



Evaluating the efficacy of non-invasive and invasive surgical techniques to coeliotomy to remove retained eggs in a red-footed tortoise (*Chelonoidis carbonaria*).

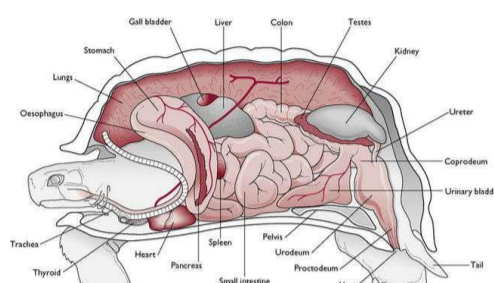
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INTRODUCTION

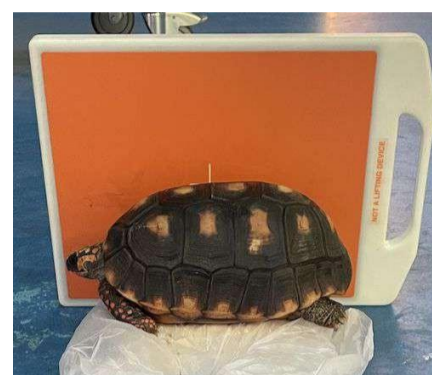
Chelonians, turtles and tortoises, are commonly owned as companion animals. Proper husbandry, diet, and environmental conditions are of extreme importance given their direct impact on chelonian health. If insufficient, this can predispose to various pathological conditions including but not limited to urolith (stone) formation or dystocia. Often times, the chelonian patient will show non-specific signs or present relatively normal which likely prolongs their visit to a veterinarian. Overall, chelonians typically present at advanced stages of their medical condition and may require aggressive medical management or surgery to save the patient's life.



DIAGNOSTIC IMAGING

Radiography

- Lateral view
- Dorsal-ventral view



Computed Tomography

- Smallest cross-sectional images



DISSECTION PROTOCOL



Figure 1. The *C. carbonaria* specimen was placed in dorsal recumbency for plastronomy using a dremel power tool to bevel cut and remove a rectangular section from the abdominal scute region. Once the plastron flap was created & removed, the caudal portion of the pectoralis major m., paired abdominal veins, and coelomic membrane, can be appreciated.



Figure 2. The coelomic membrane was cut at midline to mimic the clinical procedure however, additional cuts to the caudal and lateral borders were made to better visualize the coelomic cavity. Once reflected cranially, the numerous follicles in the ovary and a loop of large intestine were appreciated. Both were reflected cranially to visualize cloaca.



Figure 3. The specimen was turned 180 degrees in order to visualize the caudal coelom through plastron incision. The intestines & multiple follicles were reflected cranially to better visualize the cloaca and its junction to the rectum, bladder, and oviducts. These series of images focuses on the shiny, white thin urothelium of the urinary bladder. The bladder was empty, small, and able to be reflected cranially to reveal urodeum.



Figure 4. After thorough intracoelomic palpation, a scalpel handle and 10 blade were used to make a horizontal incision into the urodeum region of the cloaca just cranial to the urinary bladder where the retained egg was appreciated. The egg can be appreciated grossly and required gentle manipulation to be removed. The initial incision was extended laterally as needed to accommodate for the size of egg. The egg accidentally broke during manipulation revealing the yolk.



Figure 5. Once the retained eggs were removed from the urodeum of the cloaca, the cloaca was closed with 3-0 Ethicon black braided suture in a simple continuous pattern. Once cloaca was closed successfully, all coelomic contents including intestines and follicles were replaced into the coelom.

CLINICAL RELEVANCE

Uroliths

- Cystic calculi is a common finding in companion & wild chelonians
 - Non-specific clinical signs
 - Can be an incidental diagnosis
 - Likely caused by diet and water imbalances which promote crystal formation
- Uroliths can be extremely large and require surgical removal
 - Can be fatal if left untreated
 - Common surgery for boarded exotic veterinarians

Retained Eggs

- Dystocia may occur in companion chelonians
 - Multifactorial etiology: inappropriate husbandry, stress, nutritional deficiencies, or underlying disease.
 - Tortoises are very responsive to medical management using oxytocin
 - Surgery only indicated in cases of extremely large eggs

SURGICAL APPROACHES

The ARCIVES specimen used for this study was a 12-year-old female red-footed tortoise that had 3 retained eggs. These eggs were appreciated on diagnostic imaging (radiographs and CT scans) prior to dissection.

The two surgical techniques utilized to remove the eggs:

1. Transplastron approach

- Invasive procedure
- Prolonged plastron healing time
- Reserved for large eggs and uroliths

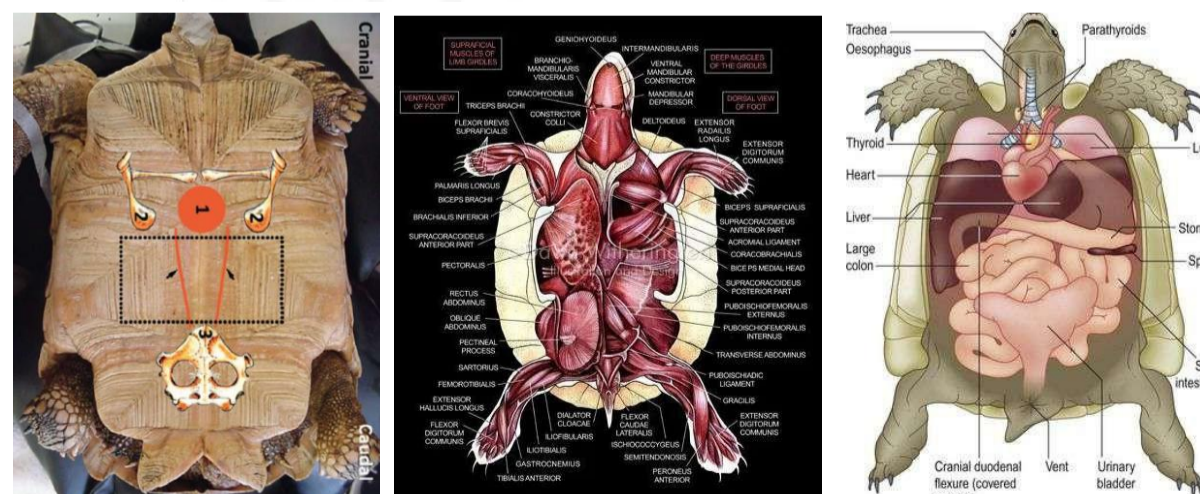


2. Cloacal approach

- Non-invasive procedure
- Typically coupled with endoscopy
- Reserved for small eggs and uroliths

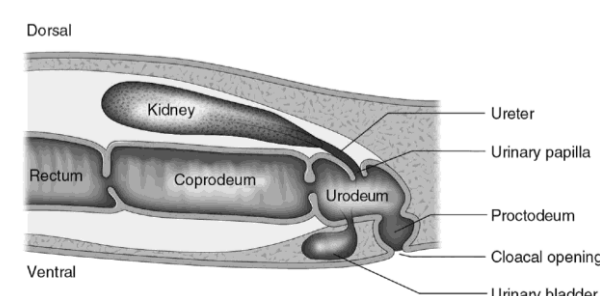


ANATOMICAL DESCRIPTION



Key Structures:

- Plastron
- Abdominal Scutes
- Coelomic Membrane
- Abdominal veins
- Coelom
- Cloaca
 - (Coprodeum, Urodeum, Proctodeum)



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- Thank you to Dr. Goe & Dr. Cunningham for their clinical expertise.
- Thank you Dr. Sosa, Dr. Georgi, and Dr. Hall for support and assistance during the dissection.
- Scan QR code for references.



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