Surgery of the Avian Reproductive Tract

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FEMALE ANATOMY

As the embryo develops, both right and left ovaries and oviducts develop; however, the left side continues to develop while the right atrophies. In most adult birds, the right reproductive tract is virtually nonexistent. Females are heterogametic and the gamete the female contributes determines the sex of the offspring which is different from mammals.

The arterial supply is through the ovario-oviductal branch of the left cranial renal artery with venous drainage through 2 ovarian veins into the caudal vena cava. These vessels and many nerves enter through a broad based ovarian hilus on the dorsal aspect of the coelom. This anatomy makes ovariectomy very difficult.

There are 3 phases to the ovarian cycle with **prenuptial acceleration** resulting in ovarian enlargement. Ovulation and release of the yolk occur during the **culmination phase**. During the **refractory period** the ovary shrinks in size. Once the yolk is released, it is picked up by the infundibulum which has a funnel and a tubular portion. The air sac anatomy favors the entrance of the yolk into the oviduct; however, at times, it does not enter properly and the yolk is released into the coelomic cavity. These loose yolks are often resorbed quickly but can serve as a nidus for peritonitis.

The magnum is the longest and most coiled portion of the oviduct and has numerous tubular glands which are responsible for the addition of the white of the egg. The isthmus is a narrowing in the oviduct with less prominent folds and a transparent junction with the magnum. The shell membranes are produced in this section. The uterus (shell gland) has no distinct separation from the oviduct and it is in this location that the shell is laid onto the egg. The caudal aspect is generally larger and it is in this location that the egg rests while being shelled. The vagina is attached to the cloaca and is in an "S" configuration. It is very thick and muscular but has no glands.

The oviduct and uterus are suspended from the dorsal coelom by a double layer of peritoneum which forms the dorsal and ventral ligaments. These ligaments contain smooth muscle which is responsible for transporting the egg along the pathway. The ventral ligament comes together caudally as a thick muscular band which attaches to the caudal uterus and vagina. The oviduct is supplied by three major blood vessels: the cranial oviductal artery is a branch of the left renal artery, the middle o.a. is a branch of the ischiatic artery, and the caudal o.a. is a branch of the pudendal artery.

FEMALE REPRODUCTIVE SURGERY

Female reproductive surgery is generally indicated for the treatment of egg laying related disorders (egg binding, damage to the uterus, abnormal egg production, yolk peritonitis) or a sterilization procedure to stop egg laying. A left lateral, transverse abdominal, ventral midline or flap approach may be chosen depending on which part of the tract must be accessed.

Egg binding is defined as a failure to pass an egg through the oviduct at a normal rate. Dystocia is defined as the presence of a lodged egg which may be obstructing the caudal uterus or prolapsing with the uterus into or out of the cloaca. Dystocia usually occurs at one of three locations; the caudal uterus, the vagina, or the junction of the vagina and cloaca. Egg binding and dystocia may be the result of many factors alone or in combination. Muscle dysfunction often related to improper nutrition, obesity, infection, damage to the uterus

from previous eggs, lack of exercise, stress, systemic disease, and malformed eggs have been associated with egg binding and dystocia. Sequelae to dystocia are related to the compressive effects of the lodged egg and include pelvic nerve dysfunction, compression of pelvic vessels, disruption of the renal circulation, and associated circulatory disorders and shock.

Budgerigars, cockatiels, lovebirds, canaries and finches are most commonly affected, possibly because of their more rapid onset of metabolic compromise. The hen will appear depressed, fluffed, often at the bottom of the cage with a wide based stance. They are usually unwilling to fly and often show abdominal straining and tail wagging as if straining to pass the egg.

Diagnosis is often made on physical examination by palpation of the lodged egg. In some cases, the ventriculus may feel like an egg and in others where the shell is not calcified no egg may be palpable. Radiographs or ultrasonography may be required to confirm the diagnosis. Removing the egg is a secondary priority to treating the patient's metabolic disturbances. Supportive care may be as minimal as providing a warm, humid, quiet environment with calcium and vitamin supplementation. In more advanced cases, fluid therapy, shock treatment, and antibiotic therapy may be indicated. Prolapsed tissues must be kept moist and clean. Water based lubricant is applied to keep tissues moist and promote expulsion of the egg.

Once the patient is stable, attention is directed at removing the obstructing egg. Medical therapies include increasing the environmental temperature and humidity, administration of calcium parenterally, and administration of hormones such as oxytocin, prostaglandin F_2 , or prostaglandin E_2.

If the egg is not passed in an appropriate period of time or the bird's condition deteriorates, ovocentesis may be performed to aid in passage. It is best to visualize the egg through the vent and insert the needle directly into the egg. If this cannot be accomplished, the egg is brought against the body wall and an 18 ga needle inserted into it to allow aspiration of the contents. After removal of the contents, the shell is gently collapsed and allowed to pass which may take several days. Once the egg has passed, it is beneficial to irrigate the oviduct to prevent metritis.

If it is still not possible to remove the egg or if the oviduct is damaged, celiotomy may be indicated. Hysterotomy or hysterectomy may be performed to remove the obstructing egg. Where oviduct rupture has occurred, celiotomy is necessary to remove the aberrant egg. In some cases, oviductal tissue may prolapse from the cloaca as a result of egg binding. There may be volvulus of the prolapsed oviduct at the uterus making identification of the lumen very difficult. In order to save the reproductive viability of the patient, the exposed tissues must be aggressively treated. They must be kept moist and returned to their normal position as quickly as possible. If the tissue is dry and devitalized, hysterectomy is recommended after the patient is stable. The egg must be removed by manual expression or ovocentesis and collapse of the egg. The oviduct and uterus are then replaced using a probang. Vent sutures or percutaneous cloacopexy sutures may be required to maintain reduction until healing restores normal muscular tone and security of the reproductive tract. If it is not possible to remove the egg manually, an incision is made in an avascular region of the prolapsed tissue, the egg gently removed, and the incision sutured carefully with fine material on an atraumatic needle using a simple continuous pattern. Necrotic tissue should be excised and viable tissues sutured. Once the patient is well, the damaged oviduct can be dealt with through a celiotomy approach. It is also important to stop the bird from passing another egg. This can be accomplished by changing the light cycle or hormonal means (e.g. Depot Lupron).

Chronic or recurrent egg related problems are also indications for hysterectomy. Although some hysterectomized birds exhibit copulatory and laying behavior, yolk peritonitis or other problems arising from the deposition of ova into the coelomic cavity are rarely encountered. Because the procedure carries some risk, it is not presently recommended as a prophylactic procedure. A left lateral approach is used. The ovary is visualized by retracting the proventriculus lateral and ventral. The oviduct and uterus are examined throughout their length.

There is a ventral suspensory ligament which is nonvascular and throws the oviduct and uterus into numerous folds. The ligament is broken down bluntly either with bipolar forceps or other means allowing the oviduct to be stretched out into a more linear configuration providing exposure to the vessels in the dorsal suspensory ligament. The cranial oviductal artery may be identified at the infundibulum emerging from the ovary. Two hemostatic clips or ligatures are applied to the blood vessel as it emerges from behind the ovary. If this blood vessel is accidentally torn, a small piece of Gelfoam is placed where the blood vessel emerges to aid in clotting. The dorsal suspensory ligament of the uterus may be identified extending from the dorsal body wall to the oviduct and uterus. You will see numerous branches supplying the oviduct and uterus. Each of these vessels may be coagulated with the bipolar forceps as close to the oviduct and uterus as possible, thus preventing any hemorrhage from them as the ligament is broken down. Clips may be applied to larger vessels.

Once all the blood vessels are coagulated, the uterus and oviduct can be exteriorized in a linear fashion extending completely outside the body wall such that only its junction with the cloaca is visible within the abdominal cavity. This is where the clips will be applied prior to the transection. A cotton-tipped applicator is inserted through the vent into the cloaca to help delineate its boundaries. Two clips are applied to the uterus near its junction with the cloaca. The uterus is then transected distal to the clips and discarded. Prior to closure, the abdominal cavity should be extensively evaluated for any residual hemorrhage. If hemorrhage is found, the bipolar forceps may be used to control it. Clips are an alternative for larger vessels that cannot be controlled with bipolar forceps.

Once all hemorrhage is controlled, the abdominal retractor is removed allowing the ribs to fall back into their original position. No effort is made to reattach the transected edges of the ribs. You will need to release tension from the leg so that the muscle of the body wall can be opposed with your suture. A single layer of simple continuous pattern is used to close the muscles of the body wall. A second layer of continuous interlocking suture is placed in the skin completing the procedure.

ORCHIDECTOMY

The indications for orchidectomy in birds remain anecdotal. In male birds with chronic cloacal prolapse, straining and masturbation may be contributing factors. Castration may prevent these behaviors which may decrease the chances of recurrence of the prolapse. In aggressive male birds, castration may ameliorate their behavior. In the author's experience, approximately 50% of male birds have a decrease in aggressive behavior following castration.

Birds have two testicles which lie on the external iliac vessels where they join to become the caudal vena cava. They are attached to these veins by a short ligament. Numerous small vessels pass through this ligament to provide blood supply to the testicle. The size of the testicles and the associated vasculature vary with species and reproductive status. In sexually active birds the testicles are large and vascular making castration more difficult.

The testicles are approached through a left lateral celiotomy. The left testicle is identified caudal to the lung and ventral to the kidney. The caudal pole of the testicle is gently grasped with fine forceps and elevated from the external iliac vein exposing the short ligament. A vascular clip is applied between the testis and the vessel. Fine scissors are used to cut the ligament along the clip, distal to it. In most cases it will take more than one clip to be able to remove the testis. Once the ligament is cut, the testis can be elevated farther allowing a second clip to be placed cranial to the first one. The ligament is then cut along the second clip. This procedure is continued until the testis is removed. The site is inspected for the presence of any testicular tissue which must be removed. The right testicle is adjacent to the left but separated by an air sac membrane. This membrane is opened using blunt or sharp dissection to create a window through which the right testicle can be removed. Once the right testis is accessible it is removed in a manner analogous to that described for removal of the left testis. It is somewhat more difficult because the right testicle is deeper (through the left lateral approach); however, it can be removed without too much difficulty.

A right angled hemostatic clip applier is advantageous especially in smaller birds where exposure is limited. The right angled applier allows the clip to be placed under the testis without having to lay the applier flat. In addition to controlling hemorrhage from the vessels supplying the testis, the clips provide a barrier to help protect the fragile external iliac veins. If the vein is damaged during dissection, gentle pressure is applied and a small piece of a hemostatic agent is placed at the site to aid in hemostasis.

VASECTOMY

Vasectomy is indicated to control reproduction in birds. In situations where flock size has become a problem, such as with Muscovy ducks or pea fowl in a zoological setting, vasectomy may be utilized to control reproduction.

The vasa deferentia are approached through a ventral midline celiotomy. The viscera are retracted to allow visualization of the cloaca and the structures dorsal to it. The colon is identified where it joins the cloaca. On each side, lateral to the colon the vasa deferentia are located. Be sure you have identified the vas and that it is not the ureter. Hemostatic clips or ligatures are placed in two sites approximately 5 mm apart. The section of vas between the ligatures is excised. This tissue may be submitted for histologic examination to assure that the correct tissue has been excised.

ABDOMINAL HERNIORRHAPHY

Abdominal hernias in birds may be congenital or acquired. Acquired hernias appear to be more common and occur primarily in egg laying females. They may occur secondary to hormone induced muscle weakness, abnormal calcium metabolism resulting in muscle weakness, or chronic straining. In most animals, the major risk associated with an abdominal hernia is entrapment of viscera. In birds, this is not usually a problem as the hernias are quite large. The main problem seen in birds with abdominal hernias is herniation of the cloaca with resultant entrapment of eggs, urates, or feces.

In most cases, the hernia can be repaired primarily without the need for synthetic mesh materials. An incision is made over the hernia through the skin entering the hernial sac. It is vital to identify the borders of the body wall surrounding the hernia. Dissect the skin from the midline incision laterally until the body wall can be identified. The hernial sac is usually adhered to the hernial ring in the body wall making it challenging to determine the margins of the hernia. It is necessary to dissect the hernial sac off the hernial ring. Once the border of the hernial ring in the body wall is identified, dissect circumferentially around the hernial ring to isolate the entire hernial ring on both sides of the body wall. Simple interrupted sutures of a monofilament absorbable material are used to close the defect along ventral midline. Any abdominal fat should be removed prior to closure. One of the major complications associated with closure of an abdominal hernia in birds is compression of the air sacs. Because the viscera have been herniated, when they are replaced, they may compress the air sacs. Removing abdominal fat will help prevent this. If it appears that the patient has difficulty breathing after reduction of the hernia, a mesh may be needed.

Plastic mesh, such as Marlex, may be used to repair body wall defects. The hernial ring must be isolated as previously described. The mesh is not absorbable making aseptic technique critical. If the implant becomes infected, it must be removed. The mesh is placed inside the body wall. An appropriately sized piece of mesh is cut and inserted into the defect. Mattress sutures are used circumferentially to secure the mesh in place. Sutures pass through body wall into the mesh and into the coelomic cavity, then, out the mesh and through the body wall again, then tied. Skin is sutured along the midline over the mesh. Also note there is very little subcutaneous tissue in birds to support the skin laying over the mesh. Because of this, the skin to may become devitalized exposing the mesh.