopathologic Conference

January 15, 2021

Advisor:

Jeb Cade, DVM, MS

Introduction

Reproductive disease is a common and important cause of morbidity and mortality in captive female lizards of various species, including bearded dragons (*Pogona vitticeps*).[1] Of these diseases, dystocia is the most common disease affecting the reproductive tract.[2] In most species, dystocia refers to a difficult birthing process. In reptiles, dystocia is a broad term and includes any situation in which the female fails to complete or reverse the ovulation process.[2] It is worth noting that this is primarily a problem in captive reptiles, though it has not been extensively studied in wild reptile populations.[2] There are two recognized forms of dystocia in the reptile: pre-ovulatory follicular stasis (POFS) and post-ovulatory egg stasis (POES).[1,3] Pre-ovulatory follicular stasis, as the name suggests, occurs when follicles develop but fail to ovulate. Post-ovulatory egg stasis, also called egg binding, is a true dystocia and occurs when the shelled eggs are retained within the oviducts. The underlying etiology of both of these diseases is largely unknown, but inappropriate husbandry conditions play a large role in many diseases of captive reptiles.[1,2] Treatment options include medical management or surgical intervention, dependent on the diagnosis, the species presented, and the duration of the issue. Ovariosalpingectomy is recommended for lizards that will not be bred, as many are poor surgical candidates when POFS or POES occur.[2]

History and Presentation

Rocky, a 7-year-old female intact bearded dragon, presented to Arizona Exotic Animal Hospital on September 2nd, 2020. She had been seen previously on August 27th and it was noted that she had multiple follicles present in her coelom. On presentation on the 2nd, Rocky was quiet, alert, and responsive. She weighed approximately 530 grams and was in appropriate body condition. She had a respiratory rate of 10 breaths per minute and a heart rate of 60 beats per minute. Gentle palpation of her coelom revealed multiple large follicles present on both ovaries. Her coelom appeared mildly enlarged, but no other organ abnormalities could be appreciated on palpation. Rocky's owners noted that she was increasingly lethargic and anorexic. At her previous visit on August 27th, 2020, radiographs had been performed to confirm the presence of ovarian follicles. Repeat radiographs and pre-operative bloodwork were declined at this time, and Rocky was scheduled for an ovariosalpingectomy the following day.

Diagnostic Approach

The diagnosis of a pathologic process versus a normal physiologic process can be a tricky one, even for veterinarians experienced with reptiles. A complete history, including a description of the husbandry practices, is an incredibly important aspect of reptile medicine as many problems can be traced back to incorrect husbandry. Improper nesting site, improper temperature, inadequate nutrition, and dehydration can all play a role in the development of POFS or POES.[1,2]

A thorough physical exam is another important aspect of achieving a diagnosis. Anorexia, lethargy, and a distended coelom occur in both pathologic and normal physiologic processes in lizards. One of the distinguishing factors in many lizard species is the attitude of the individual. A healthy, gravid lizard, while not eating and may have difficulty ambulating, will be bright and alert.[2] Lizards with retained eggs or large space-occupying follicles will become depressed, and depending on the duration and severity of disease, may even collapse or die acutely.[3]

Diagnostic imaging, when paired with the physical exam, can be helpful in diagnosing these cases. Radiology and ultrasonography are two helpful modalities that most practitioners can access, but CT and MRI may provide better imaging of the coelom. Both follicles and eggs can be visualized on radiographs. Follicles often appear as rounded, soft-tissue opaque clusters of grapes located in the caudal coelom while eggs appear as larger, more oval shaped structures with a mineralized shell.[6] In cases of POFS, radiographic signs of coelomitis may be present, such as decreased serosal detail due to fluid accumulation in the coelom. Sonographically, normal follicles appear as spherical, homogenous and anechoic to hypoechoic. Follicles that fail to ovulate will begin to become more hyperechoic with an anechoic center and are said to have an onion-like layered appearance, depending on the duration of the disease.[6] Serial ultrasound is especially useful in the diagnosis of POFS because the mature follicles do not change in size or texture over the course of 2-3 weeks.[7]

A complete blood count (CBC) and chemistry panel should be obtained to evaluate the overall health of the individual. A reptile with reproductive disease may present with an increased white blood cell count characterized by a heterophilia with toxic changes, hypoglycemia consistent with sepsis, and increased uric acid if egg yolk coelomitis is present due to impaired renal function.[7] An elevated packed cell volume, total protein, and blood urea nitrogen (BUN) are consistent with dehydration and may also be present. It is important to note that reproductively active females will often have a significant hypercalcemia; this is a normal physiologic response and is associated with increased calcium mobilization and vitellogenesis.[7,9] Individuals suffering from POES may actually display hypocalcemia, which contributes to egg retention due to an inability of the oviduct to contract normally.[7] Other changes consistent with vitellogenesis include elevated triglycerides and hyperproteinemia.[5] It is important to obtain bloodwork to determine if the individual is a surgical candidate. However, one study that compared pre- and post-surgical evaluation of bearded dragons prior to sterilization found minimal differences between the biochemical values of those that survived versus those that did not. Instead, the reproductive status of the female bearded dragons prior to undergoing surgery was more important.[8]

Pathophysiology

To understand and better treat POFS and POES, some knowledge of the anatomy and physiology of the reptile reproductive tract is required. Squamates (lizards and snakes) have paired ovaries and oviducts that lay in the caudal coelom near midline.[7] The gross appearance of the ovaries varies on the stage of oogenesis; an inactive ovary will be small and granular, while an active ovary will be large and lobular and filled with spherical follicles.[9] The oviducts have albumin-secreting and shell-secreting functions and empty directly into the urodeum of the cloaca as no true uterus exists.[7,9] Onset of sexual maturity and subsequent oogenesis is dependent on size, but as a general rule small lizards reach sexual maturity by 1-2 years and large lizards by 3-4 years.[9] Vitellogenesis, accumulation of yolk, is a major step in follicle development and occurs with a rise in circulating estrogen levels.[1,9] Estrogen triggers the liver to convert lipid stores into vitellogenin, which is then selectively absorbed from the bloodstream by the follicles.[9] The follicle grows 10-100 fold larger than a pre-vitellogenic follicle during this process.[9] In a normal reptile, the follicles will then either ovulate or undergo atresia. It is poorly understood what factors trigger ovulation versus atresia, but day length, high temperatures, and a high energy diet can all trigger reproductive activity.[1] Albumin is added, and shell is laid down as it moves through the oviduct.[9]

The exact etiology of POFS and POES is unknown at this time, but many speculations exist. As these two diseases are rarely found in wild reptile populations, it is largely concluded that various husbandry issues play a large role in the development.[2] POES can be further classified into obstructive or nonobstructive, both of which have other causes that are not related to husbandry. An obstructive dystocia, as the name implies, occurs from the inability to pass the egg or fetus (if a viviparous species) through the oviduct and out of the cloaca. The causative defect may be due to a maternal abnormality or an egg/fetal abnormality. Common egg abnormalities that can lead to dystocia include a malformed egg or an oversized egg/fetus.[2] Common maternal abnormalities include stricture of the oviduct, a misshapen pelvis, or obstructive masses that are not related to the reproductive tract (such as cystic calculi or abscesses).[2] Nonobstructive dystocia, on the other hand, occurs when no underlying cause for obstruction can be found. Common causes include inadequate husbandry conditions (inappropriate nesting area, improper temperature, and malnutrition), poor physical condition of the reptile, endocrine disease, hypocalcemia and infection of the oviduct.[1,2] With both obstructive and nonobstructive cases, the egg becomes adhered to the wall of the oviduct if not passed at the appropriate time.[1]

POFS occurs when the follicles undergo vitellogenesis, but the mature follicles fail to ovulate or undergo atresia. The underlying etiology is largely unknown, but it is thought to be multi-factorial and include inadequate husbandry conditions, poor diet, lack of hibernation, and lack of male stimulation.[2,5] Because the follicles fail to ovulate or regress, they continue to absorb vitellogenin and grow, which causes them to act as space-occupying masses in the caudal coelom and can lead to the clinical signs of lethargy, anorexia, and dyspnea.[1,7] The follicles will either become necrotic and inspissated and leak vitellin into the coelom, or they may rupture due to their friable nature.[1,5,7] Vitellin is highly irritating to tissues and can lead to a condition commonly referred to as egg yolk coelomitis, which is a well-known potential sequela of

POFS.[1,5,7] Egg yolk coelomitis may be fatal if left untreated, but these patients generally have a poor prognosis even with appropriate treatment.[2,5,10]

Treatment and Management Options

Medical and surgical treatment options exist for both POFS and POES, but it requires a correct diagnosis as treatment in a normal gravid reptile jeopardizes the survival of the developing clutch.[2] In the case of POES, treatment should be pursued 48 hours after the failure to complete delivery because some females will complete oviposition or parturition within the first 48 hours but rarely do so after.[2] The treatment of choice depends on the condition of the female in question, the character of the dystocia (obstructive or nonobstructive), and the value of the female versus the clutch.[2] One of the most common first approaches to stimulate oviductal contraction is with hormones; oxytocin can be given intramuscularly or intracoelomically with doses ranging from 5-30 IU/kg.[2,7] Ideally, the patient should be maintained at their optimal body temperature when oxytocin is to be administered, as the temperature influences its effects on the oviductal muscles.[2] The efficacy of oxytocin is variable and depends on the species of reptile and the duration of the dystocia, with reports stating that it is more effective when administered within the first 48 hours of dystocia.[2] Arginine vasotocin is the reptile equivalent of oxytocin and while reptilian oviducts are 10 times more sensitive to arginine vasotocin, it exists only as a research drug at this time.[2] Calcium gluconate given intramuscularly or subcutaneously at 100 mg/kg is another treatment option when nonobstructive dystocia is diagnosed.[1] In cases of obstructive dystocia, another somewhat controversial treatment option in snakes and turtles is percutaneous ovocentesis, in which a needle is introduced into the egg and the contents are aspirated, with care given not to contaminate the coelom with the contents.[2] This decreases the size of the egg and makes it easier for the reptile to expel the egg, but if it is still retained within 48 hours, surgical removal is the treatment of choice.[2]

In cases of POFS, supportive care and changes to husbandry can be attempted to medically manage a stable patient in which no mature follicles are palpated or observed on imaging. The goal is to give enough time for resorption to occur and avoid a major surgical procedure.[3] However, the mainstay of treatment and prevention of POFS is a bilateral ovariosalpingectomy or ovariectomy.[2,3,7] This procedure involves removing both ovaries and oviducts, which is completely curative and in recent years has become a more commonly advocated procedure for prevention.[2] A celiotomy is the approach of choice in lizards, but care must be taken to avoid the ventral abdominal vein (VAV) that runs along ventral midline.[10] A paramedian or ventral midline approach may be taken; if a ventral midline approach is taken, it is recommended to make the initial stab incision through the skin either between the pubis and the umbilical scar or the umbilical scar and xiphoid. By making the stab incision here, the VAV can be simply dissected out of the way of the area of the midline incision.[10] An advantage to this approach is minimizing postoperative pain and discomfort. If the VAV is accidentally incised, ligation of the vessel appears to have no apparent clinical complications based on the current literature.[10] In lizards, the ovaries will appear as clusters of grapes on a short stalk bilaterally in the caudal coelom, with the structure becoming more friable with increasing duration of POFS.[10] The entire ovary should be gently elevated by grasping the avascular area of ovarian interfollicular connective tissue and the vessels ligated using vascular clips before being excised.[1,10] Once the surgery has been completed, the coelomic membrane, abdominal muscles and fat are all closed as one layer with an absorbable suture in a simple continuous pattern.[1,10]

The skin, which is the holding layer in the reptile, is then closed in an everting pattern (horizontal mattress) with either non-absorbable or absorbable suture.[1,10]

Case Outcome

Rocky was scheduled for a bilateral ovariosalpingectomy on September 3rd, 2020. She was pre-medicated, and the injections were given intramuscularly. She was induced and when at an appropriate anesthetic depth, an endotracheal tube was placed, and she was attached to the breathing circuit with sevoflurane at 5%. She was positioned in dorsal recumbency. A doppler was placed over on her cranial thorax to monitor her heart rate throughout the procedure. Her ventral abdomen was scrubbed with a chlorhexidine solution, and a clear plastic drape was placed aseptically. An incision was made for a ventral midline celiotomy. The VAV was cut in the approach and a mild hemorrhagic event transpired, but the vein was ligated, and no further bleeding was noted throughout the procedure. The left ovary, which had many mature follicles present, was gently grasped and elevated out of the abdomen. Vascular clips were used to maintain hemostasis. The ovary was excised. The procedure was repeated for the right ovary. Both oviducts were identified, and any vascular connections were ligated with vascular clips. The oviducts were transected and removed in their entirety. The coelomic cavity was evaluated for any hemorrhage, and then it was flushed with sterile saline. The muscle and fat were closed as one layer in a simple continuous pattern. The skin was closed in a horizontal mattress pattern. At the conclusion of surgery, Rocky was put in sternal recumbency, taken off of sevoflurane and kept on the ventilator at 100% oxygen. Her heart rate remained consistent in rate and rhythm, and she was monitored for recovery by testing for toe-pinch withdrawal, purposeful movement, and spontaneous breathing. About 2 hours after taking Rocky off of the sevoflurane, she had a positive withdrawal to a toe pinch and showed purposeful movement. As time progressed, she lost her response to the toe pinch and spontaneous breathing stopped. There were no variations in her heart rate or rhythm. She was kept on the ventilator and doppler overnight and placed in a warming incubator. Unfortunately, Rocky did not recover from the anesthesia and was confirmed dead the following day.

References

1. Knotek Z, Cermakova E, Oliveri M. Reproductive medicine in lizards. Veterinary Clinics of North America: Exotic Animal Practice 2017; 20: 411-438.

2. Denardo D. Dystocias. In: Mader D, and Divers S, eds. Reptile Medicine and Surgery. Saunders, Elsevier, 2006; 787-792.

3. Barten S. Differential Diagnoses by Symptoms: Lizards. In: Mader D, and Divers S, eds. Reptile Medicine and Surgery. Saunders, Elsevier, 2006; 683-695.

4. Raiti, P. Husbandry, Diseases, and Veterinary Care of the Bearded Dragon (Pogona vitticeps). Journal of Herpetological Medicine and Surgery 2012; 22 (3-4): 117–131.

5. Gardner BR, Barrows MG. Yolk coelomitis in a white-throated monitor lizard (Varanus albigularis). Journal of the South African Veterinary Association 2010; 81: p121-122.

6. Gumpenberger M. Diagnostic Imaging of Reproductive Tract Disorders in Reptiles. Veterinary Clinics of North America: Exotic Animal Practice 2017; 20: 327-343.

7. Rivera S. Health Assessment of the Reptilian Reproductive Tract. Journal of Exotic Pet Medicine 2008; 17: 259-266.

8. Christiansen E, Stoskopf M, Harms C. Pre- and Post-Surgical Evaluation of Bearded Dragons Undergoing Sterilization. Journal of Herpetological Medicine and Surgery 2013; 23: 83-90.

9. Denardo D. Reproductive Biology. In: Mader D, and Divers S, eds. Reptile Medicine and Surgery. Saunders, Elsevier, 2006; 376-390.

10. Mader D, Bennett RA. Surgery: Soft Tissue, Orthopedics, and Fracture Repair. In: In: Mader D, and Divers S, eds. Reptile Medicine and Surgery. Saunders, Elsevier, 2006; 581-596.