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RESEARCH ARTICLE

Removal of foreign bodies from the proventriculus in a young golden eagle (*Aquila chrysaetos*)

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ABSTRACT

This paper presents a clinical case report of a golden eagle (*Aquila chrysaetos*) with foreign bodies (stones) in its proventriculus. The case deals with the identification, management and removal of foreign objects identified in the gastrointestinal tract. A surgical removal by proventriculotomy under general anaesthesia was attempted. The surgery and the recovery were uneventful, and the follow-up after six months revealed no complications. To the best of our knowledge, there are no other reports of successful foreign body removal by proventriculotomy in the golden eagle.

KEYWORDS

foreign body removal, proventriculotomy, eagle, bird

INTRODUCTION

Foreign bodies in the digestive tract of animals are relatively frequently diagnosed in veterinary medicine. Many cases have been reported in different species of birds as well. These foreign objects are mostly located in the crop, proventriculus and stomach, as well as in the small intestine. In the case of parrots, these are most often small pieces of toys placed in a cage, as well as small household items like rings, beads, etc. (Hoefer and Levitan, 2013). The presence of synthetic materials such as fibre, foam, rubber and other plastic items has also been reported. In predators these are most often bones, branches, sand, wood, and gravel, etc.

The management of foreign bodies in birds should be based on the clinical signs of the individual bird, the species affected and its anatomic characteristics, the nature and location of the foreign body, the available tools, and the preference and experience of the surgeon (Speer, 1998; Bailey et al., 2001; Oglesbee and Steinohrt, 2001; Cotton and Divers, 2017).

Sharp objects can lead to perforation with subsequent coelomitis (Hoefer and Levitan, 2013; Laniesse et al., 2018). Radiography with or without contrast medium can depict the foreign bodies and they can be removed via the crop using endoscopically-guided minimally invasive surgery with biopsy forceps. In some cases, when it is not possible to remove the object endoscopically, surgical intervention is indicated (Reuschel et al., 2015). Pieces of bullets are very dangerous foreign bodies in the gastrointestinal tract (GIT) of birds as lead can cause intoxication (Pain et al., 2019). Birds of prey commonly ingest lead pellets or lead fragments concealed in the body of shot prey. Lead intoxication in free-living birds is a fairly

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usual phenomenon affecting also waterfowl. The use of lead pellets for shooting has resulted in their release into the environment over many years. Many bird species have consumed them, either directly or indirectly, and this has significant consequences for their populations (De Francisco et al., 2003). The clinical signs of lead toxicity generally include amaurosis, ataxia, paresis of the wings and legs, hyperaesthesia, seizures, reduction or absence of appetite, weakness and also breathing difficulties (Greenacre and Ritchie, 1999; Samour and Naldo, 2002). Treatment of heavy metal toxicity is a common procedure of avian emergency and critical care practice (Mateo, 2009).

Foreign body ingestion in birds may be the result of their curious nature or their obsessive behaviour for food when they are frustrated in captivity (Altman, 1992). Additionally, some reports show that environmental stressors such as dramatic alterations of housing may result in foreign body ingestion (Morishita and Harr, 1999).

MATERIALS AND METHODS

Clinical case

The patient was transported from a private breeder to the Clinic of Birds, Exotic and Free Living Animals at the University of Veterinary Medicine and Pharmacy in Košice, Slovakia. It was a two-month-old female, weighing 4.2 kg. The owner had already placed this individual in a separate aviary with a gravel base. The anamnesis included reduced appetite and behavioural change lasting for three days. Excretion was maintained. The suspicion was that the bird could have possibly consumed gravel with the food, which was then regurgitated together with the pellet. Clinical examination did not reveal any significant changes in behaviour, and the bird was conscious with a preserved defensive reflex.

A hard, bumpy mass (distal to the sternum, of a size about 10 cm) was located by palpation. Considering the available medical history, a foreign object was immediately suspected. The diagnosis was confirmed by gastrointestinal tract (GIT) insufflation endoscopy (Fig. 1) using a rigid endoscope of 4 mm diameter (Karl Storz®, Germany). A radiological examination with two projections, ventrodorsal (VD) (Fig. 2) and laterolateral (LL), was also performed. Using these imaging methods, a large amount of gravel was found, especially in the proventriculus.

Gastric lavage, a less invasive option, was chosen for the initial approach. This method has proved successful in removing small objects from the cranial sections of the GIT in other cases at the clinic. After placing the bird under anaesthesia with isoflurane, it was placed downwards and, using a gastric tube, a large amount of saline was administered into the proventriculus. Due to the nature and amount of the filling, the desired effect could not be reached, and the patient was scheduled for surgery next day.

Before surgery, the bird was premedicated by using butorphanol [1 mg kg^{-1} body weight (bw), i.v., Butomidor®, Richter Pharma, Austria]. After about 20 min, the bird was connected to the inhalation anaesthesia with isoflurane (Isoflurin®, Vetpharma Animal Health, Spain). The induction dose was 5% isoflurane at an oxygen flow of approx. 1.5–2 litres per minute. After induction alone, the dose of isoflurane was reduced to approx. 3% and maintained at this value throughout the procedure. Throughout the procedure, thermal support was provided using a heating pad, and constant monitoring by a Doppler (Model 811-B, Parks Electronics Inc., USA) was applied.

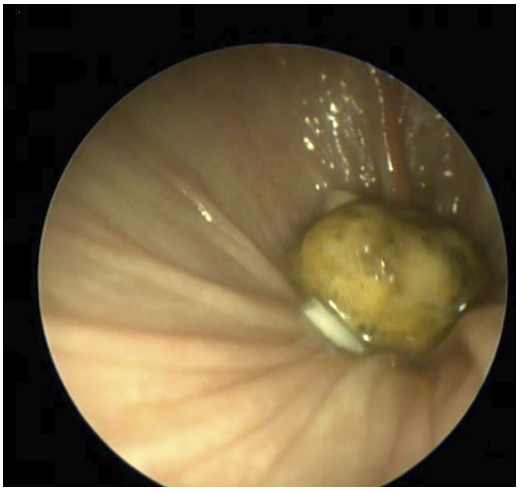

Fig. 1. Endoscopic diagnosis of a foreign object

Fig. 2. X-ray image in ventrodorsal (VD) projection

The bird was placed in dorsal position. Feathers on the incision site were plucked and the skin was prepared for aseptic operation using Betadine solution. The operative field was draped, and an incision was made along the ventral midline from the tip of the xyphoid and extended caudally. The abdominal musculature was tented with forceps and a stab incision was made with a scalpel in the mid-portion of the ventral midline. A forceps was inserted and used as a groove director to extend the incision cranially and caudally.

Care was taken to ensure that the abdominal air sac remained intact and would appear as a clear, membranous structure that billowed gently inward and outward as the patient breathed. An incision was made in the left abdominal air sac and was extended cranially and slightly caudally. After opening the proventriculus (Fig. 3), the excess liquid gastric content was aspirated, using a 20-mL syringe, to prevent contamination of the surgical field. Subsequently, careful removal of the contents was initiated. A large amount of stones (up to 0.5 kg) was removed (Figs 4 and 5). The individual pieces ranged in size from 0.5 to 2 cm. After the proventriculus had been emptied, it was closed by a standard surgical procedure in two layers using a resorbable monofilament suturing material (Polydox monofil 4/0, Chirmax, Czech Republic). The linea alba and the skin were

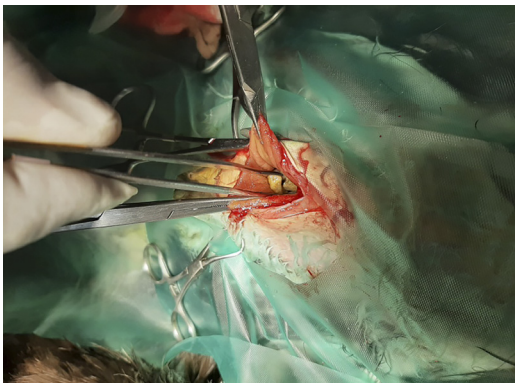

Fig. 3. Surgical opening of the proventriculus with visible stone content

Fig. 4. The patient after surgery with selected contents from the proventriculus

Fig. 5. Content of the foregut containing 512 g of solids

then closed separately, using a simple, continuous suture pattern.

After completion of the procedure, the bird was hydrated with a mixture of Ringer lactate and 5% glucose in a ratio of 1:1 (50 mL kg^{-1} bw, sc.). Meloxicam (0.5 mg kg^{-1} bw, im., Metacam®, Boehringer Ingelheim Vetmedica, Germany) was used to relieve pain, and amoxicillin (100 mg kg^{-1} bw sc., Betamox®, Norbrook Pharmaceuticals World Wide, Ireland) was applied for antimicrobial prophylaxis. Until awakening within 5 min, the animal was placed in sternal position. Post-surgical radiographs were normal and no further signs of a gastrointestinal foreign body were observed. The patient was released for home treatment on the same day. Postoperative management consisted of a food diet (small amount of soft boneless meat and liver) and cage rest for at least one week. Parenteral antibiotic administration and semi-fluid feeding to prevent gastrointestinal hypomotility were essential for a good outcome. Towards that end, prokinetic agents such as metoclopramide (1 mg kg^{-1} bw, im., Degan®, Sandoz, Germany) were used. No complications were observed after the surgery, and the bird recovered uneventfully.

This clinical case is very unusual due to the species of bird and also the amount of stones consumed. The cause of this behaviour is not exactly known, as it was a young individual bred in captivity. We attribute this behaviour to the individual's inexperience, inappropriate breeding conditions, and weak stimuli for mental development.

DISCUSSION

Foreign bodies in the digestive system of birds are a common cause of health complications. Anterior gastrointestinal tract obstruction by a foreign body has been reported in several avian species including psittacine birds, ostriches, penguins, raptors, pigeons, chickens, kiwis etc. (Miller et al., 2009). Ingestion of foreign objects is often associated with behavioural issues that lead to compulsive consumption of bedding materials or bright moving objects (Cannon, 1992; Castaño-Jiménez, 2016). Ingested parts of hoses and probes are often found as well, caused by inexperienced breeders while trying to feed young birds (Reuschel, 2015).

The clinical signs of foreign object ingestion are variable, such as regurgitation, vomiting, diarrhoea, haematochezia or the passing of undigested food (Ritchie et al., 1994). Nonspecific signs include lethargy, anorexia, dehydration, weight loss, polyuria, laboured breathing, ataxia, paresis, poor growth, rapid weight gain and death (Ingram, 1990; Miller et al., 2009; Lloyd, 2009). The bird in our case showed signs of anorexia. None of the other above-mentioned clinical signs were found in our patient.

Diagnosis of the presence of a gastrointestinal foreign body requires a thorough clinical history and physical examination findings (Miller et al., 2009; Hoefer and Levitan, 2013; Cotton and Divers, 2017). An important method for the diagnosis of a foreign body in the gastrointestinal tract of birds is radiological examination combined with advanced imaging techniques, such as contrast radiography, fluoroscopy, computed tomography, or endoscopy (Miller et al., 2009; Hoefer and Levitan, 2013; Castaño-Jiménez et al., 2016; Cotton and Divers, 2017; Laniesse et al., 2018). Radiographs can provide useful diagnostic information in sick raptors that exhibit vomiting, altered appetite and abdominal dilatation, and can support treatment decisions about birds with gastrointestinal impaction (Applegate et al., 2017). We also use endoscopy in many cases, especially in birds. This method is really suitable for the detection of foreign bodies in the GIT of birds, and it confirmed the diagnosis in this case, too.

Differential diagnosis in this case included the presence of a foreign body, infectious disease such as bacterial enteritis, parasitism, neoplasia, and heavy metal intoxication. The abdomen can become distended either due to fluid in the stomach, fat, a hernia, organ enlargement, a tumour or an egg (Speer, 2015).

There are no haematological or biochemical parameters that are specific to the gastrointestinal tract in avian species. Therefore, the complete blood count (CBC) and biochemical analysis are often unremarkable in birds with a gastrointestinal foreign object (Laniesse et al., 2018). It can often be difficult to diagnose a foreign body problem, unless we have a good history and a co-operative owner. Since the clinical signs and examinations often do not lead to satisfactory results, we may opt to proceed to exploratory coeliotomy to find a foreign object which needs to be removed.

Based on factors such as the location of the unknown object and its size, type of the material, and also the general health condition of the patient, we can immediately start adequate therapy (Hoefer and Levitan, 2013; Cotton and Divers, 2017). Using laxatives or other drugs that should help the object to pass through the gastrointestinal tract is usually unsuccessful (Smart-Ridgway, 2017). The technique of proventricular rinsing that washes the objects out is also described. In our clinical case, we used the flushing technique to extract stones from the proventriculus, but it was not successful. In the case of large objects or complete blockage of the gastrointestinal tract, other techniques such as endoscopy or surgery are required (Hoefer and Levitan, 2013).

The use of endoscopy to remove foreign objects from the gastrointestinal tract is considered a low-invasive procedure, because no incisions are made. However, the disadvantage may be reduced visibility. Endoscopy is usually recommended for the examination and removal of foreign bodies from the upper gastrointestinal tract (Lloyd, 2009; Cotton and Divers, 2017). During the examination of our patient, an endoscope was used to visualise objects; however, due to their placement and amount, they could not be removed with an endoscope.

Surgical approaches to the proventriculus or ventriculus to remove foreign objects can be done through a left lateral transverse coeliotomy or the ventral midline with a flap coeliotomy approach. An incision is made into the isthmus and extended to enlarge the access site. In some cases, a caudoventral ventriculotomy through the thin muscle fibres can be used to enter the ventriculus (Guzman, 2016). In the case of ventriculotomy in a common myna, Champour and Ojrati (2014) had to approach the last two ribs to access the proventriculus, which requires a postoperative analgesic treatment (non-steroidal anti-inflammatory agents, NSAID). Most of these agents increase healing time and cause gastric ulceration and sluggish ulcer healing, especially in the acid-secreting portion of the gastrointestinal tract (Champour and Ojrati, 2014). In the case of coeliotomy for the removal of a proventricular foreign body, some authors preferred ventriculotomy over proventriculotomy, which is also a possibility for removing a foreign body from the proventriculus in a bird (Goulart et al., 2019). In our case, we used ventral midline coeliotomy and direct access through the proventriculus. As there was a large amount of stones, this procedure seemed to be the most suitable. The operation performed in this way was successful without any complications.

Potential postoperative complications of surgical approaches can include leakage from the incision, localised infection, incision site dehiscence and coelomitis (Speer, 2015; Castaño-Jiménez et al., 2016; Guzman, 2016). We did not notice any postoperative complications in our patient. After a few days, the bird began to eat a normal diet, was active, and the postoperative wound healed well.

In our experience, in most cases, treatment does not require surgical intervention to remove the foreign objects, when they are located in the cranial segment of the digestive tract. We managed to remove the vast majority of foreign bodies at the clinic by insufflation endoscopy using endoscopic forceps, rinsing the crop or even massaging the object from the crop. In addition, in predators, foreign objects can also be removed physiologically, in the form of a pellet. Proventriculotomy is indicated, if the previous methods do not lead to the desired effect, as happened in our case. Due to the fact that birds do not have a mesentery, the procedure also poses an increased risk of postoperative coelomitis.

In conclusion, we can state that the therapeutic approach for the presence of foreign objects in the digestive tract of birds requires an individual procedure, which must take into account the nature and size of the object, the presence of clinical signs, but also the anatomical and physiological

peculiarities of the given species. Our report shows that proventriculotomy is useful for the removal of foreign bodies, also in case of the golden eagle. Careful consideration of substrate, enrichment items, and access to potential foreign material that could be ingested, is probably the best preventive management strategy in captive raptors (Applegate et al., 2017).

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