Coelomitis in Birds

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INTRODUCTION

Inflammatory processes within the coelom can be seen secondary to a number of pathologic processes. Among the most common causes, diseases of the reproductive tract, "yolk coelomitis" is one of the more prevalent seen in clinical practice.

ANATOMY

The female reproductive tract consists of the left ovary and the left oviduct in most birds, and lies predominately within the coelomic cavity.[1] The left and right ovary and oviducts develop embryologically as paired structures, but, after hatching, the right ovary and oviduct degenerate. 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. The ovarian arterial blood supply is usually from the ovario-oviductal branch of the left cranial renal artery, which comes from the descending aorta between the cranial mesenteric artery and the external iliac artery. The venous drainage is via two ovarian veins directly into the vena cava.

Ovarian developmental activity stages noted in the mature hen include: 1) Prenuptial acceleration - the enlargement of the ovarian follicles, 2) Culmination - Ovulation and oviposition, and 3) Refractory period - ovarian follicles reduce in size. It is predominately during the ovulation component of this cycle and less frequently during the ovipositional components that yolk coelomitis can be initiated. 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 egg consists of a germinal disk, yolk, the membranes surrounding the yolk, albumen and a shell. Yolk is made in the liver, and is hematogenously transported to the ovary. The yolk is a thick viscous material containing about 50% solids. Of these solids, 99% are proteins (30% lipoproteins and phosphoproteins). Yolk provides the main source of nutrition for the developing embryo. There are two kinds of yolk - white and yellow. The white yolk is approximately 2/3 protein and 1/3 fat. The central area of white yolk in the ovum is called the latebra. The yellow yolk is approximately 2/3 fat and 1/3 protein. Yellow yolk can be laid down in alternating whitish and yellow strata, depending on diet of the hen - carotenoid pigments providing the yellow color. The yolk membranes form a barrier between the yolk and albumen which provides good mechanical strength but is permeable to water and salts. The yolk membranes consist of four layers from closest to the yolk: the oocyte laminella and the perivitelline lamina (derived from the follicle of the ovary) and the continuous lamina and the extravitelline lamina (from the oviduct soon after the egg has entered).Albumen is secreted by the magnum and contributes to the aqueous environment of the embryo, has anti-bacterial properties, and in many if not all birds provides a source of nutrition for the developing embryo to consume. This albumen and yolk, when released free into the coelomic cavity, contributes to the inflammatory processes of coelomitis. These may or may not be associated with secondary bacterial infections.[2]

YOLK COELOMITIS

Clinical Signs

Egg yolk coelomitis is a fairly common clinical problem encountered in companion birds. Historically, these patients may have a past of known recent reproductive activity, but this may not always be noted by their owners. General malaise, weight loss, ill-thrift, decrease in physical activity, and sometimes a delayed molt processes all can be seen. Not all will demonstrate these clinical signs, however, and abdominal distention may be the only observation made by the owners of these pet birds. At physical examination, birds may present with palpable abdominal distention of a considerable degree. Fluid may be appreciable by ballottement of these distended abdomens. There may be mass-effects noted at palpation, consistent with displacement of the ventriculus, soft shelled or firm shelled eggs in the oviduct, ectopic eggs free within the abdomen, or even ovarian masses. The birds may show some mechanically induced respiratory difficulty due to the pressure and space occupying nature of the coelomic fluid present.

Supportive and Confirmatory Diagnosis

Normally, most hens will demonstrate a mild to moderate elevation to their total white cell count when ovulating, which resolves in approximately one week without treatment being necessary. There may be a normal to slightly low hematocrit noted in hens during a period of active lay. Some hens with chronic yolk coelomitis may have a depression anemia present, with hematocrits as low as 30% or more, with minimal polychromatophilic red blood cells noted in peripheral smear to suggest active regeneration.

In birds with subclinical to mild coelomitis, a relative or absolute heterophilia may be seen. These patients typically will not require medical intervention to return to clinical and hematological normalcy. Some forms of septic yolk coelomitis, particularly when in their acute phase, may demonstrate a relative and / or absolute leukopenia. Most confirmed yolk coelomitis diagnoses in avian patients, in this author's experience, are non-septic, however. In the chronic forms of yolk coelomitis, the hens more often appear hematologically normal, with the exception of a mild depression anemia. Although not specific for reproductive tract disease by any means, observation of a persistently low resting hematocrit and normal to decreased reticulocyte percentages should serve as a trigger for further diagnostic investigation and / or therapeutic intervention.

In those birds with a more severe and advanced state of chronic yolk coelomitis, more obvious and classically reported clinical signs including respiratory difficulty, abdominal distention or ascites may be seen. Some of the hens that have yolk coelomitis, hypercalcemia, hyperamylasemia, hyperfibrinogenemia, elevated total serum protein and hypercholesterolemia may be seen on a standard biochemical profile.[2] These changes are inconsistently seen however, and should not be presumed to be required for supportive evidence of diagnosis of yolk coelomitis. Coelomocentesis can be performed in birds with fluid distention. Fluid analysis may yield result in a number of findings, including the presence of a septic or modified transudate, and on occasion free yolk can be seen grossly and at cytology. Septic peritonitis may on occasion be diagnosed cytologically from coelomic fluid aspirates. Further supportive diagnosis may come with the radiographic observation of coelomic fluid or hyperostotic endostosis. Ultrasonography may confirm the presence of coelomic fluid or more solid egg yolk in the coelom. Definitive diagnosis of yolk coelomitis requires laparoscopy in some situations, or more often, laparotomy. Yolk coelomitis is often seen as a secondary or concurrent event to a variety of other pathologic conditions, including ovarian neoplasia, oviductal impaction, chronic obesity,

Treatment

Treatment of confirmed or suspected yolk-related coelomitis includes a combination of components: Pain and inflammation management, removal of fluid, general supportive care, and address of a confirmed or hypothesized causation. Often, concurrent coelomic disease processes must also be identified and treated as well. Although convention frequently includes the empirical treatment with broad spectrum antibacterials, the majority of yolk coelomitis is aseptic, and antibiotic treatment may not necessarily be needed. Supportive care may include parenteral fluids, supplemental feedings, and supplemental heat. Mild, aseptic yolk coelomitis may not require specific therapy, other than time and rest. More severely affected patients with chronic yolk coelomitis and other concurrent coelomic disease processes will often require surgical intervention as a part of successful and definitive resolution of the problem(s).

Pain Management

Bimodal treatment of pain and inflammation is most often indicated, viewing the probable inflammation and discomfort that is associated with most coelomitis and its causes. Of the opioids, butorphanol (1 to 4 mg/kg IM BID–TID) is currently recommended for analgesia in birds. There remains no support of dynamic analgesic action of buprenorphine at present time in the species and dosages that have been studied. Of the Non-Steroidal Anti-inflammatory Drugs (NSAIDs), meloxicam and carprofen are the best studied. Meloxicam doses are 1 mg/kg PO or SC SID–BID in most parrot species, and 2 mg/kg in pigeons. Carprofen dosages that have been shown to have dynamic analgesic value in chickens are 1 mg/kg PO or SC.

Fluid Removal

If coelomic distension is present and is determined to contain fluid, coelomocentesis can provide rapid relief. Preoxygenation, potentially the use of conscious sedation, and flow by oxygen during the procedure may help. Because of the lateral location of the air sacs and concern about fluid leakage into them, centesis is most often performed in the central third of the coelom. Transillumination may help to identify fluid pockets to tap. Use a 22–25-ga butterfly needle Samples can be collected for fluid analysis, cytologic analysis and bacterial culture and sensitivity. In almost all situations in avian patient, it is appropriate to remove as much of the fluid as possible to relieve respiratory compromise. If frank blood is aspirated, stop immediately, as this may indicate penetration of a vital organ.[3]

Supportive Therapy

Fluid support, if needed, may be administered via oral gavage, subcutaneous, intravenous or interosseous routes. Common fluids administered include warm Lactated Ringer's, and isotonic saline. Fluids with 5% dextrose may be given in the oral, IV or IO routes. A generic maintenance fluid requirement for most birds is commonly quoted at 50 ml/kg/day, although it is acknowledged that there should be significant variation amongst species and clinical circumstances. Desert species probably have lower requirements, as do many of the larger avian species. Some small bird species may require as much as 100 ml/kg/day or even higher in some situations. The rates of fluid administration selected are based on patient-specific criteria, including clinical assessment of dehydration. Signs of dehydration in birds include decreased skin turgor, sunken or closed eyes, dry oral mucous membranes, and thick mucus in the pharynx. The turgor and filling time of the basilic vein can be helpful in assessing dehydration. The normal filling time of the basilic vein is less than ½ second. A filling time of the basilic vein that is increased to 1–2 sec can be interpreted to represent approximately 7% dehydration. Sunken eyes and tacky mucosa occur at approximately 10% dehydration. The most commonly utilized maintenance parenteral fluid administration route is subcutaneous. Subcutaneous fluid administration sites utilized in birds include the inguinal skin web between the knee and body wall, the interclavicular area, and the propatagial wing web. Comparatively, the largest amount of fluid can be administered in the inguinal skin web (generally up to 5% of body weight), with the other two sites having lower volume capacity. Fluids may also be given intravenously or intraosseously. These routes offer the advantage of continual rates of infusion if an infusion pump is utilized, but also bring the potential disadvantages of patient discomfort and stress. Maintenance rates are calculated loosely in a similar manner as with subcutaneous administration. With these two routes of administration (IO or IV), boluses of up to 10 ml/kg may be given over 5 to 10 minutes. Interosseous fluid therapy is a quick and easy method of administering fluids to many companion bird species, offering an access route that is always available even in the most dehydrated animal. IO fluid administration carries a low complication rate, is effective in even the smallest patients, and uptake from bone marrow in mammals is comparable to that of an IV catheter placed in the anterior vena cava. Clinical experience by many veterinarians suggests that interosseous fluid bolus administration may be painful, and this may need to be considered.

Most ill birds generally benefit from a warm (85–90°F), quiet environment with easily accessible food and water. Obese birds, or those with some forms of respiratory disease or coelomic distention, may need to be maintained at a slightly lower temperature (75°F). A warm, calm and soothing hospital environment that has no noxious or anxiety-generating stimuli (noise, predators, etc) is very important. Companion birds should benefit from caring and positive human interaction over the course of their hospital stay, with social contact and interaction integrated into their daily treatment regimes.

Surgery

A left flank laparotomy or mid ventral laparotomy can be used for surgical approach, with the left flank being the more commonly utilized in this author's practice. A partial or complete oophorectomy, salpingohysterectomy and removal of retained yolk from the coelom may be required individually or in combination for any single individual patient.

Left Lateral Celiotomy

Left lateral celiotomy provides good exposure to the left female reproductive tract, proventriculus/ventriculus, spleen and left kidney, testicle and ureter.[4] The anesthetized patient is placed in right lateral recumbency with the wings pulled dorsally, the right leg caudally and the left leg cranially. In some cases, the left leg is best pulled caudally, especially when a more cranial approach to the lateral coelomic cavity is required. The extremities are taped in place with masking tape (or any other tape that is easily removed). The initial incision is made longitudinally from cranial to caudal in the left paralumbar area. The incision may extend from the cranial extent of the pubis to the uncinate process of the last rib. If needed, the incision can be further extended cranially by incising through the last rib(s) dorsal to their uncinate processes. In species larger than cockatiels (*Nymphicus hollandicus*) and small conures (*Pyrrhura* sp. and some *Aratinga* sp.), the rib(s) can be transected and reflected or removed to improve visualization. Use radiosurgery, laser, sutures or simple hemostasis to control hemorrhage, including bleeding from intercostal vessels. Once through the skin, bluntly dissect through the lateral abdominal muscles (external oblique, internal oblique and transverses abdominis muscles) to expose the peritoneum. Once the peritoneum has been incised, the underlying ventriculus (cranial) and intestines (caudal) should be visible. At this point the abdominal air sac is visible dorsally and the caudal thoracic air sac may be noted cranially depending on species and entrance site. Palpebral or similar retractors are very useful to better expose the underlying structures. When finished, close the muscle in 1–2 layers, subcutaneous tissue and skin with absorbable monofilament suture (3–4 layers total). Two disadvantages to this approach are the limited access to right ovarian, oviductal and testicular tissues and the potential need to cut through air sacs which adversely affects ventilation during surgery. A right lateral celiotomy can also be performed to approach the right testicle, liver lobe, kidney and persistent right ovary and oviduct if present and surgically manipulate/excise tissue as needed.

Ventral Midline, Transverse, and Combination Celiotomy

A ventral midline, transverse or combination celiotomy is used to expose the middle and/or both sides of the abdominal (coelomic) cavity gaining access to the liver, male and female reproductive tract, intestines, pancreas, and cloaca. The incision is made on the ventral midline from just caudal to the sternum extending caudally to the interpubic space. The supraduodenal loop (ileum) lies relatively ventral along the midline of the caudal abdomen and can be easily transected if not careful. For this reason, the midline incision should be made as cranial as possible unless the caudal ventral abdomen must be explored as with some cloacal surgeries. After the skin incision is made, the linea alba is tented upward and carefully transected, being careful not to damage underlying organs. The transverse and combination ventral celiotomy can be used to increase exposure to the abdominal cavity in birds. A transverse incision is made just caudal to the sternum. If needed, a ventral midline incision is used in conjunction with the transverse incision to increase exposure. As discussed above, underlying structures should be carefully avoided when incising through the underlying abdominal wall. Closure is the same as with a lateral approach. A disadvantage of this approach, in terms of reproductive tract exposure, is that the ovary(ies) and testicles are not as readily accessible as through the lateral approach.

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