Backyard Poultry Online 'Mini Series'

Session 2: Reproductive Disease, Critical Care and Clinical Techniques

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Reproductive Disease, Critical Care and Clinical Techniques

Reproductive disease
The most common system affected by disease seen in hens. This is believed to be due to their prolonged reproductive period with commercial hybrids laying over 300 eggs a year.
It is the cause of up to 90% of mortality in barn egg-laying flocks. However it is less common in less productive breeds.

Anatomy basics
In birds the coelomic cavity is not divided into two separate areas as it is in mammals. There is no Diaphragm. This is important in many respects not least in handling as the ribcage must be able to move to create the negative pressure to draw air into the air sacs. Only the left ovary and the left oviduct are present in adult hens. However there is a left and right testicle in males which can get very big especially in the breeding season (or in the case of cockerels when sexually active). There is one common opening “the vent”, for the gastrointestinal tract, the urinary tract and the reproductive tract. In poultry domestication and selective breeding has produced birds which have a prolonged reproductive period. Domestic fowl were bred from the Red Jungle fowl a species that lays eggs in clutches of 8 – 10 eggs and will lay another clutch if the first is lost. Modern commercial poultry breeds lay eggs almost daily often for more than 10 months, followed by a period of moult. The domestic hen reaches sexual maturity at about 16- 22 weeks of age (point of lay) depending on the breed. They reach peak egg production about 6-10 weeks after the onset of laying. Eggs are not laid at the same time each day as the ovulation-oviposition cycle of the chicken is about 25 hours. Many hens are laying over 300 eggs a year compared with the wild red jungle fowl which would rarely lay more than 20 eggs per year.

The vent
The vent is a slit like opening from the cloaca. The dorsal and ventral lips of the vent are normally held inverted into the cloaca, but when a large faecal mass or an egg is being passed, the lips evert and the vent assumes a circular shape. In older hens the muscle tone around the vent may be poor leaving the lips of the vent slightly parted however this doesn’t appear to be a problem for the bird. There should be no discharges and the surrounding area should be clean and free from faecal contamination. Faecally contaminated feathers or skin around the vent (pasty vent) may indicate intestinal disease or may be a sign of weakness and warrants investigation. There should also be no tissue structures protruding. Prolapses of the oviduct can be seen in females and prolapse of the colon, intestinal intussusception and / or the cloaca can be seen in both males and females. Abnormal discharges may be seen leaking from the vent. This is often referred to as “Vent Gleet”. The underlying cause needs to be investigated to obtain a diagnosis. Differentials would include any disease or abnormality leading to cloacal inflammation and / or infection, pathology of the oviduct can sometimes present as a vent discharge. Partial cloacal prolapse and vent picking are other possible differentials.
Note the shape of the vent, it is a slit rather than circular. If there is a cloacal prolapse purse string sutures are contraindicated in the avian vent. A mattress suture on either side to narrow the vent opening will be much more effective with less side effects and less discomfort to the bird.

Examination
Palpation of the coelomic space is best done while the bird is standing. Use both hands. Palpation may reveal asymmetry of the musculature and the presence of any abnormal swelling. With the bird standing the ventriculus should just be palpable on the left side. It can easily be mistaken for a mass or an egg however if normal its contractions can be felt. The oviduct is also on the left side and its size will depend on the reproductive status of the bird. Sexually active males can develop very large testis, however they are too far forward to be palpable, though may be misdiagnosed as abnormal on radiography and ultrasound because of their large size. If the coelomic cavity is filled with fluid, abdominocentesis will make palpation more productive and make the bird more comfortable and may provide a diagnostic sample.

In the chickens the ventral apterium (featherless area) runs down the ventral midline allowing the thin skin and underlying muscles or adipose tissue to be visualised. Using an alcohol swab will enhance the examination by damping back the feathers and removing deposits on the skin. Distension of the coelomic space may be due to the accumulation of fluid in the coelomic cavity, organomegaly or

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some other space occupying structure within the coelomic cavity. Cytology of aspirates, ultrasonography, radiography, as well as biochemistry and haematology screening will provide information that may lead to a diagnosis. Poor muscle tone can give the appearance of distension especially when the bird is standing, however on palpation the coelomic cavity will feel empty.

The cloaca is examined by digital palpation. A gloved lubricated finger is introduced through the vent. Space occupying lesions causing asymmetry can be appreciated. Concretions of urates may be found in the cloaca and eggs can sometimes be palpated.

Moving the finger into the colon from this position palpate the structures of the coelomic cavity within reach. Manipulating structures from outside with the free hand will enhance the examination
Be careful not to push against the contractions or damage may be caused to the tissues. Digital palpation of the coelomic space via the cloaca may reveal changes in shape or/and position of normal structures. Or abnormal masses may be palpated. Distinguish the ventriculus from the oviduct if the ventriculus can be palpated. Become familiar with the normal oviduct on palpation at different stages of the reproductive cycle.

Multiple masses/nodules are a possible finding. This will lead on to other diagnostics such as ultrasound, radiography, endoscopy, cytology of the masses of fluid collected.
Differentials of multiple nodules would include uterine adenocarcinoma, leiomyoma, mareks disease, mesothelioma (avian leukosis virus), coliform granuloma, mycobacterium and other neoplasia.

Polyostotic Hyperostosis
About 10 days prior to laying an egg the hen lays down calcium deposits in the medullary cavity of the large bones by increasing absorption from the alimentary tract. The total bone density increases by about 20% as bony trabeculae are laid down from the endosteum which is visible radiographically. Parathormone then mobilises this calcium depot into ionised plasma calcium which is then used to calcify the eggshell.
This network of bony trabeculae will affect the placement of intraosseous catheters and can also influence fracture repair.

Calcium Homeostasis
2-3 times more dietary calcium is required by a laying hen compared to the requirements of a growing chick, so diet is critical. They need to be eating predominately layers pellets. These birds are on a nutritional knife edge as regards their calcium/phosphorus balance. The original jungle fowl would have laid at most 2 clutches a year, rarely more than 20 eggs a year compared with a bird laying approx 300 eggs a year. Home-made diets will result in calcium deficiency, however breeds that are not very productive may scrape by on homemade diets.
Vitamin D3, calcium and phosphorus are all metabolically linked. The diet not only has to provide sufficient calcium and phosphorus, but also to provide them in the correct ratio (approximately 1.5-2 Ca: 1 P). The bird needs enough vitamin D3 circulating to absorb and utilise both these minerals properly.

Laying birds are susceptible to problems associated with deficient diets, as when in lay they are constantly utilising medullary bone as a temporary store of calcium.
If there is a calcium deficit in the diet then soft shelled eggs and bone fractures may be seen as the bird uses up its skeletal calcium. It's not uncommon for demineralisation of the vertebrae to result in collapse of the dorsal part of the spinal canal resulting in spinal cord compression and posterior paresis/paralysis.
Oestrogen increases Ca^{2+} binding proteins (albumin, vitellogenin) resulting in an increase in bone deposition. Medullary bone forms 10–14 days before laying. Medullary bone may replace hematopoietic tissue in up to 75% of the marrow cavity and the skeleton may increase by up to 25% in weight. During lay, hens will alternate between intense medullary bone formation and severe bone depletion. On low calcium diet, this results in erosion of cortical bone.

Vitellogenesis (also known as yolk deposition) is the process of yolk formation being deposited in the oocyte. Yolk is lipoprotein composed of proteins, phospholipids and neutral fats along with a small amount of glycogen. The yolk is synthesised in the liver. It is transported in the blood to the follicle cells that surrounds the maturing ovum, and is deposited in the form of yolk platelets and granules in

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the ooplasm. The mitochondria are said to convert the soluble form of yolk into insoluble granules or platelets. Majority of lipid and protein is deposited 6–11 days prior to ovulation. The process of vitellogenesis is regulated by oestrogen and gonadotropins.

In the preovulatory phase, which in the laying hen is continuous, parameters such as cholesterol, calcium and total proteins will be raised.

Oviduct
The oviduct is divided into five parts called the infundibulum, magnum, isthmus, shell gland (uterus) and vagina. The wall consists of ciliated epithelial lining, glands and smooth muscle. The smooth muscles are thickest in the uterus and vagina. Sperm moves up the oviduct by the action of cilia and retroperistalsis while the egg is moved down to the urodeum by the peristaltic action of the oviduct.

Infundibulum
The funnel of the infundibulum catches the oocyte and fertilisation by sperm takes place here within 15 minutes of ovulation. After that the yolk gets covered by a thin a layer of albumin from the tubular section. It takes between 15 – 30 minutes for the egg to pass through the infundibulum. It is approximately 7cm long.

Magnum
The magnum is the longest and coiled part of the oviduct and numerous tubular glands give it a thickened appearance. These glands produce 50 % of the albumin, which gives the lumen a milky white colour. It takes 3 hours to go through the magnum where it acquires albumin. It is approximately 30 cm long.

Isthmus
The folds of the isthmus are less prominent. Its tubular glands produce the inner and outer shell membranes which cover the egg and a small amount of albumin is produced as well. Movement through the isthmus takes about 75 minutes. It is approximately 8 cm long.

Shell Gland (uterus)
The last 20 hours are spent in the shell gland where the albumin doubles in volume and the shell is formed. It is approximately 8 cm long.

Vagina
The final part is the vagina which is separated from the uterus by a vaginal sphincter and has a powerful smooth muscle wall. Sperm host glands are present in the utero-vaginal junction which allows sperm can survive for at least 5-11 days in the hen. Movement of the egg through the vagina takes only seconds. The vagina is approximately 8 cm long.

Ovulation
In domestic fowl ovulation usually follows half an hour after an egg is laid. The left ovary of the actively laying hen resembles a bunch of grapes with thousands of macroscopic and microscopic follicles. These consist of numerous slow growing follicles and 5-7 rapidly growing yolk filled ones that are arranged hierarchically according to size. The follicle is suspended by a stalk containing smooth muscle, which has a rich vascular and nerve supply. Protein and lipid are synthesised in the liver and travel to the ovary to the oocyte (vitellogenesis) where they are made into yolk. Under the influence of LH the largest follicle (F1) splits to release the primary oocyte. The infundibulum catches the oocyte and this is facilitated by the left abdominal air sac, which tightly encloses the ovary. However if the sequence gets out of phase oocytes can be lost into the body cavity where it is eventually absorbed but will cause an inflammatory response to the yolk (yolk coelomitis). Once ovulation has taken place the empty follicle shrinks and regresses. There is no corpus luteum remaining as there is no developing embryo to maintain.

Ovary, surgical anatomy
Only a left ovary is present in the adult hen. It lies caudal to the adrenal gland and near to the cranial pole of the kidney. It is suspended from the dorsal body wall by the mesovarium. It consists of a vascular medulla, with nerve fibres and smooth muscle, and a peripheral cortex. It receives its blood supply from a short branch of the left cranial renal artery called the ovarian artery. The ovarian artery

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divides into many branches with the largest blood supply to the largest pre-ovulatory follicles present at the time. There are many accessory ovarian arteries arising from other adjacent arteries. Multiple ovarian veins are present that drain into the cranial oviductal vein. This then drains into the common oviductal vein which then empties into the common iliac vein. There are also usually many small veins that connect directly to the common iliac vein. Ovariectomy is challenging due to poor access, multiple short blood supply and its attachment to the common iliac vein.

Oviduct surgical anatomy

It is important to be familiar with the normal anatomy and vascular supply to the oviduct and ovary before engaging in any reproductive surgery. The oviduct is suspended in the coelomic cavity by a dorsal and a ventral ligament. The large oviduct extends from the ovary to the cloaca. It is a massive coiled tube occupying the left dorso-caudal side of the coelomic cavity. In a laying hen it is about 65cm in length and weighs 75g regressing to 15cm and weighing 5g when out of lay. If there is a salpingitis with many eggs impacted inside it can often weigh between 500 to 1000 grams. Following surgery the bird will often have lost more than 25% of its body weight.

The oviduct is richly supplied with anastomosing oviductal arteries and veins. The cranial, middle and caudal oviductal arteries track through the dorsal ligament to the oviduct. The veins draining from the cranial oviduct empty into the common iliac vein and into the caudal vena cava. Those draining from the caudal oviduct empty into the renal, portal or hepatic systems.

Cloaca

There are 3 compartments of the cloaca, the coprodeum, the urodeum and the proctodeum. The coprodeum is the deepest area of the cloaca. The rectum opens into it. It is separated from the urodeum by a fold of tissue called the coprourodeal fold. The urodeum contains the openings of the ureters and the genital openings. In the female there is the opening from the oviduct on the left side. Another fold of tissue the uroproctodeal fold separates the urodeum from the proctodeum. It is important to be familiar with this anatomy to be able to identify prolapsed tissues and evaluate if any vital areas have been damages, such as the openings of the ureters. The proctodeum opens to the outside via the vent.

If the coprodeum is full of faeces the coprourodeal fold protrudes through the vent so that there is no faecal contamination of the urodeum or the proctodeum.

If there is any pathology of the area the situation changes and there may be faecal contamination of the urodeum, including the urogenital openings.

Yolk Coelomitis

Ectopic ovulation, Ectopic eggs, Egg yolk peritonitis, Yolk peritonitis, are all alternative names that are sometimes used for the same condition. Yolk Coelomitis occurs when the infundibulum fails to engulf the ovum, or when reverse peristalsis stops the egg entering the oviduct or if there is an oviduct rupture due to salpingitis.

Once in the coelomic cavity the ovum breaks up. Unfortunately for the bird, yolk is a very irritating substance to the serosal surfaces so the result is a sterile yolk coelomitis. It is a very common condition and in in most cases is self-resolving. Symptoms seen in mild cases are non-specific.

If it is reoccurring with several ectopic ovulations then more severe symptoms will be seen and it develops into a potentially fatal condition. Clinical signs can range from ceased egg production, deformed or soft shelled eggs through to anorexia, depression, abdominal swelling and ascites and dyspnoea. Birds with severe ascites are often seen with a wide based penguin like stance.

Diagnosis is suspected on a history of cessation of laying in conjunction with supporting clinical signs. Diagnostic tests will provide further information on the likely diagnosis. Yolk coelomitis causes a severe inflammatory response with a profound leucocytosis in many cases on haematology with further useful diagnostics including radiography, abdominocentesis with cytology of the aspirate (culture and sensitivity may be necessary if the cytology confirms it is septic) and ultrasonography. Exploratory coeliotomy would be necessary to confirm that yolk coelomitis is the primary pathology as

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often other diseases of the reproductive tract such as adhesions in the area of the infundibulum, salpingitis, neoplasia and occasionally trauma may be the underlying cause.
Possible complications which can develop from yolk coelomitis include pancreatitis, splenitis, yolk-thromboembolic disease, hepatitis, nephritis and coelomic adhesions (the most common secondary problem)
Septic yolk coelomitis is most commonly recorded with coliform bacteria such as *E coli*, *Yersinia spp*., and *Staphyloccus spp*. Septic yolk coelomitis requires the most intensive treatment and carries the worst prognosis.

Intensive supportive care is often required as these birds are often admitted in a collapsed state. If it is a septic yolk peritonitis antimicrobials are essential. Inflammation of the serosal surfaces of the organs in the coelomic cavity is the main cause of all the symptoms exacerbated by the inflammatory exudate and the associated pain. It is essential to attempt to control this inflammation to have a successful outcome. Meloxicam has a very short ½ life in the chicken approximately 2 hours compared with 22 hours in the dog. It should be given at least every 8 hours and at a dose rate somewhere between 0.5 – 1 mg/kg. Removing as much fluid as possible will noticeably give these birds great relief and also facilitate more productive palpation and yield diagnostic samples.

Often there is an underlying cause that needs to be sorted or the condition will be reoccuring. A coeliotomy is often the only way to properly evaluate the coelomic cavity. Lastly preventing further ovulations will help prevent a reocurrence. Use of deslorelin is covered below.

Cloacal Prolapse
The first step is to identify the prolapsed tissue and then to evaluate if the tissue is viable. Cloaca, oviduct, colon and intestinal intussusception can all be prolapsed with cloaca and oviduct being the most common tissues prolapsed. If the cloaca is prolapsed and areas surrounding the ureter openings are non-viable then the prognosis is grave.
If the oviduct is prolapsed it is most commonly the uterus portion but the vaginal area can also come out and occasionally other parts of the oviduct. If viable it should be cleaned with warm saline and replaced.

If the tissue has been exposed for some time it may be oedematous. Various methods are advocated to reduce the swelling including topical concentrated sugar solutions and DMSO. Steroids have been suggested by some but should be avoided in birds.
Following replacement it is often necessary to narrow the vent with two mattress sutures to hold the tissues in while the swelling resolves and the tissue regains its tone.
Supportive care and antimicrobials as necessary together with anti-inflammatories and treatment of any pre disposing conditions.

Prolapse of the cloaca and or oviduct is a secondary condition. Salpingitis, cloacitis / cloacoliths, obesity, intestinal inflammation / endoparasitism, malnutrition, spinal disease and neoplasia are examples of conditions that can lead to a prolapse. It is imperative the underlying cause is identified and addressed to prevent it reoccurring.

Often cannibalistic behaviour by other flock members may have resulted in significant damage prior to presentation and surgery or euthanasia may be required. However, acute cloacal prolapses carry a fair prognosis with appropriate management.

Avian surgery techniques general
There are several principals that should be applied to maximize avian surgical success that are stated in the avian medicine literature. The first is to minimise haemorrhage. Here familiarity with the vascular anatomy is very important in reducing haemorrhage. The second is to minimise tissue trauma. Surgical experience and the correct instruments are vital in this regard. Availability of vascular clips will make a huge difference especially in some of the complex reproductive surgery in the hen. The third is to minimise the anaesthetic time and the forth is to minimise anaesthetic and metabolic complications. We will not be covering anaesthesia in this series but these are long surgeries that have become possible with the advances in avian anaesthesia in recent years. I would add to that the importance of pain management which should be all part of post-surgical management.

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Bipolar radiosurgery is very useful (some would say essential) it can be used for cutting tissues offering good control, and also be used to seal small vessels that are bleeding.

Fine instruments which are long handled are best as often you will be working deep in the coelomic cavity and the short opthalmic instruments that many try to use make it difficult to work deep inside the coelomic cavity.
During the anaesthesia the most important additional parameters to monitor are body core temperature and blood pressure.
Use suture material that causes minimal reaction and is absorbable, example polydioxanone (PDS). Polyglecaprone 25 (Monocryl), Glycomer 631 (Biosyn), Polyglytone 6211 (Caprosyn).

Salpingitis
Salpingitis or inflammation of the oviduct is the most common cause of mortality in commercial poultry and associated with a wide variety of infectious agents.
Predisposing factors include age, malnutrition, obesity, high rates of egg laying or history of reproductive disorders.
Salpingitis may be septic or non-septic. *E. coli* is the most common infectious cause. There are certain serotypes of *E. coli* are regarded to be primary pathogens of the hens reproductive tract. However other bacteria such as *Streptococcus Mycoplasma Actinobacter Corynebacterium, Salmonella, Pasteurella*, among others have all been implicated as potential causes.

Viral infections e.g. Infectious Bronchitis virus and Newcastles Disease virus and also bacteria such as *Mycoplasma spp*. may damage the mucosa allowing invasion of secondary bacterial pathogens leading to salpingitis.

Salpingitis can also be secondary to diseases of the ovary such as cystic ovarian disease, oophoritis, or neoplasia.

It can lead to an impacted oviduct. On surgery it is common to find the oviduct packed with an amorphous mass of adhered shell-less eggs. The oviduct will not be functioning so shells will not be formed and the oviduct will not be contracting to expel the eggs. Yolk coelomitis is a common sequale to salpingitis.

Oviduct prolapse due to prolonged contractions to expel an egg or a mass of eggs that may be adherent to the wall of the oviduct

Oviduct torsion again this is related to contractions and the build-up of material in the oviduct

Oviduct rupture is actually relatively common and result in a yolk coelomitis.

Clinical signs are often nonspecific and include weight loss, fluffed plumage, anorexia and lethargy. Malformed eggs may be passed (soft shelled, or an abnormal shape or blood streaked). Occasionally there may be a cloacal discharge.
Nonseptic salpingitis generally will result in vague signs of illness, whereas birds with a septic salpingitis are usually clinically very ill.
Infectious bronchitis will also produce egg shall deformities as will nutritional deficiencies and sometimes at the start of laying (point of lay) and also as they stop laying

No eggs often just means non laid, the ovary may continue ovulating every 25 hours resulting in an impacted oviduct which is distended with a mass of caseated material and misshapen soft shelled eggs. It is not uncommon during surgery to remove a large number of eggs. Non septic salpingitis is often chronic condition

In addition to the symptoms already mentioned the coelomic space may be distended and an enlarged oviduct may be palpable per the cloaca.

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Ultrasound will identify an enlarged oviduct and may detect a retained right oviduct which some say this may predispose the bird to a salpingitis.

Endoscopy through the vent to cloaca and through cervix into the oviduct. Cytology of samples from the oviduct will help confirm inflammation and may identify pathogenic organisms especially if there is a monoculture seen on the cytology. Culture and sensitivity of samples from septic salpingitis is recommended. Coeliotomy will allow a definitive diagnosis and full evaluation of associated structures

Treatment for salpingitis depends on the underlying cause. Anti-inflammatories are a very important part of the treatment as inflammation is a major component of the pathology. Meloxicam is the most commonly used drug. Supportive care as needed is very important to support the bird while the medication starts to work and the condition starts to resolve. Fluids, thermal support, nutritional support and analgesia are covered later but are a vital part of the treatment. In non-septic salpingitis supportive care plus anti-inflammatories may be enough but most cases with require antimicrobials. Many cases will require a salpingohysterectomy to resolve the problem especially if they are non-responsive to medical treatment.

Egg binding

Egg binding does not occur in the traditional sense of a bird struggling to pass an egg and then going into shock as a result of failure to pass the egg. It is common to be presented with a hen that may produce an egg when hospitalised but as they usually lay an egg every 25 hours this is to be expected although illness will also slow the reproductive tract as it slows other body systems.

The paralysis/paresis sometimes seen in passarines and smaller psittacines as a result of egg binding is not seen in hens as egg-pelvis mismatch is not reported.

Oxytocin and prostaglandins used in the species where egg binding is regularly seen are rarely if ever needed in hens.

Salpingohysterectomy

Salpingectomy is the surgical removal of the entire oviduct from the infundibulum to the vagina. It is the only way to deal with many oviduct diseases. Oviduct impaction, oviduct rupture, salpingitis non responsive to medical management, reoccurring yolk coelomitis, oviduct neoplasia.

There are two possible surgical approaches. The left lateral and the ventral midline. The left lateral approach will give the best exposure to the ovary and in the opinion of many to the oviduct. However with this approach the abdominal air sac will have to be entered. The ventral midline approach is the best for an overall evaluation of the reproductive tract and the other structures in the coelomic cavity and it is possible to avoid opening into the air sacs. However it is in the ventrally dependant area of the coelomic cavity so there will be more strain on the incision line. Additionally there may be a fat pad to incise through which further weakens the surgical incision.

Left Lateral Coeliotomy

Place the bird in right lateral recumbency with the wings taped dorsally, the right leg taped caudally and the left leg cranially (there is an alternative approach with the left leg pulled caudally). The area is prepared for surgery as in other birds. Make an incision in the skin cranial to caudal in the left paralumbar area, then blunt disection through the external oblique, internal oblique and the transverses abdominal muscles until the thin transparent peritoneal membrane is seen, which is incised. For better exposure the cranial end of the incision may be extended by transecting the first one or two ribs.

Ventral Midline Coeliotomy

With the bird in dorsal recumbency an incision is made on the ventral midline from just caudal of the sternum extending caudally. It can be extended as far caudally as the interpubic space. Just under the incision area the duodenum comes right down in a big loop called the supraduodenal loop which could easily be transected. Starting cranially will allow the incisional site to be tented to avoid this risk. If necessary the cranial end of the incision can be extended laterally just at the attachment the sternum.

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Most cases of hens undergoing a coeliotomy have severe pathology much worse that would have been expected from the condition of the animal. These surgeries are prolonged and what greets you on opening up is nothing like the normal anatomy. It will take a long time breaking down adhesions removing clots of yolk material and gently dissecting the oviduct free of the adhesions while ligating the blood vessels.

Preparation for the surgery

Birds presented for reproductive surgery should be thoroughly evaluated to reveal any underlying problems and to determine the extent of their problems. A full clinical exam rather than just concentrating on the presenting signs together with a full haematology and biochemistry screen. The birds should be stabilised as deemed necessary, fluid therapy, nutritional support, thermal support and if necessary oxygen therapy. Madical treatment should be started in advance of surgery. Fluid should be drained by abdominocentesis. If the surgery is elective then there may be time to use drugs to stop ovulation and start involution.

The first step is always to evaluate the tissues. Often lots of debris from yolk coelomitis and inflammatory exudates have to be removed to visualise the tissues.

Tissues will need to be pushed aside using atraumatic instruments, moistened sterile cotton tips work well for us.

The next goal is to identify the blood vessels. In the ovary the large preovulatory follicles will have to be removed to properly visualise the ovary and any of its vascular supply. They can be aspirated and drained, but they are attached by a stalk containing the vascular supply and can be twisted off. These should be removed even if the ovary is not to be removed as they will ovulate intra abdominally.

It is easier to remove the oviduct 1st due to its size. Its removal will create a lot of space.

Start at the area of the infundibulum and gently retract it out of the incision. The oviductal arteries vary considerably in size. If small then radiosurgery may be used to cauterise but usually they are too big and have to be clipped. Gradually work caudally ligating and freeing up the oviduct. Remove it to the level of the cervix, removing most of the vagina which can be difficult as it takes a deep loop behind or to the side of the cloaca.

There are different approaches to removing the ovary. Some apply vascular clamps to the body progressively debulking. Others carefully place vascular clips between the common iliac vein and the ovary and gently lift the ovary from the caudal aspect while applying further vascular clips. The last clip has to try to ligate the more cranial ovarian artery.

I generally do a combination of both methods progressively debulking initially and then when there is less tissue obscuring the visibility to place vascular clips between the ovary and the common iliac vein and cranially between ovary and cranial ovarian artery to completely remove the ovary

Reproductive Neoplasia

Ovarian and uterine cancer is commonly encountered in laying hens.

Uterine adenocarcinoma is the most commonly encountered tumour of the reproductive tract. Neoplastic cells are often shed from tumours in the oviduct into the abdominal cavity. They can implant on the ovary, pancreas, and other viscera and produce multiple, hard, yellow nodules. They may block lymph return and result in ascites. The incidence increases with age, and this tumour is a frequent cause of death in hens over 2 years of age. Leiomyoma of the broad ligament is an oestrogen-induced hypertrophy of the smooth muscle of the broad ligament. It is benign and is generally an incidental finding at necropsy. Mareks disease has been known to induce lymphoid tumours of the female reproductive tract and adenomas and granulose cell tumours are also seen.

Egg retention, abdominal swelling, ascites and cloacal prolapse are common sequalae to reproductive tract neoplasms. Treatment is surgical to remove or biopsy. Depending on the tumour type deslorelin implants may supress growth.

Deslorelin

Deslorelin is a non-steroidal, peptide-based contraceptive GnRH agonist implant whose effect is to mimic overproduction of GnRH and thereby suppress function of the pituitary-gonadal axis. Production of follicle stimulating hormone (FSH) and luteinising hormone (LH) decrease and, as a

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result, ovulation is prevented. In most cases the implant is easily inserted subcutaneously or intramuscular over the hen’s pectoral muscle without the need of anaesthesia or sedation.

Deslorelin has been used in chickens for the last few years anecdotally to supress ovarian activity. Now there is a valid study on which to base recommendations. The full study has not yet been published but its findings were presented at a recent conference.

70% of hens treated responded by cessation of egg laying. When the 4.7mg implant was used it was an average of 161 days before they started laying again. When two 4.7mg implants were used the effects lasted 207 days. When the 9.4 mg implant was used the effects lasted 385 days. Side effects seen were moulting which would normally occur after the breeding season and weight loss of 10 - 25%, but this weight loss was due to reduction in size of the reproductive tract

According to the summary report of the veterinary medicinal products committee deslorelin is very poorly absorbed orally and 4.7 mg is below the level considered to have side effects. It would seem reasonable to set a withdrawal period of equal to or greater than 161 days when the 4.7 mg implant is used.

http://www.ema.europa.eu/docs/en_GB/document_library/Maximum_Residue_Limits_-_Report/2009/11/WC500013629.pdf

There have been case reports in other avian species where deslorelin has been used to control ovarian cancer. The main motive of the study quoted above was to evaluate deslorelin’s chemopreventive effects on ovarian cancer. It was found to significantly reduce the incidence of cancer in the treatment group when compared with a placebo group.

Abdominocentesis

Peritoneal fluid can accumulate with certain diseases, such as egg yolk peritonitis and neoplasia. Free peritoneal fluid may be collected for cytology, culture, and biochemical analysis. The presence of separate coelomic, intestinal-peritoneal, and hepatic-peritoneal cavities means there is no single compartment in which fluid can accumulate.

Firmly restrain the bird upright and slightly tipped forward. If necessary, pluck overlying feathers. Aseptically prepare the skin Insert a small-gauge needle (21- to 27-gauge) or a teflon intravenous (IV) catheter through the skin and muscle directly in at the level of the umbilicus to avoid the liver cranially and directed to the right.

It is not uncommon for the needle to become blocked with clots of yolk material

Blood pressure measurement

Arterial blood pressure measurement is an important tool in the management of the critically ill bird. Systolic blood pressure is the pressure exerted against the blood vessel wall during contraction of the heart. Non-invasive or indirect blood pressure measurement techniques are based on detection of blood flow beneath an inflated cuff. Although there are several methods to measure indirect or non-invasive blood pressure, ultrasonic Doppler flow detection (Doppler) appears to work best in chickens. Systolic blood pressure determination via Doppler has been found to correlate well with direct blood pressure measurements

Birds are considered hypotensive when blood pressure is less than 90 mmHg systolic. Treatment of hypotension involves monitoring blood pressure, removal of the underlying cause, and volume support for hypovolemia. Hypertension has not yet been defined in the avian species, but clinical signs with a Doppler blood pressure greater than 180 mmHg, may be indicative of hypertension. However there are currently no studies to validate this in chickens so the pressure obtained should be regard as a guide. It is a more accurate measurement of hypotension than hypertension.

Blood pressure monitoring helps the veterinarian identify cardiovascular problems in patients under anesthesia earlier than when using an ECG only. Immediate correction of hypotension (systolic blood pressure less than 90 mm Hg) with a fluid bolus helps correct hypovolemia and prevents cardiovascular collapse and death.

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The Doppler cuff can be placed on the distal humerus or femur and the Doppler probe on the medial surface of the proximal ulna or tibiotarsus, respectively. The Doppler probe is placed on the distal ulnar artery (above the radial carpal bone of the wing), on the proximal ulnar artery (at the bend of the elbow of the wing), or on the medial tibial tarsal bone (measurement on the leg).The proper cuff width size is measured at 40% of the circumference of the humerus or distal femur. If an incorrect cuff size is used then the reading will be inaccurate especially if too big a cuff size is used.The cuff bladder is inflated to a pressure that exceeds systolic blood pressure. At this time, the Doppler signal of blood flow is diminished, and the blood pressure cuff is then deflated gradually.The first sound heard as the cuff is deflated denotes the systolic pressure.

We most commonly measure blood pressure in the critically ill or as a monitoring aid during anaesthesia. When blood pressures are less than 90 mm Hg systolic, birds are treated for hypovolemia as described below. Bolus administration of crystalloids (10 mL/kg) and colloids (hetastarch (HES) or Oxyglobin at 5 mL/kg) can be given intravenously or intraosseously until blood pressure is greater than 90 mm Hg systolic. When hypotension cannot be corrected after using three boluses of hetastarch and isotonic crystalloids then switch to Oxyglobin at 5 mL/kg intravenously or intraosseously. Usually one to two boluses are required to increase the blood pressure in refractory cases. Oxyglobin has oxygen-carrying capacity and vasoconstriction properties. When Oxyglobin is not available hypertonic saline at 5 mL/kg bolus can be given slowly over 10 minutes to refractory hypotensive birds.

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Intravenous catheters

Small indwelling catheters (23- to 25-gauge) are the most commonly used. The catheter is stabilized with surgical glue or suture and butterfly tape and bandaging. Although hematoma formation may occur relatively quickly, the patient's status has often improved significantly by that time.
Accessible veins for catheter placement include the jugular vein, medial metatarsal vein, and the basilic vein, also known as the “wing” or cutaneous ulnar vein. The right jugular vein is larger than the left. Place jugular catheters as close to the thoracic inlet as possible to minimize the risk of kinking but avoiding the cervicocephalic air sacs. Encircle the catheter loosely with a padded wrap to improve stability.

The medial metatarsal vein also works well. Place a piece of cotton beneath the hub of medial metatarsal vein catheters to provide support.
The basilic vein is also a good choice in chickens. Apply tissue glue to the hub, and suture the catheter to skin or flight feathers using butterfly tape. Cover the site with an adherent bandage (i.e. Tegaderm, 3M), and immobilize the wing using a figure-of-eight wrap and a belly band if necessary.

Intraosseous catheters

IO catheters are indicated when it is too difficult to stabilize a standard IV catheter, the patient is too small, or when blood vessels are collapsed. The complication rate is low with IO catheters, and fluids are immediately taken up into the vascular system.
General anesthesia is generally required for placement unless the patient is extremely weak. A spinal needle or hypodermic needle may be selected. The advantage of the spinal needle is that a stylet will prevent the formation of a bone plug within the needle, although a hypodermic needle may be pre-loaded with stylet made from stainless steel suture to prevent blockage.

The distal ulna is the site of choice for IO catheter placement. Flex the carpus and identify the dorsal condyle of the distal ulna. The needle is inserted just ventral to this site in a plateau-like region of the bon. The proximal tibiotarsus may also be used, however most birds seem uncomfortable and are unable to bear weight normally, therefore it is best to save this site in an emergency situation for example when the ulnar site has failed. The needle is directed into the tibial plateau just posterior to the cnemial crest and distally into the marrow cavity of the tibiotarsus. The femur and humerus cannot be used because they are frequently pneumatic and fluid would enter the air sacs.

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After identifying the landmark for needle insertion, infuse 2% lidocaine to anesthetize the periosteum and overlying structures. This step is important, since the periosteum is the site where most pain sensation comes from during this procedure. Perform an aseptic preparation. Gently, yet firmly, seat the tip of the needle by pushing into the periosteum. Then insert the needle by rotating the needle. A gentle “pop” may be felt as the needle passes through the cortex and into the medullary cavity.

To check catheter position, gently move the entire limb by grasping the needle hub. If the needle is in soft tissue, the hub will merely wobble by and forth. A small amount of blood, or even sometimes marrow, may also be aspirated from a syringe. Finally, a small amount of heparinized saline may be used to flush the needle.There should be almost no resistance to the flush. If an ulnar catheter is flushed, fluid may be seen passing through the basilic vein. The vein will be seen to blanche.

Sometimes the bevel of the needle is right up against the cortex of the bone causing blockage. Gently turn the needle 90 to 180 degrees to free it from the cortex. Sometimes a bone plug will cause blockage. If the blockage cannot be removed by flushing or gently passing the stylet of a spinal needle, then remove the needle. Pass a new needle of the same diameter or one size larger using the same entry hole made by the first needle.
Secure the catheter using butterfly tape and stay sutures. Bandage the catheter, using a figure-of-eight wrap to immobilize the wing. Unless a very large needle is placed, IO catheters generally do not flow by gravity in the avian patient and a syringe pump must be attached. Like IV catheters, IO catheters may be left in place for up to 72 hours. Check catheter placement regularly.

Routes of fluid administration
Fluid may be administered via enteral, intravenous or the intraosseous routes.

Oral rehydration is sufficient for stabilised birds with mild dehydration and to meet maintenance requirements. The major disadvantage is the risk of aspiration. Oral fluids should not be given to birds that are laterally recumbent, seizuring, regurgitating or have crop stasis.

The methodology is covered below under crop tubing.

Subcutaneous fluid administration is not ideal due to the very small subcutaneous space available, much smaller than in the equivalent sized mammal. Small volumes of fluid may be given in cases of mild dehydration. The usual site of SC fluid administration is in the inguinal region where the leg and the body wall meet. Subcutaneous fluids are not suitable for shock therapy or severe dehydration due to poor peripheral circulation.
Intracoelomic is contraindicated in birds due to the presence of air sacs which if flooded will result in drowning.

IV fluid administration is the route of choice for the treatment of the extremely dehydrated or hypovolemic bird. The primary advantage is replacement of large volumes within a short period of time.
If the bird is collapsed it may be beneficial to place an IV jugular catheter and usually no feathers need to be plucked due to the apterium over the puncture site.

Intraosseous catheterization may be preferred in smaller birds or in those presenting with extreme debilitation and veins too collapsed to permit venepuncture. They may be placed in any bone with a rich bone marrow cavity. Pneumatic bones such as the humerus and femur are unsuitable. Also remember that polyostotic hyperostosis depending on the stage may make placement of the catheter difficult. Preferred sites are the distal ulna and the proximal tibiotarsus. Both colloids and crystalloids can be given by this route, with responses very similar to that from the intravenous route.

Fluids can be given by continuous infusion, but are more commonly given in boluses due to the difficulty of protecting the infusion line.

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Fluid administration rates

Maintenance rates are approx 4ml/kg/hour.
As a guide to determining the volume of fluid required for rehydration 10% dehydration in a 1kg bird roughly equates to a 100ml deficit.

Dehydration deficits are added to daily maintenance fluid requirements, then estimate for any on-going losses. Maintenance requirements for birds are higher than those required for dogs and cats because of their higher metabolic rate. Usually aim to replace acute losses over 6 to 8 hours and chronic losses over 12 to 24 hours. After successfully treating hypovolemic shock and replacing fluid deficits one should continue to administer maintenance fluids until the bird can maintain hydration on its own, provided no on-going losses are present. Fluids can be given by continuous infusion or boluses. Depending on the bird sometimes the fluid requirement can be divided into 3 boluses per day.

It is difficult to assess hydration in the avian patient. The most reliable parameters may include elevations in hematocrit, total protein, and blood urea. Mucous membranes may be tacky and strands of mucus may be visible within the oropharynx. The skin on the dorsal surfaces of the feet or the upper eyelid may be gently tented. Severely dehydrated birds may also have sunken eyes.

Hypovolemic Shock rates

Hypovolemic shock is defined as poor tissue perfusion due to low or unevenly distributed blood flow, which results in inadequate delivery of oxygen to the tissues. It is caused by either an absolute or relative decrease in blood volume. Restoring intravascular volume is the key to treating shock. It is very common to be presented with a hen in hypovolemic shock.
Crystalloids expand the intravascular space, but this effect is short-lived. Because approximately 80% of extracellular fluid is in the interstitial space, crystalloids rapidly redistribute. After approximately 1 hour, only 20% of administered volume remains in the circulation. Thus, crystalloids should be thought of as interstitial rehydrators, not intravascular volume expanders. This increase in interstitial fluid can lead to tissue edema (thus decreasing the ability of oxygen to diffuse to the cells). Interstitial edema may be extremely detrimental in cases of cerebral and pulmonary edema.
Hetastarch is a synthetic colloid that effectively increases oncotic pressure beyond that which can be obtained with infusion of blood products alone. Hetastarch expands the intravascular volume by about 1.4 times the volume infused and has a half-life of 25 hours. Synthetic colloids are administered with isotonic crystalloids to reduce interstitial volume depletion. In this case, the dose of crystalloid administered is only 40-60% of what it would be if crystalloids were used alone during resuscitation. One to three bolus infusions of crystalloids (10 ml/kg) and colloids (Hetastarch or Oxyglobin at 5 ml/kg) can be given in the same syringe IV or IO until blood pressure exceeds 90 mmHg systolic.

Thermal support

Normal body temperature in chickens is between 41– 42.5 degrees C.
Elevated body temperature is rare and usually caused by high environmental temperatures. We don’t normally take a chickens temperature during the clinical examination unless we suspect hypothermia.

Hypothermia is common and has major negative effects on the body.
Thermal support is of utmost importance to the critically ill avian patient. The goal is to return to bird to its normal body temperature as soon as possible.
Do not allow therapy to contribute to heat loss.
Heat balance is affected both by decreased production and increased loss. If we are not careful, therapy may contribute to heat loss. A bird that is unable to stand may lose a profound amount of heat by conduction if in contact with an unheated surface. Cleansing a wound with alcohol or room temperature liquid may also contribute to heat lost by evaporation and conduction respectively.
We use of an incubator stocked with parenteral fluids to ensures they are available at body temperature when needed.
Use a custom critical care cage or improvise by adapting a normal hospital cage
Set temperature somewhere between 25 – 38 degrees C depending on the degree of hypothermia.

This cage should preferably be oxygen administration-compatible, and easy to clean and sterilize. The cage should also have a heated floor and at least one heated wall. Cage temperature should be

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easy to monitor, and the unit should have safety features that prevent or warn of overheating or failure.

To create a simple, inexpensive warming cage, place a circulating warm water blanket or heating pad underneath a glass or Plexiglass aquarium. Direct a 60-watt bulb at a protected corner of the cage. Layering towels between the floor and the heating pad will further modify floor temperature.
Humidify the air in the chamber to reduce heat loss by evaporation and prevent drying of delicate respiratory passages. A bubble humidifier works well, of course, but merely placing a moist cloth where the patient cannot get to it will also provide some humidity.
Although it may help to cover part of the incubator with a towel to provide visual security, some portion of the unit should be transparent to facilitate observation of the patient. Signs of overheating include panting and spreading the wings.

Crop Tubing

Crop tubing is a useful way of providing short term nutritional support.
A specialised crop feeding tube can be used. These are called crop feeding tubes and are available in either stainless steel or red rubber. Care is required with any hard plastic catheters there is real risk of perforation. The crop feeding tube must be at least the length of the beak to the level of the crop and have a rounded atraumatic end. Wider diameter tubes allow easier delivery of the food and this will also reduce the risk of being accidently passed down the trachea
If using a plastic or rubber catheter then lubricate using a water-soluble, biologically inert lubricant.
Attach the syringe and fill the tube with fluid to expel the air.

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If using a plastic or rubber catheter then lubricate using a water-soluble, biologically inert lubricant.
Attach the syringe and fill the tube with fluid to expel the air.
Hold the birds head upright. An assistant will be needed to control the bird.
Introduce the tube through the beak and glide it along the roof of the mouth and down the oesophagus to the level of the crop where it can be palpated before introducing the food. If the tube is in the oesophagus it will not be palpable in the crop.
Then withdraw the tube slowly (unless attaching another syringe) and keep upright for a short period afterwards.

Care is required as it is possible to perforate the oesophagus on passing the tube (unlikely with the red rubber tubes) and deposit the food in the tissues. Good restraint and training on the technique make this complication unlikely.
Crop feeding is only suitable if the bird can hold its head up, otherwise there is a risk of crop reflux and aspiration pneumonia.
The crop must also be empty. If there is a crop stasis for any reason then crop feeding is not appropriate. If food in the crop is foul smelling then the crop may need to be emptied
The crop should empty fully between feeds. It should empty in at least 1-2 hours depending on the volume added. When just fluids are added to the crop it will pass through quickly. If not then the gastro-intestinal tract is not functioning normally.

Aims of nutritional support

- To provide an adequate nutritional intake
- To prevent the negative effects of malnutrition
- To preserve gastrointestinal structure and function in critical illness
- To achieve better outcomes when treating a range of conditions

Anorexic patients must have nutritional support as part of the treatment plan. There should be a daily reassessment of the patients changing nutritional needs.

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Severely dehydrated birds must be rehydrated with normal blood pressure restored before nutritional support is started. Delivering food to the gastrointestinal tract of a bird which is not adequately perfused may lead to mucosal damage with loss of its barrier function.
Only feed small volumes if the bird is very weak to reduce the risk of aspiration pneumonia
Only deliver food at the optimum body temperature.

When re feeding syndrome is suspected in a patient or to prevent refeeding syndrome in critically ill patients, begin feeding the patient **very** slowly. Also as discussed above, with refeeding syndrome patients, it is best to begin nourishment at a portion of the requirement, with increasing amounts as tolerated, over the course of 3 to 5 days. Consideration should be given to starting nutrition at 25% to 30% of the calculated requirement for the first 24 hours (small, frequent meals), working up to 100% of the requirement after 5 days.

Don't exceed estimated energy requirements. Use manufacturer's recommendations for quantity fed and for the dilution factors. Reassess requirements daily in the first few days.
Do not rely on appetite stimulants as they will not result in an adequate nutritional intake and there is no evidence they work in birds.

It is a common misconception that while nutritional support is on-going the animal will not eat voluntarily.

As the underlying condition is corrected the animal's appetite will return and they will show interest in food and begin eating.

Feedings should not be reduced or suspended solely to check if appetite has returned.
Reducing or stopping nutritional support is based on assessment of recovery from the underlying condition. Scattering a little wheat or other favourite food will often stimulate normal foraging behaviour and get them eating.

Ideally they should be weaned off nutritional support after discharge from hospitalisation while recovering in their own environment.
Types of nutritional mixes available:

- Simple nutritional mixes e.g. Critical Care Formula (Vetark, Winchester, UK)
- Elemental diets Emeraid nutritional care system (Lafeber, Illinois, USA)
- Complete foods in a powdered/liquid format examples include Oxbow Care system (Oxbow, Nebraska, USA) and ground up normal commercial diet

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