Treating and Managing Chronic Egg Laying in Companion Birds

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Chronic egg-laying in the pet bird poses a significant threat to the health and behavioral well being of many pet birds. When a hen lays repeated clutches or larger than normal clutch size without regard to the presence of a normal mate or confined breeding season, a myriad of secondary problems can follow. Ultimately, functional exhaustion of the reproductive tract poses risk of metabolic and physiological drain on the bird, particularly on calcium and energy stores. All of these ultimately predispose the hen to egg binding, dystocia, yolk coelomitis, oviductal impaction, oviductal torsion, cloacal prolapse and osteoporosis. Although chronic egg laying is seen in many companion bird species, it is most commonly described in the smaller species, including budgerigars, cockatiels, lovebirds and finches. Medical intervention has traditionally focused combinations of environmental management, counter-hormonal therapies and surgery. In general avian medical practice, salpingohysterectomies and counter-hormonal therapies including leuprolide acetate (lupron) and more recently Deslorelin, seem to be the more common treatments recommended for chronic egg laying, with environmental/behavioral recommendations seem to be less commonly emphasized. This discussion will outline the form and function of the female reproductive tract, the etiopathogenesis of chronic egg-laying issues, and will critically review and ethically prioritize potential medical interventions to resolve or address the problem.

Female reproductive anatomy and endocrinology

The anatomy and endocrinology of the avian female reproductive tract is well described. The normal reproductive cycle and the clinical problems that can occur, with treatment considerations and recommendations are described in depth in most current texts. The female bird's reproductive tract consists of the left ovary and the left oviduct. The left and right ovary and oviducts develop embryologically as paired structures, but, after hatching, the right ovary and oviduct degenerate in the domestic fowl. If the left ovary and oviduct are removed from a chick before 30 days of age, the remnants of the right ovary will develop into an ovotestes.

Ovary

The left ovary is located in the coelomic cavity, cranial to the left kidney and adjacent to the adrenal gland. The ovary is attached to the dorsal body wall by the mesovarian ligament, which can have considerably large blood vessels during an active breeding cycle. Surgical access, concerns about residual or regrowth of ovarian tissue, and threat of hemorrhage makes ovariectomy a particularly challenging procedure in an adult hen. The ovary histologically consists of two major portions: the medulla and the cortex. The medulla contains connective tissue, nerves, smooth muscle and blood vessels. The cortex covers the medulla externally and contains the primary oocytes. These oocytes have developed from a set number of prenatal oogonia by the time the female bird has hatched. Within the ovarian cortex of the adult hen, several hundred to several thousand primary oocytes may be visible to the naked eye. About twelve thousand are visible microscopically. Very few of these will enter the stage of rapid growth and actually develop beyond the primary oocyte stage. Primary oocytes visible on the surface of the ovary are termed follicles, which pertain to the primary oocyte and its membranous covering. After completion of the rapid growth period, the primary oocyte undergoes two maturation divisions. Fertilization of the ovum occurs within 15 minutes of ovulation, and presumably occurs in the infundibular oviduct. The budgerigar is an example of a determinant laying species, meaning that they lay a fixed number of eggs. Many other non-domestic birds also are known to be determinant layers, such as the California Condor, Eclectus parrot, and Bald Eagle. Aviculturists may choose to take advantage of this physiologic trait and remove eggs from the nest for artificial incubation, knowing that the parents will often "double clutch" and re-create another clutch of eggs. The reverse management, providing the perception of a completed clutch to a hen, sometimes can be used as a mechanism to reduce the number(s) of eggs layed by determinate laying species that has a recognized nesting area.

Oviduct

The left oviduct is attached to the dorsal body wall by the mesovarian ligament. Glandular development within the oviduct results in a thickening of its walls which differentiate it into five functional regions associated with egg formation. These portions are termed the infundibulum, magnum, isthmus, uterus and vagina. The infundibulum is the funnel shaped structure at the proximal end of the oviduct along with a very small portion of the tubular shaped proximal oviduct. The funnel shaped portion of the infundibulum forms an elongated slit which faces the ovary. The ovulated secondary oocyte is literally swallowed or "caught" by the funnel portion of the infundibulum. This "catching" process is facilitated by the adjacent air sac which tightly encloses the ovary and forms the "ovarian pocket", leaving only the direction of the infundibulum for easy movement of the secondary oocyte. Formation of the yolk membrane's outer layers probably begins in the tubular portion of the infundibulum. These outer layers of yolk membrane are termed the chalaziferous layer of albumen and the chalazae. The magnum is the longest and most coiled portion of the oviduct. It is distinguished by its greater external diameter and markedly thicker wall caused by the presence of numerous secretory glands which account for the prominent mucosal folds of the magnum. These glands secrete the thick albumen protein around the ovum. The stimulus to secrete albumen may be mechanical, arising from passage of the ovum along the magnum. Smooth muscle contractions peristaltically move the ovum along the oviduct. In a sexually active bird, the magnum undergoes tremendous enlargement. Added

length of the enlarged magnum causes a folding of the oviduct upon itself. This region of the oviduct is short and has less prominent mucosal folds than the magnum. The division between the magnum and the isthmus is marked by a thin translucent line which can be seen on the mucosal surface with the unaided eye in domestic fowl. The isthmus produces two shell membranes which are loosely secreted around the ovum and albumen. The uterus is initially a similar diameter as the isthmus, but rapidly expands to form a pouch which retains the egg during the entire portion of egg formation. The short terminal portion of the oviduct immediately proximal to its junction with the urodeum is the vagina. Strong muscle of the vaginal wall and a well-developed muscular sphincter at the uterovaginal junction serve to expel the egg during oviposition.

Endocrine control of reproduction

In the female, the hypothalamus also plays a central controlling role in female reproduction External factors as well as internal factors are responsible for development of hypothalamic and reproductive activity in birds. Light photoperiodism can play a role in many psittacine species, but not all. Light stimuli affect the hypothalamus directly via optic nerve transmission as well as indirectly through the skull and the pineal body. The primary female gonadotropin is FSH which is responsible for follicular growth. Only small amounts of LH are required for normal follicular growth. As the follicles increase in size, they begin to produce increasing amounts of estrogen and progesterone. These hormones in turn influence the amount of gonadotropins that are secreted by the anterior pituitary gland. Of these two hormones, progesterone is the most significant hormone regulating anterior pituitary activity. Serum concentration of progesterone seems to directly influence its role in an inhibitory or stimulatory role. Higher levels of progesterone inhibit the anterior pituitary gland and low levels stimulate it. Progesterone acts mainly on LH, and LH is clearly involved with control of ovulation. LH peaks approximately 6-8 hours before ovulation. This results in increased progesterone secretion from the developing follicles. Increased progesterone levels pass the threshold from positive to negative feedback. This mechanism acts to prevent the development and ovulation of more than one follicle at one time.

After ovulation, the post-ovulatory follicle shrinks to an empty sack which rapidly regresses. There is no avian equivalent to the corpus luteum seen in mammals. Progesterone secretion decreases rapidly in the post-ovulatory follicle and is negligible after 24 hours. This helps to decrease progesterone to a low level which acts to positively feed back to the hypothalamus and increase LH secretion and promotes ovulation of the next mature follicle. Estrogens are involved in the induction of numerous female sex characteristics and behaviors. Estrogen probably works synergistically with other hormones such as progesterone and prolactin to initiate these activities as well. The role of testosterone in the female bird is poorly understood.

The environmental and behavioral controls of female reproductive endocrinology

Unlike many of the more common pet domestic mammal species, avian reproductive function is predominately initiated by extrinsic or environmental stimuli, as opposed to intrinsic cyclicity. Once the hypothalamic-pituitary-gonadal axis is triggered, a predictable cascade of events and consequences can occur. These events include endocrine, physiologic, behavioral and anatomic changes and activities in birds. Even what has been described as signs of reproductive behavior (paper shredding, nest building, hiding under papers, and/or seeking dark places), in reality, are predominately controlled by activity of the pituitary-gonadal axis, and are not necessarily involved with the triggering of its activity. In this sense, nest-seeking behaviors are merely the result of an already activated pituitary-gonadal axis, and are predictive of more direct reproductive activity in birds. In an ideal clinical preventative setting, by effectively controlling the triggers of the pituitary-gonadal axis should be most preventative, if not curative. In clinical settings with more advanced reproductively linked disorders, after the immediate clinical problem has been successfully addressed, efforts on a preventative level still are an essential part of complete medical care.

Most non-domestic avian species breed opportunistically, and are reproductively active only when favorable environmental conditions exist. These are typically birds adapted to tropical or desert climates, and, if the climate allows, these birds may breed. In the absence of supportive environmental conditions, reproduction does not occur. In a given year, the proportion of birds in a wild population that actually breed can be low, and some species breed only every other year or every few years. Parrots are mainly monogamous and, in the case of larger species at least, pair for life. The bond between pairs is constantly reinforced by a variety of behaviors, such as allopreening and feeding. This strategy is perhaps adaptive, because of the high proportion of learned (as compared to instinctive) behavior exhibited in parrots: pairs that know each other well and have experience of one another breed more successfully.

Environmental cues that can stimulate reproductive activity and ultimately lead to oviposition in avian species include photoperiod, temperature, rainfall, available food supply, the presence of nesting material, and/or the presence of a mate (real or perceived). The perceived photoperiod by birds is understood by many as a very important environmental cue for reproductive activity in most avian species. Its role in parrot species is not as well studied as it is in many other taxonomic groups of birds. Rainfall is known to stimulate reproductive behavior in many tropical and desert-dwelling species of birds. Rainfall and temperature often directly affect the available food supply, which is another critical factor affecting reproductive activity. The presence of nesting sites and appropriate nesting materials is a powerful reproductive cue for many parrot species. Abnormal "mates" can include an owner or other human, some items within the cage, and toys. Another bird housed in the same cage, the same room, or even simply within hearing distance may strongly stimulate reproductive drive. In some species, there is a genetic predisposition for chronic egg-laying and lack of normal reproductive hormonal balance. Pet chickens and waterfowl are common species representations of the genetic predisposition for

chronic egg laying. Pair-bond enriching behaviors such as include regurgitative feeding, copulatory behaviors, nest site inspection and mutual preening are acknowledged as triggering cues for reproductive activity.

A scale for selecting and prioritizing professional recommendations

Medical intervention generally is guided along the ethical guidelines of "Least intrusive, most effective". A hierarchy of treatment options that progressively move up this scale, as-indicated in specific cases is vastly important. Many of the more intrusive treatment options, when not preceded by some of the more foundational and less-invasive recommendations for excessive egg laying should be realistically predisposed to a higher degree of failure. Degrees of intrusiveness of a recommended treatment can be tested by the amount of induced stress, physical pain, and cost. In addition, treatments that require repeated administrations should be challenged for their compatibility with this hierarchy in-toto. Degrees of effectiveness can be tested by their short term and long term effect at directly achieving their goal, as well as their effect at preventing recurrence in the future. Reduction of the probability of potential side effects and their adverse consequences on the health and welfare of the bird is also a very important test of effectiveness of a treatment.

Prevention

Many young parrots sold as pets are "mentored" and taught by their new owners only one form of social interactive skills (pair bond enrichment behaviors), as opposed to the typical array of social skills that would have been taught by the parents of their wild counterparts. Deficits in normal social interaction skills, foraging activities, learned inappropriate pair bonding behaviors, inappropriate diets, the provision of nesting environments and other factors are common. The first and foremost component of healthcare and prevention of excessive egg laying comes from the identification of existing risk factors at routine examination, client education, appropriate recommendations, and careful follow up on recommended actions with owners. Recommendations for enrichment of normal lifestyles, positive reinforcement training for guiding flock interactive behaviors, dietary recommendations, foraging training, and cage environment improvements all are essential foundational preventative maneuvers. In essence, enrichment of these types of behaviors is a key aspect of the routine annual examination.

Environmental and behavioral interventions

In the presence of excessive egg-laying in companion birds, a series of recommendations and training / enrichments should be outlined for bird owners. Specific recommendations are guided by signalment, history and physical examination findings. Although many of the needed recommendations require the "removal" of reproductively associated stimuli and behaviors, more ethical recommendations should also concurrently package and emphasize the training of normal behaviors to replace what is removed. The stress that can be generated by environmental and behavioral deprivation, although it can add to short-term "effectiveness", should be viewed as less ethical than a behavior-change strategy that is based on differential reinforcement of alternative behaviors. Environmental and behavioral deprivation can easily result in an increase in behavioral problems, ultimately adversely affecting the health and welfare of these patients. In most circumstances and when applied correctly, environmental and behavioral interventions should be viewed as most ethical, least intrusive and most effective treatments for uncomplicated chronic egg laying.

Environmental stimuli may need to be altered, and every recommendation should be carefully balanced with an enrichment or differential reinforcement plan for alternative behaviors. The photoperiod may need to be altered and reduced for some species. Nest sites, toys, and other items to which the bird has a sexual affinity should be removed from the enclosure. Access to a nesting environment (shredded papers, a box, or other dark cavities) should be prohibited. In the event that a pet bird is showing nesting behavior and laying eggs in a designated site within the cage environment, removal of eggs from the nest should be avoided for the normal incubation period for each species to discourage the hen from laying another clutch. Any perceived or actual mate should be removed from the cage or room environment. In some situations, and with some species such as the Cockatiel, visual and auditory separation from a "mate" may be necessary. A "one-person bird," with only a single household member who exclusively handles and cares for the bird should be potentially viewed as an established "mate relationship", which may serve as a trigger for reproductively driven behaviors and activities. Stimulatory petting by the owner, such as rubbing the pelvis, dorsum, and cloacal regions should be stopped. "Flock" interactive behaviors should be encouraged in preference to one person or "mate" interactions in the home. The cage location and internal set up (perches, toys, etc) should be changed and rotated periodically to provide a "new or changing" environment that is less stable and less reproductively stimulating. Inappropriate nutrition that is identified should be corrected to improve the hen's dietary plane to decrease the severity of metabolic drain. Dietary alteration with a reduction of caloric intake appears to significantly reduce or stop egg production with many companion parrot species, as well as enable training and behavior-change strategies.

Medical therapy

Medical therapies for chronic egg-laying tend to focus on drug therapies to reduce or stop egg production. Pharmacologic options have included medroxyprogesterone acetate, levonorgestrel, human chorionic gonadotropin, Norethidrone/mestranol, testosterone, leuprolide acetate (Lupron) and deslorelin. With the exceptions of the GnRH agonists leuprolide and deslorelin, most of these drug or hormonal therapies have variable effectiveness and significant adverse side effects. Although these GnRH agonists appear to be a safe alternative with no direct adverse effects known at present time, these products are expensive, require repeated use, and do not alone correct the causative cascade of reproductive activity in the female bird.

Surgical intervention

Surgical salpingohysterectomy or endoscopic salpingohysterectomy may be indicated in specific patients that are plagued with chronic egg laying problems, or some of the secondary diseases that can result from chronic egg laying. Ethically, this option should be pursued in an otherwise healthy bird unless environmental, behavioral and/or medical therapy has not been successful, the relative risk to the overall health and welfare of the bird is gauged to be significant, and if there is no intent to breed the particular hen. Surgical treatments carry the greatest cost at their outlay, require advanced training in avian soft tissue surgery or endosurgery, and also carry the greatest immediate risk of procedural complications and death. Salpingohysterectomized birds still retain their ovary, and hence remain predisposed to estrogenic behaviors, hyperestrogenism, cystic ovarian disease, internal ovulation and egg yolk coelomitis.

Conclusions

Chronic egg laying issues in companion birds can be successfully addressed, most effectively, least intrusively by applying an ethical hierarchy to treatment recommendations. Behavioral and environmental changes are essential and often are effective when applied in a first-line approach. Medical treatment options and surgery are more intrusive, and still require behavioral and environmental changes in order to be effective. Ethical guidelines for treatment of chronic egg laying in companion birds are essential components of the standard of care.

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