Exploratory Laparotomy In The Ostrich

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Indications

It is not uncommon that the need for the ostrich abdomen to be explored will arise. Conditions that will commonly require an exploratory laparotomy include:-

Chicks

1. Proventricular impaction;
2. Intestinal accident (volvulus, rupture etc.); and
3. Retained or infected yolk sac.

Adults

1. Egg yolk peritonitis;
2. Proventricular impaction;
3. Intestinal accident (volvulus, rupture etc.);
4. Egg retention;
5. Metritis;
6. Abdominal neoplasia; and
7. "Hardware disease".

Diagnosis

The final diagnosis of the condition may not be made until the laparotomy is performed. However, in most cases the diagnosis will be definitive prior to the performance of the laparotomy. In chicks, the diagnosis will require one or more of the following:-

1. Daily weighing of chicks.
2. Monitoring the droppings and faecal output
3. Abdominal palpation
4. Radiography and Ultrasonography
5. History

During the first 3 weeks of life the daily monitoring of body weight can be an important tool in aiding the diagnosis of disease. Chicks with conditions such as yolk sac infection/retention, proventricular impaction, septicaemia etc., will not steadily gain weight after an initial expected weight loss during the first 3 to 5 days. Yolk sac infection/retention chicks will often drop weight significantly (approximately 100g) on day 10 to 12. This observation combined with the detection of a large, undiminishing yolk sac can lead to the diagnosis and provide an indication for laparotomy. Care needs to be taken when diagnosing this condition. It is often diagnosed inaccurately as many sick chicks may have yolk sacs present yet not necessarily contributing to the disease process.

Proventicular impacted chicks will also fail to show progressive weight gain. Palpation of the gizzard and proventriculus will aid diagnosis. This condition may be treated medically in the first instance. However, if the

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nature of the material in the proventriculus is such that medical treatment is likely to be unsuccessful and wasteful of valuable time, or if the bird is regurgitating or if previous medical treatment has failed then surgical intervention will be necessary. If an intestinal accident is suspected and no faecal passage is occurring at all, then again surgery is necessary.

In adults, the diagnosis will require one or more of the following:-

1. Abdominal palpation
2. Abdominal paracentesis
3. Ultrasonography
4. Haematology and Biochemistry
5. Monitoring of droppings and faecal output
6. History (especially breeding history, egg quality etc.).

A detailed history is paramount in arriving at a diagnosis. A mature adult hen that has suddenly ceased egg-laying yet remains "clucky" and accepts breeding by the male is highly suspicious of reproductive tract blockage or egg peritonitis. Ultrasonography and abdominal paracentesis will allow a more definitive diagnosis to be made. As in chicks, regurgitation, the lack of any faecal passage and severe abdominal pain may be indications for exploratory surgery. Again, abdominal paracentesis and possibly ultrasonography may help to ascertain if surgery is required.

Profuse discharge of oviduct origin and a finding of significant infection from an oviduct swab may lead to a requirement for laparotomy in order to access and irrigate the oviduct. In severe oviduct infections, parental antibiotic therapy may not be sufficient to clear the problem. Also retrograde flushing will involve some risk of introducing infection into the abdomen via the opening of the oviduct at the level of the infundibulum.

Radiography showing the presence of nails, wire, screws etc. in a clinically affected adult will also lead to a decision to perform a proventriculotomy.

Anaesthesia*

Chicks (even up to 4 to 6 months of age) can be induced with Isoflurane by mask. This will usually require concentrations of up to 5% at oxygen flow rates of 2 to 4 litres per minute. Once induction has occurred anaesthesia can be maintained with Isoflurane delivered via endotracheal tube at 1 to 3% and 0.25 to 3 litres per minute. These settings will be determined by the size of the chick and the severity of it's condition.

In severely debilitated chicks less than 2 weeks of age, yolk sac excision may be successful when performed under local anaesthesia and restraint.

In most cases requiring exploratory laparotomy it is advisable to deliver a warmed intravenous fluid infusion via an iintravenous catheter. This intravenous catheter is usually placed in the brachial vein on the underside of the wing in adults. An alternative iintravenous catheter site is the medial metatarsal vein. In very small chicks, however, the only easily accessible vein for intravenous catheter placement may be the jugular vein (on the right side of the neck).

The general anaesthetic technique that I prefer for adult ostriches for the performance of exploratory laparotomy or any extended surgical procedure is as follows:-

1. Stresnil (Azaperone) - 2 to 4 mL per 100 kg body weight given intramuscularly.

   About 10 minutes later .....

2. Ketamine 8-10 mg/kg combined with
3. Valium at 0.2-0.4 mg/kg and given intravenously in the same syringe and delivered into the brachial vein.

Be sure to agitate the Ketamine/Valium combination during mixture to avoid precipitation.

General anaesthesia is then maintained using Isoflurane. This is achieved by intubating the bird using a 14mm-16mm straight endotracheal tube. I prefer to use a cuffed tube with the cuff only gently inflated to avoid pressure necrosis of the cartilaginous tracheal rings.

The concentration of Isoflurane and the oxygen flow rates will vary. However, using a small animal anaesthetic vaporiser it is not unusual to require quite high concentrations (3 to 5%) and flow rates 2 to 6 litres per minute. I use a to-and-fro soda lime canister of about 8 litres capacity with a large (10 to 12 litre) rebreathing bag attached.

I have found this combination to be very safe (with some procedures even taking up to 5 hours!). The recovery from this anaesthetic combination is much smoother than other previously recommended induction methods such as intravenous Zoletil (tiletamine-zolazepam).

Just as critical as drug combinations and dose rates and equipment used, are two other aspects of ostrich general anaesthesia. These are:-

1. Padding of downside leg during anaesthesia. If the downside leg is not well padded during anaesthesia, then subsequent paresis or even paralysis of that leg may result. Foam mattresses, inflated tyre tubes etc. can be used for this purpose.

2. Provision of appropriate anaesthetic recovery facilities. The ostrich must recover from general anaesthesia while in sternal recumbency. I have found that the easiest and, by far the most efficient recovery area is one side of a divided double horse float. The division in the middle of the float must be solid and complete to the floor level. The bird is placed in the float in sternal recumbency and the bird is either hooded (using a hood that does not impede respiration) or the float is darkened.

Smooth recovery is facilitated by a dark and quiet environment that is restrictive enough to prevent the bird from going into lateral recumbency. Once the bird can hold it's head and neck steadily in a vertical position the hood can be removed.

Positioning and Surgical Approaches

1. Chicks. I perform most laparotomies in small ostrich chicks with the birds in dorsal recumbency.

   The approach for yolk sac surgery or exploration of the abdominal cavity is via a ventral midline incision. In yolk excisional surgery I incorporate an elliptical incision around the umbilicus. Proventriculotomies are performed via an incision over the proventriculus on the left ventral abdomen. This incision normally is sited within the left feather follicle tracts. If the incision is properly sited the surgical area is isolated from the rest of the abdomen by fascia and air sac lining, and suturing of the proventriculus to the abdominal wall is unnecessary. If the incision is positioned too far back towards the posterior abdomen, the intestines can be directly visualised and accessed. This area would then need to be closed by suturing before the proventriculus is entered to avoid contamination of the abdomen by spillage of proventricular contents.

2. **Older Chicks & Adults**

   I generally perform abdominal surgery on older ostrich chicks and adults with the birds in lateral recumbency lying on their right side. Entry into the abdominal cavity is via an incision through the left abdominal wall in the unfeathered portion of the flank. The position and orientation of this incision will be determined by the nature of the condition leading to the laparotomy. For example, most egg yolk peritonitis surgeries are performed via a vertical incision about halfway between the back of the left thigh and the posterior margin of the abdomen. In some instances a horizontal incision may be

used (e.g. to gain greater oviduct exposure) or even a T-type incision combining both can be used. The horizontal incision usually results in greater haemorrhage and is subjected to much greater tension on closure.

Proventriculotomy surgery in older birds is done in right lateral recumbency. The left leg is abducted and the incision is sited similarly to chicks. Again this incision is usually within the left abdominal feather follicle tracts and directly below the inner thigh. In fat birds the incision may have to be moved further dorsally to gain better access.

Occasionally, a decision may be made to perform the laparotomy with the bird in dorsal recumbency and the incision made on the ventral abdomen. This is rarely done, but may be required to access some intestinal problems (especially small intestine). In these cases it is necessary to slightly extend the legs to avoid potential nerve and muscle injury at the level of the upper thigh during the procedure.

One of the most commonly encountered problems is the presence of excessive fat in older juvenile and adult birds. It is not uncommon to encounter up to 15cms of abdominal fat during the surgical approach. This makes access limited in some cases and creates some difficulty for easy suturing.

Surgical Procedures

1. **Yolk Sac Excision**

As with any other small avian surgical procedure, time is the most critical factor. After mask induction the chick is intubated, placed in dorsal recumbency with the anterior part of the chick slightly elevated. The ventral body feathers can be removed using small animal clippers. Ideally the jugular vein is catheterised using a 22G i/v catheter for delivery of warmed fluids (usually Dextrose-Saline). If difficulty is encountered in placement of this catheter, then I prefer to get on with the surgery and employ the use of intraperitoneal fluids at the end of the procedure.

As mentioned previously a ventral midline skin incision is made including an elliptical incision around the umbilicus. Immediately below the skin is an extremely thin abdominal lining. This lining consists of a connective tissue layer with a black pigmented peritoneum immediately below. Care should be taken in cutting these layers as the dilated yolk sac can be very close or even adhered to the peritoneum.

Once the abdomen is exposed the incision may have to be lengthened to enable the yolk sac to be exteriorised. Again care must be taken as the yolk sac may rupture if excessive pressure is applied to it. The vitelline duct and blood vessels are ligated between the yolk sac and duodenum. Absorbable suture is used. Once ligated a clamp can be applied on the yolk sac side of this ligature and the tissue between the ligature and the clamp can be transected. The yolk sac and the umbilicus can be removed after the umbilical section of the peritoneum and abdominal wall is excised. The abdomen can be irrigated using a warmed saline solution and a small amount of aqueous antibiotic can be infused (e.g. Amoxicillin, Ampicillin). This is particularly important if the yolk sac has been ruptured either before or during the surgery. Occasionally the yolk sac may be very inflamed and adhered to abdominal wall or intestine. Careful dissection is necessary to remove all yolk sac tissue without significant damage to the intestinal serosa.

Suturing is usually performed in only two layers. The peritoneum and abdominal wall is sutured in one layer using your favoured pattern. I tend to use a simple continuous suture pattern of 2/o or 3/o Dexon or Vicryl. Knot security is important as abdominal herniation is possible with inadequate suture technique. The skin is closed in a simple continuous suture pattern with the same suture material.

The chick is then recovered in sternal recumbency in a warm darkened environment. Humidicribs are

ideal for this purpose.

2. **Proventriculotomy**

The approach to the impacted proventriculus has previously been described. The relatively thin proventicular wall is located just below the thin ventral abdominal wall. This is not the case in obese birds. In these birds the proventriculus may be up to 5cms below the abdominal wall. As previously discussed, if the incision is properly sited it is possible to open the proventriculus without first suturing the proventriculus to the abdomen around the incision site.

The proventriculus and the ventriculus can be both accessed via this approach. It is not advised to access the gizzard directly via the ventricular wall. The ventricular wall in adults can be up to 5cm thick.

Any free fluid in the proventriculus can be aspirated and then the impacting material or foreign bodies can be removed.

The closure is in 3 layers:- proventriculus, abdominal wall and skin. The proventricular closure is achieved using techniques similar to those in mammals. I normally use a continuous Lembert type suture pattern using Vicryl, Dexon or PDS. The abdominal wall is closed with similar suture material. The skin closure can be done with absorbable or non-absorbable material.

3. **Egg Yolk Peritonitis**

Surgical approach for egg yolk peritonitis cases is via the left abdominal flank as described previously. The skin is incised to reveal two muscle/fascial layers directly below (there is very little subcutaneous tissue). Between the second muscle/fascial layer and the peritoneum is a variable and sometimes excessive fat layer. The peritoneum is opened by puncture using blunt-pointed scissors. The peritoneum is pigmented (grey colour of varying darkness) and very tough. If significant yolk-stained fluid is present in the abdomen, this fluid will immediately begin draining through the surgical opening. This fluid can be aspirated or allowed to passively drain. Drainage is facilitated by tilting the bird's abdomen downwards. The abdomen can be explored by hand to detect the presence of inspissated yolks, retained eggs, neoplasia etc. It should be noted at this point that virtually all egg yolk peritonitis cases that I have encountered in Australia have **not** been infected.

The aim of the surgery is to extensively flush the abdomen until all yolk debris has been removed. This can be a very difficult exercise in view of the size of the abdomen, the length of intestine present and the relatively difficult access. The abdomen is flushed with 0.25% Betadine/Saline fluids until no further debris is found and the fluid escaping the abdomen becomes clear. This can take up to 12-14 litres of fluids. A final litre of Saline and antibiotic is instilled into the abdomen 250 mL of this solution is usually infused into the oviduct lumen via a needle through the anterior oviduct.

The oviduct is visualised to detect any pathology such as oedema, inflammation, neoplasia. The entire length is palpated to detect any blockages, retained eggs etc. The infundibulum is also visually inspected. It is imperative to avoid much handling of the infundibulum. This is a highly motile, thin and delicate structure which is easily torn, bruised or inflamed. It is also important to ensure that the infundibulum is kept well away from the incision site during suturing of the peritoneum.

There is usually a variable amount of inflammatory change on the intestinal serosa. The degree of change is directly proportional to the length of time that the condition has been present.

After the abdomen has been flushed satisfactorily a large bore abdominal drain tube is inserted into the ventral abdomen. site. This drain is exteriorised via a small abdominal opening created by blunt dissection near the ventral midline about 5-10cms behind the level of the surgical site. The drain tube is sutured in place using skin sutures of non-absorbable material. This drain tube is used for flushing of the abdomen with 2 litres of fluids(1 litre 0.25% Betadine and 1 litre of Saline and antibiotic

solution) daily for 3 days. The drain tube is removed in 3 days and the small wound left to granulate over.

The closure of the abdomen is normally done in 4 or 5 layers. The peritoneum is closed with 1 or 2 Dexon, Vicryl or PDS usually in a simple continuous pattern. The two muscle/fascial layers are then closed either separately or as one layer using similar material. A subcutaneous suture may then be done using 2/0 absorbable suture. The skin is usually closed with non-absorbable suture such as Vetafil, Prolene, Novafil etc. This skin closure is an interrupted pattern of simple or mattress sutures.

The prognosis associated with this procedure is influenced by the length of time the condition has been present and the degree of damage found in the abdomen. Prognosis for survival is excellent but prognosis for future productivity is guarded with expected success rates about 1 in 4.

4. **Intestinal Accidents**

Intestinal volvulus is not uncommon in ostriches especially associated with diet changes. Some cases will occur without any obvious predisposing trigger. Gut penetrating injuries can also occur after ingestion of sharp objects such as sticks, nails, wire.

Diagnosis is based on clinical symptoms (anorexia, depression, abdominal pain, lack of faecal passage.), abdominal paracentesis, haematology and possible radiology.

Ostriches have very little tolerance to skeleto-muscular pain but show remarkable tolerance to visceral and abdominal pain. It is possible that birds with significant peritonitis and avascular necrosis of a section of gut may show only mild symptoms of abdominal pain!

The laparotomy site is usually the left lateral abdomen as described previously. A decision to access the abdomen via a midline approach may be made if the problem is suspected in the upper small intestine or if there is insufficient access via the lateral route.

If non-viable intestine is found requiring resection and anastomosis a poor prognosis should be given. The large intestinal wall is extremely thin and very difficult to suture successfully.

Peritoneal lavage using saline and saline/antibiotic solution is necessary in all cases as invariably a septic peritonitis is present. If surgical intervention is early enough it is possible to correct a volvulus or intussusception without further complications provided gut viability is present.

6. **Egg Retention and Metritis**

Access to the oviduct is gained via the left lateral abdominal approach. A horizontal incision may need to be incorporated to maximise exposure.

Severe metritis cases are best treated surgically. An "intra-uterine" infusion of an appropriate antibiotic saline solution is employed via a needle introduced into the proximal oviduct (magnum). A volume of 250-1000 mL is used depending on the extent and nature of the infection. Care must be taken to avoid retrograde passage of fluid back into the abdomen via the infundibulum.

Some retained eggs may be accessed via the cloaca and removed manually while the bird is anaesthetised. Eggs higher in the oviduct can only be removed surgically. The site of the retention can be previously ascertained by an ultrasound examination. Access to the lower oviduct is difficult. The oviduct is very friable and has poor suture-holding properties. After egg removal from the incised oviduct the wall is sutured carefully using 2/0 or 0 Vicryl, Dexon or PDS suture material in a continuous Lembert type pattern.

Post-Operative Care

Apart from cases of yolk sac excision or egg yolk peritonitis most laparotomy cases in ostriches do not require intensive post-operative care.

Chicks recovering from yolk sac excisional surgery require close monitoring, heat support and frequent tube feeding. The tube feeding may be necessary for only 24 hours or may be required for several days until the chick becomes self-sufficient and is regularly gaining weight. I use a "lamb feeder-tube" and syringe for this purpose. The tube is passed into the proventriculus past the cardiac sphincter. The tube feeding mixture I normally use is ground-up ostrich starter-crumble, a small amount (approximately 1/2-1 teaspoon) of Nutrigel and warm water or warm Lectade or Vytrate water. A volume of 25-30 mL is given one to four times daily.

Egg yolk peritonitis cases require daily flushing of the abdominal drain tube. I normally use 1 litre of 0.25% Betadine/Saline and 1 litre of antibiotic/Saline for each infusion. This is done once daily for 3 days, at which time the drain is removed and the wound left to granulate as previously described.

Most laparotomy cases require post-operative antibiotics. The choice of antibiotics will be determined by any culture/sensitivity testing previously carried out. If this has not been done, antibiotics such as injectable Trimethoprim/Sulphur or Lincomycin/Spectinomycin or Amoxycillin can be chosen. Tube feeding in some chicks may also be required during the post-operative period.

Suture removal, if necessary, is usually done at a minimum of two weeks after surgery.

In summary, there are many indications for exploratory laparotomy in ostriches. The critical factors that will maximise the chances of full recovery include accurate timing of the surgery; the employment of a safe, reliable anaesthetic regime; good, efficient surgical technique; appropriate safe anaesthetic recovery and adequate post-surgical care and monitoring.