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Gastric ventriculotomy in *Caracara plancus* (Falconiformes: Falconidae): case report*

Ventriculotomia gástrica em Caracara plancus (Falconiformes: Falconidae): relato de caso

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Abstract

The present case report aim to detail the surgical removal of a sharp foreign body of metallic origin, adhered to the inner wall of the gastric ventricle, in a specimen of *Caracara plancus*. The chosen surgical procedure was gastric ventriculotomy, although this is not the approach of choice since this organ has a thick muscular wall. Once adhered to the gastrointestinal tract, with most of its portion in the gastric ventricle, other accesses to the foreign body were discarded. The anesthetic approach was weighted for the species, with pre-anesthetic medication with 1 mg kg^{-1} butorphanol, 15 mg kg^{-1} esketamine and 1 mg kg^{-1} midazolam, intramuscularly, while anesthetic induction and maintenance was performed using sevoflurane. Monitoration was mainly performed by capnography and vascular Doppler. In the postoperative period, antibiotic therapy was instituted with 5 mg kg^{-1} enrofloxacin, as well as analgesic control with 0.2 mg kg^{-1} meloxicam and 25 mg kg^{-1} dipyrone, intramuscularly, at an appropriate dosage for the species. Without intercurrences, the surgical procedure performed and the pre, intra and post-surgical protocols instituted were considered efficient, since they culminated in the animal's recovery with regard to the ingestion of the metallic foreign body and its triggered gastrointestinal dysfunctions.

Keywords: anesthesiology, caracara, surgical clinic, predators, gastric ventricle.

Resumo

O presente relato de caso tem como objetivo detalhar a retirada cirúrgica de um corpo estranho pontiagudo de origem metálica, aderido à parede interna do ventrículo gástrico, em um exemplar de *Caracara plancus*. O procedimento cirúrgico de escolha foi a ventriculotomia gástrica, embora esta não seja a abordagem de eleição, uma vez que tal órgão apresenta espessa parede muscular. Uma vez aderido ao trato gastrintestinal, tendo a maior parte de sua porção em ventrículo gástrico, outros acessos ao corpo estranho foram descartados. A abordagem anestésica foi ponderada para a espécie, sendo realizada medicação pré-anestésica com butorfanol 1 mg kg^{-1}, escetamina 15 mg kg^{-1} e midazolam 1 mg kg^{-1}, ambos por via intramuscular, enquanto que a indução e manutenção anestésicas se deram por sevoflurano. A monitoração se deu principalmente por capnografia e Doppler vascular. O pós-operatório teve como antibioticoterapia instituída a enrofloxacina 5 mg kg^{-1}, bem como controle analgésico por meloxicam 0,2 mg kg^{-1} e dipirona 25 mg kg^{-1}, ambos por via intramuscular, em posologia adequada para a espécie. Sem intercorrências, o procedimento cirúrgico realizado e os protocolos pré, intra e pós-cirúrgicos instituídos foram tidos como eficientes, uma vez que culminaram na recuperação do animal no que diz respeito a ingestão do corpo estranho metálico e as disfunções gastrintestinais causadas pelo mesmo.

Palavras-chave: anestesiologia, carcará, clínica cirúrgica, rapinantes, ventrículo gástrico.

Introdução

Caracara plancus, popularly known as Crested Caracara or Southern Caracara, is a medium-sized bird of prey endemic to Central and South America. Although Vargas et al. (2007) consider the species as a predator specialized in hunting, eating habits of the species are mostly generalist and opportunistic, as stated by Guilherme (2019). Their diet is protein-based and consists of fruits, arthropods, and amphibians, in addition to small reptiles, mammals, and other birds, also play a role as a scavenger and seed disperses (Tubelis, 2019; Paula et al., 2021).

C. plancus has a wide distribution, encompassing prairies, steppes, pampas, marine coasts, swamps, and crop fields. More recently, the species has been entering urban areas, thus being a synanthropic species (Saggese et al., 2021). Human-animal approximation, mediated mainly by the advance of deforestation and destruction of their natural habitat, has been causing

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changes in the general habits of these animals, modifying their feeding methods and increasing their susceptibility to anthropogenic diseases, whether infectious or not (Freitas, 2020; Mariz et al., 2022).

Feeding dysfunctions in raptors trigger a series of gastrointestinal alterations, which can lead to obstructions that culminate in paralysis of the digestive system, resulting in clinical signs consistent with weight loss, malnutrition, anorexia, ataxia, cachexia, and generalized weakness, which may evolve to death (Goulart et al., 2019; Liu et al., 2022). In addition, one of the biggest causes of poisoning in birds, with an essential emphasis on heavy metals intoxication, is the consumption of material of metallic origin, with the proximity of avifauna to the urban area being an aggravating factor (Pinheiro et al., 2018).

The objective of the present case report is to detail a case of gastric ventriculotomy to remove a sharp foreign body of metallic origin adhered to the wall of the gastric ventricle of the gastrointestinal tract in an adult specimen of Crested Caracara.

Case report

An adult male specimen of *C. plancus*, weighing approximately 800 g, was received by the Sector of Care and Rehabilitation of Wild Animals (SARAS) of the Veterinary Clinic Hospital (HCV) of the Santa Catarina University State (UDESC), rescued and delivered by the Environmental Military Police of Lages. The reported history described the animal on the side of the road, in an urban area, unable to take flight, showing clinical sights related to apathy, severe dehydration estimated at 8%, and anorexia at physical examination. Complementary tests of hematimetry, leukometry, and plasma biochemistry (sodium heparin) were performed.

Found values in the hematimetry: erythrocytes 1.05×10^6 μL^{-1}, hemoglobin 9.1 g dL^{-1}, hematocrit 26%, mean globular volume 247.6 fL^{-1}, mean globular hemoglobin concentration 35%, total plasma protein 3.8 g dL^{-1}, and thrombocytes 18,180 μL^{-1}. Values found in the leukometry: corrected total leukocytes 14,140 μL^{-1}, segmented heterophils 11,312 μL^{-1}, lymphocytes 2,687 μL^{-1}, and monocytes 141 μL^{-1}, with no eosinophils and basophils being found in the analyzed sample. Values found in the plasma biochemistry: glucose 261 mg dL^{-1}, uric acid 0.6 mg dL^{-1}, alkaline phosphatase 91 IU L^{-1}, aspartate aminotransferase 25 IU L^{-1}, and alanine aminotransferase 48 IU L^{-1}.

Initially, the hypothesis of intoxication by heavy metals was raised, given the general feeding habits of these animals, in addition to traumatic brain injury, a common condition in the wild bird clinic due to collisions with automobiles or buildings. The neurological signs presented by the bird that led to such suspicions were due to diparesia, walking difficulty, absent proprioception, and apathy. On physical examination, there was no crepitus in the pelvic limbs and wings, in addition to having a good size, moderately full globule, absence of plaques, and ulcerations on the oral cavity, and pupils responding to light stimuli.

Findings in the radiographic examination of the coelomic cavity were consistent with metallic radiopacity material in the transitional topography between the gastric proventriculus and ventricle (Figure 1. A). Due to the fact that the material has a sharp characteristic, and there may be the possibility of it being adhered to the wall of the bird's gastrointestinal tract, gastric ventriculotomy was considered the surgical protocol of choice for gastrointestinal foreign body removal.

Pre-anesthetic medication consisted of butorphanol (Butorfin 10 mg mL^{-1} VETNIL; 1 mg kg^{-1}), esketamine (KETamin NP 50 mg mL^{-1} CRISTÁLIA; 15 mg kg^{-1}) and midazolam (Dormire 5 mg mL^{-1} CRISTÁLIA; 1 mg kg^{-1}), intramuscularly, administered into the animal's pectoral muscles. Induction was carried out using a veterinary facial oxygenation mask containing 3% sevoflurane (Sevocris 1 mL mL^{-1} CRISTÁLIA; 3%), diluted in 100% oxygen (1 L min^{-1}), via a universal vaporizer. The specimen of *C. plancus* was intubated using a 2.0 uncuffed Murphy-type endotracheal tube. Anesthetic maintenance was performed using the same inhalational agent mentioned above at variable dose.

The specimen was positioned in dorsal decubitus and monitored by vascular Doppler for heart rate measurement, positioned in cardiac topography on the right side of the coelomic cavity. Capnography was evaluated via a mainstream sensor to monitor the bird's expired carbon dioxide levels. A veterinary thermal mattress was used to provide heat and intravenous fluid therapy via vascular access in the ulnar vein with 0.9% NaCl solution containing 5% glucose (5 mL kg^{-1} h^{-1}) throughout the intraoperative period.

Approximately 5 minutes before the surgical access, a local anesthetic block was performed in the form of a longitudinal line using lidocaine without vasoconstrictor (Xylestesin 20 mg mL^{-1} CRISTÁLIA; 0.1 mL kg^{-1}) on the left side of the coelomic cavity in topography of gastric ventricle. Once the coelomic cavity was accessed, assisted ventilation was established via a Baraka-type anesthesia circuit coupled to a 500 mL rebreathing balloon.

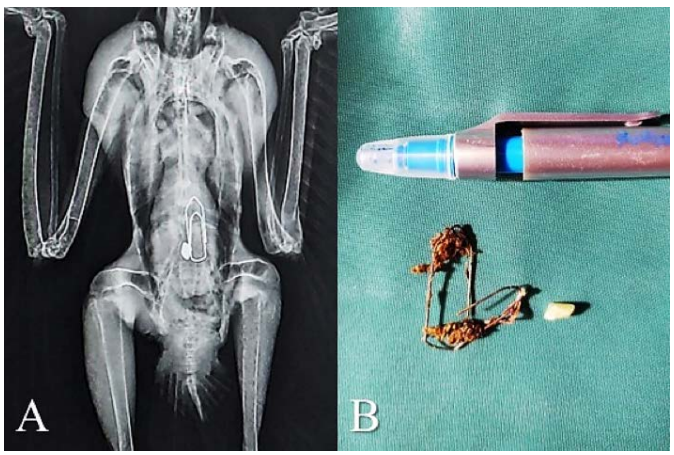
The left lateral region of the coelomic cavity was submitted to feather plucking, followed by asepsis with 70% alcohol, 2% chlorhexidine solution, and, again, 70% alcohol. The surgical procedure was performed through an incision, below the keel, free from injury to the pectoral muscles. Subsequently, the structures of the gastrointestinal tract were visually identified. Through careful palpation, it was estimated that the foreign body was located in the isthmus region, having about ⅔ of its size displaced into the gastric ventricle. The organ in question was individualized, and pulled. An incision of approximately 2 cm was then performed, resulting in immediate access to the foreign body (Figure 1. B), which was adhered by one of its pointed ends to the gastric ventricle internal wall.

Hemostatic forceps were used to carefully remove the metallic object adhered to the wall of the bird's gastrointestinal tract, performing light movements with gentle traction and rotation, avoiding as much as possible laceration and ulceration of the gastric ventricle wall. A Cushing pattern suture was chosen for ventriculography, using 2.0 absorbable monofilament thread. Subsequently, 0.9% NaCl solution was administrated inside the organ to attest the absence of extravasation and the integrity of the suture. Then, the gastric ventricle had its individualization reversed, which allowed its return to typical topography. Celiorrhaphy was performed in a Sultan type pattern using the same thread mentioned above, and dermorraphy was performed in a simple isolated pattern using 3.0 nylon thread.

At the end of the procedure, the bird was kept under observation, receiving heating via thermal gel bags and fluid therapy based on Ringer Lactate solution at a maintenance rate. The established

postoperative therapy was enrofloxacin (Chemitril 25 mg mL^{-1} CHEMITEC; 5 mg kg^{-1} BID for 7 days), meloxicam (Maxicam 2 mg mL^{-1} OUROFINO; 0.2 mg kg^{-1} SID for 3 days) and dipyrone (Finador 500 mg mL^{-1} OUROFINO; 25 mg kg^{-1} TID for 7 days), intramuscularly. In addition, wound cleaning with 0.9% NaCl solution and sterile gauze was performed two times a day.

Figure 1: Radiographic image of the coelomic cavity showing two radiolucent foreign bodies in the gastric ventricle topography (A). Metallic foreign bodies removed by gastric ventriculotomy compared to a pen (B)



Source: personal archive, 2021.

Feeding started via a rigid tube, introduced directly into the animal's esophagus. Standard prepared food consisted of ground beef or chicken, eggshell flour and commercial supplement (Aminomix Pet VETNIL, 100 g) twice a day. Food amount was established at 10% of the live weight per feed. Stitches were removed 10 days after surgery, without further complications. Unfortunately, the animal was euthanized three months after the surgery due unrelated circumstances regarding articular disorders in the lower limbs that culminated on an irreversible inability to perch.

Discussion and conclusions

According to Vargas et al. (2007), Franzo et al. (2021), and Paula et al. (2021), *C. plancus* has a generalist feeding character. Varying between hunting, opportunistic, and scavenger habits, the ingestion of non-food material is common in young animals, resulting in obstructions, perforations, and even paralysis of the digestive system. According to Tubelis (2019) and Mariz et al. (2022), the approach of this species to the urban environment has brought a challenge to these birds, modifying their feeding methods and making them especially more susceptible to anthropogenic intoxication, such as by heavy metals, as well as other infectious and non-infectious diseases of general way.

Regarding the requested complementary exams, it was concluded that the specimen in question was anemic and possibly had levels below normal for total plasma protein, correlating with malnutrition and, no less likely, parasitism by hematophagous helminths (Grandón-Ojeda et al., 2019; Madureira, 2019). Even so, the animal showed no apparent signs of infection, given its leukometry values within the expected for the species (Sousa, 2020). Other parameters analyzed were within the normal range, in general, for falconids (Goulart, 2015).

As for the radiography of the coelomic cavity, it is not uncommon for young animals, as in the present case, to end up ingesting radiolucent foreign bodies. This fact can be primarily caused by ingestion, and eating disorders related to the human-animal approximation that ends up changing their general habits significantly. Alternatively, by accidental ingestion in a secondary way, after a prey comes to ingest the non-food material, the predator ingests the same when feeding on the prey meat and viscera (Mariz et al., 2022). In addition, the foreign body in question was classified as having a metallic origin, which can result in the bird being intoxicated by heavy metals when it persists in the gastrointestinal tract chronically.

There are few species-specific descriptions of safe therapeutic agents, and anesthetics, and their respective doses in *C. plancus*. The combination of ketamine and midazolam was described in this species by Marchio et al. (2022), and the use of the atypical opioid analgesic butorphanol, resulting in adequate muscle relaxation and analgesia when administered intramuscularly in the pectoral muscles of the bird. In our study, we used esketamine, a purified form of the S+ isomer of ketamine, which has favorable characteristics such as higher potency, lower latency, and the possibility of dose reduction compared to the racemic formulation (Trevisan et al., 2016).

As for the atypical opioid, butorphanol is a μ antagonist and κ agonist. Such a drug was described in the species by Marchio et al. (2022), having its use in birds supported by Ludders (2015), who states that opioid receptors κ represent about 76% of the labeled receptors in the brain of these animals and, for this reason, have a practical analgesic effect. The same is described by Comassetto et al., (2017) and Nunes and Rassy (2019), reporting this drug for use in birds as pre-anesthetic medication and for postoperative analgesia.

In association, using of a local anesthetic block in the form of a longitudinal line using lidocaine without vasoconstrictor diluted at a concentration of 0.5% proved to be a good analgesic technique to be associated with the use of butorphanol. According to Ludders (2015), such dilution is necessary so that the bird is not intoxicated with the local anesthetic since such animals are susceptible to it. The pectoral muscles of birds are highly vascularized, and local anesthetics can be rapidly absorbed, reaching high systemic concentrations quickly. Concerning multimodal analgesia, the use of a non-steroidal anti-inflammatory drug at the beginning of the surgery was recommended, as suggested by Bizinoto et al. (2021).

Anesthetic induction with sevoflurane proved to be calm and fast. Nunes and Rassy (2019) and Guimarães and Moraes (2000) consider this as the technique of choice for birds. According to Ribeiro et al. (2008) and Escobar et al. (2009), sevoflurane has minimal effects on the cardiovascular system of *C. plancus* undergoing general anesthesia. However, respiratory acidosis can occur when spontaneously breathing in prolonged surgeries. In our study, the animal was maintained on assisted ventilation, which allowed the maintenance of expired carbon dioxide concentrations at normal levels described by Escobar et al. (2009) for the species, being from 25 to 35 mmHg.

Likewise, deleterious cardiovascular effects were not verified. The heart rate remained at an average of 260 beats per minute, values that corroborate the data described by Escobar et al. (2009) in their experiments with animals belonging to the same species submitted to inhalational general anesthesia with the same halogenated anesthetic agent used in the present case report. Furthermore, the intraoperative moment was shown to be free of elevations up to 20% in heart rate, based on the preoperative evaluation. Such a fact suggests the absence of nociception to the surgical stimulus, thus qualifying adequate analgesia (Guimarães and Moraes, 2000; Comassetto et al., 2017).

In general, it is recommended in birds the removal of foreign bodies located in the gastrointestinal tract via gastric ventriculotomy only in cases in which removal by less invasive maneuvers is not possible, such as digestive endoscopy, or even by facilitated surgical access, such as ingluviotomy (Bowles et al., 2006; Castro et al., 2013). The gastric proventriculus and ventricle are the chemical and physical stomachs of birds, respectively, the second being formed by a thick muscular layer, a characteristic for which surgical incision is not recommended (Schmidt et al., 2015).

However, although in most birds it is possible to perform ingluviotomy, as reported by Pachaly et al. (2014) and Liu et al. (2022), the present report describes a sharp foreign body of metallic origin, inaccessible through the ingluvium. Presenting one of its extremities fixed to the musculature of the gastric ventricle, a surgical procedure required careful removal to avoid lacerations to the musculature of the gastrointestinal tract of the specimen. Finally, it is concluded that surgery of choice and the protocols instituted were efficient, culminating in the animal's recovery.

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