How I Diagnose and Manage Disease of the Female Reproductive Tract

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Reproductive-related disease is common in pet avian practice, with a higher incidence of disease in smaller species such as cockatiels and lovebirds. Knowledge of normal psittacine anatomy and reproduction is important for management of reproductive disease.

Normal Female Anatomy and Physiology

The ratio of male to female birds is approximately 1:1 in most species. The sex chromosome of birds is designated Z, and female birds have ZW chromosomes, while males are ZZ. As in mammals, gonads originate from the mesonephric duct. Germ cells are distributed equally right and left, and then migrate primarily to the left in female psittacine birds to become a single left ovary and uterus. Hermaphrodites, and parrots with a portion or intact right reproductive tract have been reported (Pollock and Orosz 2002).

The early ovary contains a cortex and medulla, but this organizational structure is lost and the mature cortex contains immature follicles, while the medulla contains a prominent vascular zone. Follicles have a blood and nerve supply, and endocrine connection with the uterus (Pollock and Orosz 2002).

The infundibulum catches the egg after ovulation and directs it to the uterus. Abberations in anatomy or function can result in an "ectopic" yolk deposited directly into the celomic cavity (internal laying). In some cases the ovum is reabsorbed, or can result in yolk peritonitis. Fertilization occurs in the infundibulum, and in chickens must occur during a short time frame prior to laying down of albumin. The oviduct consists of the magnum (addition of albumin), isthmus (deposition of inner and outer shell membranes) and shell gland (plumping, or addition of water and electolytes, and actual calcification); after passage of the egg through the oviduct the egg passes through the vagina to the cloaca and out the vent.

Most psittacine birds are seasonal breeders in the wild, but many appear more opportunistic and will display reproductive behavior for much longer periods.

In the wild, a number of factors trigger the onset of the reproductive cycle, including seasonal rainfall, seasonal appearance of specific food types, increased photoperiod, presence of an appropriate mate, and presence of an appropriate nesting site and nesting material (Pollock and Orosz 2002).

Increasing day length stimulates the release of leutinizing hormone-releasing hormone (LHRH), which then in term stimulated production of LH. (The role of FSH is less clear in birds.) LH stimulates production of androgens, estrogens and progesterones by pre-ovulatory ovarian follicles. Rising estrogen levels stimulates readiness of the ovary and oviduct, and probably stimulates nest building and courtship

behavior. FSH and LH levels increase prior to ovulation, and LH and progesterone participate in a positive feedack system, each stimulating an increase in the other, with LH, estrogen, prostaglandin and testosterone all peaking about 6-8 hours prior to ovulation. Ovulation itself is induced by LH. Prostaglandin F2a (PGF2a) increases 15-60 minutes prior to ovulation, causing uterine contraction (Pollock and Orosz 2002).

Parrots such as the budgerigar are determinant layers producing a set number of eggs per ovulation cycle. Most parrots are indeterminant layers, and can replace eggs that are lost or removed by owners (King and McLelland 1984).

Onset of puberty varies as to species, with 2 months in zebra finches; budgerigar, lovebird and cockatiel at six months to one year, 1-2 years for conures and larger parrots between 3 and 6 years (Joyner 1994).

Reproductive Behavior in Captive Psittacine Birds

In captive parrots, signs of reproductive behavior can be subtle to chronic oviposition and all degrees in between. Some parrots have been known to produce eggs or present with reproductive-related disease without prior warning or indication of reproductive activity. Reproductive triggers in captivity have corollaries to those in the wild: increasing photoperiod (spring), presence of a potential mate in the form of a mirror, toy or human owner, and presence of nesting material or nest in the form of "bird huts", nest boxes, and paper or other substrate that can be used as nesting material. In some cases the "nest" and "mate" may not be clearly identified or appear to be more than one object or person.

Some birds never demonstrate sexual behavior despite inadvertent intense stimulation on the part of the owner, while some produce egg after egg with no apparent stimulation.

Signs of reproductive behavior occasionally noted by owners include increased territorial behavior (defending perceived nest sites), increase aggression (defending perceived mate), nesting behavior, paper shredding, and signs suggesting pair bonding, including courtship regurgitation, increased preening and masturbation (Table 1).

A few generalizations can be made based on the author's clinical experience:

Many larger parrots will pair bond with owners, display overt sexual behavior, but few will actually produce an egg.

Among larger parrots, cockatoos and macaws appear most prone to pair bonding with owners.

Species most prone to chronic egg production are cockatiels, lovebirds and budgerigars.

These smaller birds appear to have a lower threshold to trigger the reproductive cycle, and will often produce eggs despite the owner's attempts to eliminate external triggers.

Reproductive Disorders in Captive Psittacine Birds

Reproductive behavior in pet parrots is generally undesirable, and is linked with higher incidence of inappropriate behavior and higher risk of reproductive disease. According to the Gabriel Foundation, a large US bird rescue, inappropriate bonding and sexual behavior is a common factor in birds relinquished by owners for "behavioral problems" (The Gabriel Foundation 2006). Reproductive diseases include retained eggs, neoplasia, ovarian cysts, salphingitis/metritis, ectopic yolk with or without peritonitis, dystocia and prolapse.

Reproductive diseases often result in serious illness and death. Retained eggs and dystocia are often a result of chronic oviposition and can be exacerbated by malnutrition, obesity, primary uterine disease and possibly genetics (Bowles 2006). The retention of albumin, yolk or inspissated egg material is often termed oviductal impaction. This material can be eventually reabsorbed, but in many cases causes obstruction of the oviduct, inflammation and infection. Ovarian and oviductal neoplasia is most commonly reported in cockatiels and budgerigars, and include adenocarcinoma, granulosa cell tumors, lymphomatosis, leiomyosarcoma and leiomyomas (Joyner 1994). Ovarian cysts are reported in cockatiels, budgerigars and macaws, and exact cause is unclear. Salphingitis/metritis may be the result of an ascending infectious/inflammatory process, extention of other celomic infectious/inflammatory processes, or be the result of oviductal impaction. Ectopic yolk occurs when the ovum is not captured by the infundibulum, via reverse peristalsis of the oviduct, or through oviductal rupture. Ectopic yolk may be reabsorbed or result in severe inflammation. Dystocia is failure of the egg to be delivered within the normal time span. Eggs retained in the pelvic canal obstruct the passage of urine and feces, and compress vessels, kidneys and nerves, and represent a true emergency. Prolapse of the oviduct or cloacal can be a result of excessive straining usually associated with dystocia (Joyner 1994).

In the author's experience owners of birds with reproductive disease often, but not always, report evidence of reproductive behavior. Because certain reproductive diseases such as complications from retained eggs can occur many months to a year after ovulation, observed reproductive behavior may not be recent. Owners may report history of active egg laying that cease abruptly many months prior. Besides oviposition, other signs of reproductive activity are listed in Table 1.

Diagnosis of Reproductive Disease

Diagnosis may be readily evident to difficult. Birds may present with mild symptoms or conversely in shock and near death.

Infectious and inflammatory processes associated with the reproductive tract may produce vague symptoms such as mild lethargy and fluffed up appearance. Symptoms become more apparent when reproductive disease involves a space occupying mass, such as an ovarian cyst, neoplasia, or retained egg, or production of celomic fluid. The first indication of a space occupying mass or fluid is often expansion of the celomic space, the space between the ventral aspect of the keel and pectoral muscle mass and the pelvis. In a normal bird the space is generally narrow, and palpation of the space is unrewarding. As masses enlarge and/or fluid accumulates, the space widens, and in extreme cases, masses or fluid may be palpable. Retained eggs are generally only palpable when the eggs has been transported to the distal uterus and/or cloaca and are within reach of palpation, and have benefit of deposition of hard shell. Yolk and egg retained in the proximal oviduct are not detectable per palpation, but may still produce widening of the celomic space and/or displacement of other organs.

Complete blood count may be normal or reveal evidence of infection or chronic inflammation, which can include elevated white blood cell count, left shift, monocytosis and/or anemia of chronic inflammation. Chemistry panel may reveal elevation of so-called "liver" enzymes, which are also leaked to some degree by the ovary, uterus and muscle.

Radiographs are often an extremely useful tool for diagnosis of uterine disease. Significant findings include presence of calcified intact egg or shell fragments, evidence of space-occupying mass, and hyperostosis of long bones. In cases of unidentified celomic mass, administration of oral contrast media allows differentiation of the gastrointestinal tract from other celomic structures, and often identification of the location of the mass based on deflection of the barium column.

Endoscopy can be useful, especially when disease is confined to the ovary, for example ovarian cysts and neoplasia. Celomic fluid, celomitis, or an abnormally enlarged uterus makes endoscopy technically difficult.

Some reproductive diseases produce celomic fluid, in particular yolk coelomitis. Fluid aspiration and analysis can give important clues to diagnosis. Cytologic specimens vary, and in the case of true yolk coelomitis often contains basophilic proteinaceous debris consistent with yolk, and inflammatory cells, in particular large macrophages. Material from an impacted oviduct may contain debris only. Other findings include the presence of bacteria, or even transudate only (Bowels 2006). It must be kept in mind that aspirated fluid might indeed be free fluid in the celomic space, or fluid aspirated from within an enlarged oviduct itself.

Ultrasonography can be useful, especially in the presence of fluid, or in larger species.

Treatment of Reproductive Disease

Chronic reproductive activity and/or oviposition

Behavioral modification and environmental alteration must be an important component of therapy when the goal is reduction of reproductive behavior that has not yet resulted in disease. Treatment includes removal of as many natural environmental triggers as possible, including decreasing photoperiod, and removal of the perceived “nest” and “mate”. In many situations, this includes educating clients on redefining the human/parrot bond, and taking steps to convert from a sexual to a social relationship. Success is often not immediate, and requires patience and persistence.

A number of drugs have been advocated to reduce endogenous sex steroid production and release. While these drugs can be useful, the author has noted frequent failure when owners are not willing to simultaneously introduce behavioral modification and environmental alteration. Drugs include leuprolide acetate, 700-800 ug/kg IM for birds under 300 g, and 500 ug/kg IM for birds over 300 g; and human chorionic gonadotrophin, 250-500 IU/kg IM on days 1,3 and 7. Levonorgestrel and medroxyprogesterone have been used but are no longer recommended due to increased risk of adverse side effects (Joyner 1994). In cases of chronic oviposition refractory to behavioral modification and medical therapy, hysterectomy should be considered.

Reproductive neoplasia

Neoplasia requires biopsy and histopathologic confirmation. The author is unaware of successful attempts to surgical remove an ovarian neoplasia, and there are a few anecdotal reports of attempted chemotherapy (Joyner 1994).

Ovarian cysts

Aspiration of larger cysts, partial ovariectomy, and cryosurgical destruction have been reported (Bowels 2006). Treatment should include behavioral and medical therapy to reduce production of reproductive hormones as well.

Ectopic yolk

Birds presenting with symptoms related to ectopic yolk often require surgery to remove the yolk, and in most cases, hysterectomy is performed as well. While some ova may reabsorb, in the author’s experience, waiting for natural resolution often results in a patient in declining condition and a poor surgical candidate. Early intervention has resulted in a higher success rate in the author’s practice.

Retained egg and dystocia

Treatment of these conditions must include careful patient evaluation and stabilization prior to beginning primary therapy. Supportive care includes fluid therapy, nutritional support, increased ambient temperature, and if warranted, administration of calcium, antibiotics and analgesics (Bowles 2006). In some cases, supportive care and warmth alone may allow the bird to pass the egg naturally. Many techniques have been described for delivery of an egg retained in the oviduct or cloaca. These include administration of drugs to promote uterine contraction, manual delivery, ovocentesis and surgery. Drug therapy can benefit when the uterus is intact and functional and there are no adhesions or obstruction. PGE2 (Prepadil Pharmacia and Upjoh, Kalamazoo, MI, USA) relaxes the uterovaginal sphincter while inducing uterine contractions, and is administered .025 ml/100 g (Joyner 1994).

Manual delivery must be performed with care, and is only considered for shelled eggs in the distal uterus/vagina or cloaca. With the bird under general anesthesia, digital pressure is applied to the proximal portion of the egg, and the cloaca lubricated and gently dilated. As the egg begins to present into the cloaca, the vagina is identified via the appearance of white shell through the thin wall, and the vaginal opening identified and dilated with a blunt probe to allow passage of the egg. Complications of this procedure include uterine trauma and/or rupture, collapse of the egg, hemorrhage, and respiratory compromise secondary to celomic pressure (Bowles 2006).

Eggs or egg material retained for long periods in the proximal oviduct are unlikely to resolve without hysterectomy.

Prolapse

Prolapse of tissue from the vent has a variety of causes, not always related to the reproductive tract. Prolapse of the uterus, vagina and/or cloaca is a possible consequence of oviposition-related straining (Joyner 1994). In mild cases where the egg has passed and prolapsed tissue is healthy, simple replacement and stay sutures after carefully cleansing and irrigation of the tissue may allow healing and resolution. Steps are then taken to prevent further oviposition (see above). Severely damaged tissue may require debridement, and damaged uterus may necessitate hysterectomy (Bowles 2006).

Surgical Resolution of Reproductive Disease

The most difficult decision may to determine when surgical intervention is the best course of action for resolution of reproductive disease. The author finds the following criteria useful:

- Failure of medical management and manual manipulation to resolve dystocia
- Evidence of mass consistent with uterine enlargement and the presence of hyperostosis without recent oviposition, especially with history of previous egg laying that abruptly stopped.
- Yolk peritonitis with the presence of fluid resulting in clinical symptoms (lethargy, increased respiratory effort)
- Chronic oviposition that has resulted in two or more dystocias requiring medical intervention.
- Persistent hormonal behavior refractory to behavioral and medical management that results in significant impairment of pet quality or resulting in secondary medical disorders

Ceolomic surgery and hysterectomy have been well described in avian patients. While technically difficult, it is facilitated by properly sized surgical instruments, adequate retraction and magnification.

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Table 1. Possible appearance of reproductive behaviors in captive psittacine birds.

Behavior	Possible appearance in captive setting
Pair bonding	Increased physical contact, social grooming and/or courtship regurgitation towards perceived mate (bird/human/object) Increase in screaming and anxiety when "mate" leaves or is removed
Defense of mate	Defending "mate" from other members of the household, biting "mate" when other household members approach
Nest building	Shredding paper or other substrate, hiding under papers, cloth or other containers or hiding spots
Defense of nest	Defending "nest" intrusion from anyone other than the "mate"
Mating	Masturbation with perceived mate (bird/human/object)
Ovipostion	Actual production of an egg