FOLLICULAR STASIS IN AQUATIC TURTLES

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INTRODUCTION

Among reptiles kept as pets, aquatic turtles are particularly popular among enthusiasts. It is common to find various species in captivity, many of them native to North America, such as *Pseudemys* sp, *Graptemys* sp and *Chrysemys* sp.

Among the most frequently diagnosed pathologies in captive reptiles, and particularly in chelonians, are reproductive disorders in females, such as pre-ovulatory and/or post-ovulatory dystocia, oophoritis, salpingitis and the presence of ectopic eggs.

Thanks to progressive improvements in husbandry conditions, these species are living longer. Throughout their lives, females go through multiple reproductive cycles, during which follicular development occurs in the ovaries, followed by ovulation and, under physiological conditions, oviposition.

In aquatic turtles kept in captivity, both follicular development and the processes of ovulation and oviposition can be altered from their natural physiology. In this context, preovulatory dystocia, also known as follicular stasis, is characterised by a failure to ovulate after follicular maturation and vitellogenesis. The vitellogenic follicles continue to grow, even fusing with each other. This situation carries the risk of follicular rupture and release of the contents into the coelom, which can trigger coelomitis. The highly irritating vitellus can cause inflammation of the coelomic membrane and the serous membranes of adjacent organs, promoting the formation of adhesions with structures such as the liver, stomach, intestine and the coelomic membrane itself.

With ageing, there is a decrease in the number of eggs per clutch, as well as a progressive reduction in ovarian activity. As a result, follicular cycles become more spaced out until they cease completely.

Although this pathology has been described more frequently in terrestrial species, the author's clinical experience indicates a growing incidence in aquatic chelonians.

ETIOPATHOGENESIS

The aetiology of follicular stasis is not fully understood, and there are several hypotheses in this regard. Under normal conditions, after each ovulation, corpus luteum (CL) forms, responsible for the production of progesterone, a hormone that induces the regression of developing follicles. In the absence of ovulation, functional CL does not form, which would prevent the synthesis of progesterone and favour the persistence of the follicles.

According to McArthur (2024), this clinical picture occurs most frequently in females kept for long periods without contact with males, or in those who, after a period of isolation, are reintroduced into the presence of members of the opposite sex.

Additionally, other environmental and physiological factors can influence the disruption of the reproductive cycle, such as photoperiod, temperature, humidity, misting, habitat type, and diet.

As a result of chronic retention of developed follicles, a state of sustained hyperoestrogenism may develop, associated with a **metabolic imbalance** characterised by bone marrow suppression, hepatic lipidosis, hypercholesterolaemia, hypercalcaemia, and hyperalbuminaemia.

CLINICAL SIGNS:

Although the clinical signs are non-specific, we generally find anorexia, weight gain, constipation, paraparesis, urinary incontinence, discomfort, and agitation.

DIAGNOSIS:

The diagnosis of follicular stasis in female aquatic turtles is complex due to the non-specific nature of its clinical manifestations, as well as the fact that the presence of developed follicles is a physiological process within the reproductive cycle. Therefore, it is essential to perform a thorough differential diagnosis to rule out other pathologies with similar symptoms.

Biochemical findings associated with follicular stasis include hypercalcaemia, hyperalbuminaemia, hyperproteinemia and elevated alkaline phosphatase. Anaemia, heteropenia and leukopenia may be observed in the blood count.

Ultrasound is a valuable diagnostic tool, as it allows the identification of large numbers of large vitellogenic follicles that do not progress to ovulation or that show progressive degeneration. These follicles are usually visualised caudally to the liver as spherical, homogeneous, echogenic structures with an average size of 18 to 25 mm in the species most commonly seen in clinical practice. During follicular atresia, these structures tend to decrease in size and become hyperechoic until they are completely reabsorbed. The oviduct can be seen as a thin, folded, hyperechoic tubular structure extending beyond the ovaries.

Complementary diagnostic methods include radiography, in which no calcified eggs are evident, coelomic endoscopy and, in selected cases, exploratory celiotomy.

TREATMENT:

Some authors have proposed the use of medical treatments with progestogen or medroxyprogesterone to induce ovarian involution in turtles with follicular stasis. However, these drugs have been administered at empirical doses, with inconsistent results and little clinical evidence. In addition, these females often have concomitant hepatic lipidosis, so the haematogenous mobilisation of lipids from the ovarian contents could aggravate the hepatic condition.

GnRH analogues, such as deslorelin implants, have been used in various species, although there are few studies focusing specifically on turtles, and even fewer in the context of follicular stasis. The available studies suggest that deslorelin does not have an effective contraceptive effect in these species.

In the author's experience, ovariectomy, with or without associated salpingectomy, is the treatment of choice. Traditionally, surgical access to the coelom in chelonians has been achieved by osteotomy of the plastron, creating a window or bone flap. Although this technique has proven effective for years, it involves prolonged recovery times and the risk of sequestration or necrosis of the bone flap.

In recent years, celiotomy via the prefemoral approach has become the preferred technique. This method is considerably less invasive, allows for faster recovery and presents a lower risk of postoperative complications compared to traditional plastrotomy, and is currently the option of choice for elective sterilisation in chelonians.

However, there are situations in which the prefemoral approach is not feasible, such as in cases of extensive fibrosis, adhesions, calcifications, or large neoplastic masses. In these scenarios, plastrotomy is recommended, as it offers broader and more detailed access to the coelomic cavity.

Given the limited anatomical space in the prefemoral region of aquatic turtles, this approach can be performed with endoscopic assistance, which facilitates the visualisation and manipulation of the viscera. The incision must be wide enough to allow the introduction of the endoscope, the grasping instruments, and the subsequent removal of the ovaries. Generally, celom insufflation is not required for adequate visualisation.

Endoscopy-assisted ovariectomy or ovariesalpingectomy also allows for liver or organ biopsies, verification of vascular haemostasis, and confirmation of complete resection of ovarian tissue.

Aerobic and anaerobic bacteriological cultures of the removed ovaries and oviducts are recommended in order to rule out the presence of underlying bacterial oophoritis and/or salpingitis.

Given the high prevalence of reproductive tract pathologies and the relative simplicity of the procedure, laparoscopic-assisted prophylactic ovariectomy is considered a practical and safe option for the sterilisation of adult female aquatic turtles not intended for breeding.

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