Oesophageal granulomas in free-ranging wild Booted Eagles (*Hieraaetus pennatus*) caused by *Trichomonas gallinae*

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Abstract

Two free-ranging Booted Eagles were rescued in a severe state of cachexia and dehydration. Both had huge oesophageal granulomas, blocking the passage of food. A complete physical examination, x-rays and blood haematology and biochemistry were performed. Samples were taken for fine needle aspiration cytology and the diagnosis was avian trichomoniasis in both cases. Treatment and outcomes of the cases are described below. The aim of this study is to highlight the importance of early recognition of this disease for a more favourable prognosis, and the impact that avian trichomoniasis may have on wild populations of endangered species.

Key words: *Avian; Booted Eagle; Trichomonas gallinae; Trichomoniasis*

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Case report

Avian trichomoniasis is a potentially fatal parasitic disease of great importance, caused by the flagellated protozoan *Trichomonas gallinae*. Trichomoniasis is distributed worldwide, causing a significant impact in many domestic and wild avian populations (Martínez-Herrero et al., 2020). Columbiformes species like Rock Pigeon (*Columba livia*), Wood Pigeon (*Columba palumbus*) and Turtle Dove (*Streptopelia turtur*) are the main hosts (Amin et al., 2014), but several passerine species can also be affected (Robinson et al., 2010). Raptors are susceptible to infection, and high rates of mortality due to trichomoniasis have been highlighted as a conservation concern for several species, such as the endangered Bonelli's Eagle (*Aquila fasciata*) (Real et al., 2000; Robinson et al., 2010; Santos et al., 2019).

Transmission can be direct, namely through crop milk in pigeons from infected parents to nestlings, or the consumption of infected prey, or indirect, via contaminated water (Amin et al., 2014; Marx et al., 2017).

Loss of habitat makes birds of prey more susceptible to infection, through the consumption of urban pigeons or other synanthropic birds. Destruction of natural habitat and its conversion into urban areas, and the shortage of wild prey species, dramatically increase the rate of infection by *Trichomonas* spp. by the oral route of transmission (Palma et al., 2006; Dudek et al., 2018).

T. gallinae mostly affects the upper digestive tract (mouth, pharynx, oesophagus and crop), causing a wide range of pathologic lesions that can vary from a mild inflammation of the mucosa to necrotic caseous masses that block the oesophageal lumen and possibly evolve to systemic disease. These lesions often end up preventing the bird from eating, leading to starvation and death (Amin et al., 2014; Dudek et al., 2018).

Booted Eagle (*Hieraaetus pennatus*) is a 'near threatened' (NT) aestival migratory bird of prey that can be seen in Portugal between March and September. Its diet is based on small birds. Main threats affecting the species are habitat degradation, direct persecution and human disturbance (Birdlife International, 2023). Illegal shooting, starvation and infectious diseases are quite common causes of admission to wildlife rehabilitation centres (Cianchetti-Benedetti et al., 2016; Cococcetta et al., 2022).

The aim of this study was to describe two cases of severe oesophageal obstruction in Booted Eagles caused by *Trichomonas gallinae*'s infection.

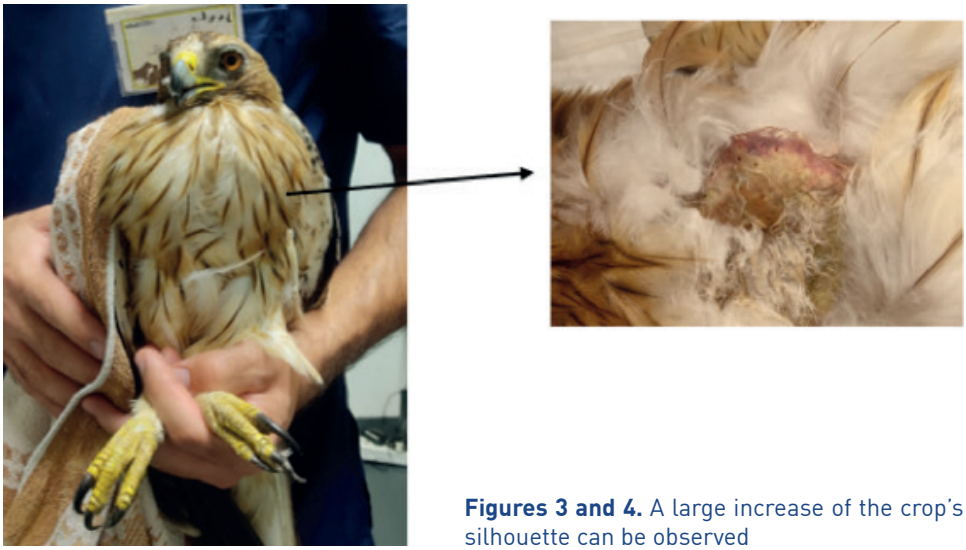
In September 2022, a female fledged hatching-year Booted Eagle was admitted to the Wildlife Rehabilitation Centre of the University of Trás-os-Montes e Alto Douro in northern Portugal, after being found in Vilar de Nantes, Chaves, unable to fly. Upon physical examination, the bird was markly depressed, cachectic and dehydrated, and a severe oesophageal granuloma was detected. Radiographs (Figures 1 and 2), an oro-oesophageal swab and a fine needle aspiration cytology of the mass were performed, the last two were stained with Diff-Quik and *Trichomonas* spp. were seen on the direct microscopic observation.

Intraosseous fluid therapy and parenteral forced feeding with highly energetic and digestible soft food were initiated. Treatment with meloxicam 0.5 mg/kg IM SID (5 days), marbofloxacin 10 mg/kg IM SID (10 days) and metronidazole 50 mg/kg PO SID (10 days) was carried out. Within 12 days of its arrival, the granuloma had shrunk in size and surgical removal was elected. A combination of

Figures 1 and 2. Ventrodorsal and latero-lateral radiographs, in which a large thick mass is visible on the crop

midazolam 0.5 mg/kg and butorphanol 1 mg/kg was administered intramuscularly 10 minutes before anaesthesia induction using 5% isoflurane in 2 L/min 100% O_2, delivered through a modified T-Ayre's system and a tight face mask. The animal was endotracheally intubated with a Rush 3 mm tube 2 minutes later, and anaesthesia was continued with 2% isoflurane in 100% O_2. An IV line was secured, and Ringer lactate solution was infused at a rate of 5 mL/kg/h. The feathers of the ventral surface of the neck were plucked and the skin was surgically prepared. A skin incision was made around the border of the necrotic mass and careful dissection was pursued using a Baby Metzenbaum scissor. The oesophageal tissue was dissected from the skin and the mass resected. The wound was washed with sterile saline and the oesophageal defect closed using a polyglactin 910 5/0 multifilament suture in an inverting Cushing continuous pattern. The subcutaneous tissue was closed in a simple continuous pattern and the skin with a simple interrupted suture, using the same suture material. The bird began to feed independently and was released back to nature in the following spring.

In September 2023, a second Booted Eagle was admitted to the same wildlife rehabilitation centre, coming from Vila Real. At the time of the admission, the



Figures 3 and 4. A large increase of the crop's silhouette can be observed

bird was cachectic presenting a severe occlusion of the crop (Figures 3 and 4), blocking the passage of food, with adhesions involving the trachea and jugular vein. White caseous plates were present at the oropharynx, which were swabbed to prepare a direct smear to monitor for trichomoniasis (Figure 5). Radiographs, haemogram and blood biochemical analysis were performed. A severe increase in urea and uric acid levels was noticed, leading to aggressive intravenous fluid therapy, and trichomonads were found on the microscopic wet-mount preparation. The same medical treatment described above was initiated as metronidazole is indicated as one of the most widely used and successful drugs for treating avian oropharyngeal trichomoniasis (Gómez-Muñoz et al., 2022). In the following days, necrosis of the skin began to appear in the affected area (Figure 3). Ten days after the beginning of metronidazole therapy, the mass reduced in size and was excised. The same approach as described above was used for the surgery. A large part of the crop was necrotic and its removal was mandatory (Figure 6). During surgery a percutaneous oesophageal tube was inserted through an incision in the lateral surface of the cervical skin and oesophagus, just 1 cm caudal to the mandibular angle, the tube was then secured to the skin with a Roman sandal technique. Anaesthesia recovery was uneventful and tube feeding was started in the same day. Antibiotic therapy was maintained after surgery and meloxicam 0.5 mg/kg IM SID (5 days) was administered.

The daily energy necessities were calculated and divided in three daily meals using a/d Hills®, and continued for approximately 10 days, to prevent suture dehiscence and allow the internal tissues to heal. Solid food was then offered but the bird would regurgitate it, leaving the suspicion of lumen stenosis, a condition not responsive to metoclopramide (0.5 mg/kg IM BID). The animal was anaesthetized using the previously described protocol and oesophageal endoscopy confirmed oesophageal stenosis with fibrotic tissue in the mucosa. Although tube feeding was resumed, its body con-

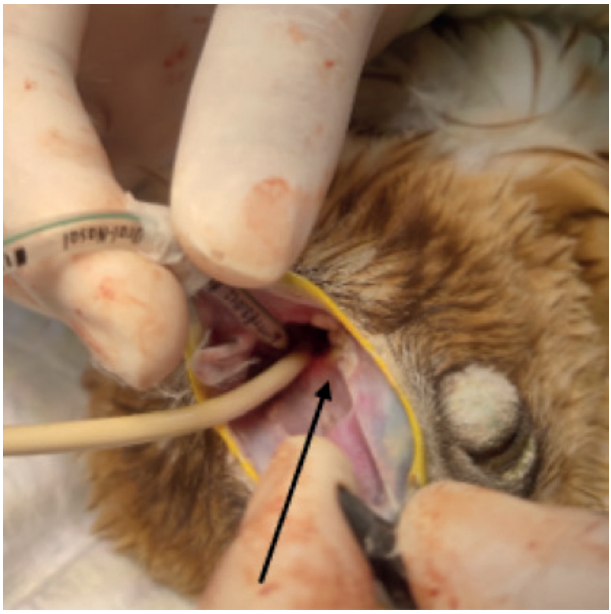


Figure 5. White caseous plates adhered to the underlying oral mucosa

Figure 6. Skin necrosis of the ingluvio area

dition started to decline, and the animal ultimately perished.

Bird-eating raptors are particularly vulnerable to *T. gallinae* infection. Trophozoites multiply on cells and a granulomatous reaction with necrosis of the involved tissues is a common finding of this disease. Oropharyngeal caseonecrotic granulomas in the upper digestive tract are the most common clinical presentation in Accipitriformes. These lesions may prevent the bird from feeding or breathing and subsequently cause its death, therefore excision is recommended. The prognosis for birds with severe lesions is guarded, with euthanasia or death as a common outcome (Martínez-Herrero et al., 2020).

Here we present two cases of Booted-eagles who arrived in serious condition. A proper macroscopical evaluation of gross lesions in the oropharyngeal cavity compatible with avian trichomoniasis is important for early diagnosis, and intensive supportive treatment for birds in poor body condition is crucial for a positive outcome of the case.

References

1. AMIN, A., I. BILIC, D. LIEBHART and M. HESS (2014): Trichomonads in birds--a review. Parasitology 141, 733-747. 10.1017/S0031182013002096.
2. BirdLife International (2023): Species factsheet: *Hieraaetus pennatus*. Available online: http://datazone.birdlife.org/species/factsheet/booted-eagle-hieraaetus-pennatus (accessed on 14/09/2023).
3. CIANCHETTI-BENEDETTI, M., F. MANZIA, F. FRATICELLI and J. G. CECERE (2016): Shooting is still a main threat for raptors inhabiting urban and suburban areas of Rome, Italy, Ital. J. Zool. 83, 434-442. 10.1080/11250003.2016.1189611.
4. COCOCCETTA, C., T. COUTANT, T. COLLARILE, A. VETERE and F. DI IANNI, M. HUYNH (2022): Causes of raptor admission to the wildlife rehabilitation centre in Abruzzo (Central Italy) from 2005–2016. Animals 12, 1916. 10.3390/ani12151916.
5. DUDEK, B. M., M. N. KOCHERT, J. G. BARNES, et al. (2018): Prevalence and risk factors of *Trichomonas gallinae* and Trichomonosis in Golden Eagle (*Aquila chrysaetos*) nestlings in Western North America. J. Wildl. Dis. 54, 755-764. 10.7589/2017-11-271.
6. GÓMEZ-MUÑOZ, M. T., M. Á. GÓMEZ-MOLINERO, F. GONZÁLEZ, I. AZAMI-CONESA, M. BAILÉN, M. GARCÍA PIQUERAS and J. SANSANO-MAESTRE (2022): Avian oropharyngeal trichomonosis: treatment, failures and alternatives, a systematic seview. Microorganisms 10, 2297. 10.3390/microorganisms10112297.
7. MARTÍNEZ-HERRERO, M. C., J. SANSANO-MAESTRE, J. ORTEGA, F. GONZÁLEZ, I. LÓPEZ-MÁRQUEZ, M. T. GÓMEZ-MUÑOZ and M. M. GARIJO-TOLEDO (2020): Oral trichomonosis: Description and severity of lesions in birds in Spain. Vet Parasitol. 283, 109196. 10.1016/j.vetpar.2020.109196.
8. MARX, M., G. REINER, H. WILLEMS, et al. (2017): High prevalence of *Trichomonas gallinae* in wild columbids across western and southern Europe. Parasit Vectors 10, 242. 10.1186/s13071-017-2170-0.
9. PALMA, L. P. BEJA, M. PAIS and L. C. FONSECA (2006): Why do raptors take domestic prey? The case of Bonelli's eagles and pigeons. J. Appl. Ecol. 43, 1075-1086. 10.1111/j.1365-2664.2006.01213.x
10. REAL, J., S. MAÑOSA and E. MUÑOZ (2000): Trichomoniasis in a Bonelli's eagle population in Spain. J. Wildl. Dis. 36, 64-70. 10.7589/0090-3558-36.1.64.
11. ROBINSON, R. A., B. LAWSON, M. P. TOMS, et al. (2010): Emerging infectious disease leads to rapid population declines of common British birds. PLoS One. 5, e12215. 10.1371/journal.pone.0012215.
12. SANTOS, N., J. JAMBAS, A. MONTEIRO, J. AMARAL, N. MARTINS, J. GARCIA, A. M. FERNÁNDEZ, K. M. TYLER, T. ALMEIDA, J. ABRANTES and P. J. ESTEVES (2019): Trichomonas Infection in a Community of Free-Ranging Domestic and Wild Columbiformes and Bonelli's Eagle (*Aquila fasciata*). Front. Vet. Sci. 6, 148. 10.3389/fvets.2019.00148.

Ezofagealni granulomi u divljih patuljastih orlova (*Hieraaetus pennatus*) iz slobodnog uzgoja prouzročeni parazitom *Trichomonas gallinae*

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Dva su patuljasta orla iz slobodnog uzgoja u teškom stanju zbog kaheksije i dehidracije spašena. Oba su imala velike ezofagealne granulome koji su blokirali prolaz hrane. Obavljeni su: kompletni klinički pregled, RTG snimci, hematologija i biokemija krvi. Uzorci su izuzeti apsiracijskom citologijom s tankom iglom, a dijagnoza je u oba slučaja bila – ptičja trihomonoza Liječenje i ishodi slučajeva opisani su u ovom radu u želji da bismo naglasili važnost ranog prepoznavanja ove bolesti za povoljniju prognozu te utjecaj koji ptičja trihomonoza može imati na divlje populacije ugroženih vrsta.

Ključne riječi: *ptičje, patuljasti orao, Trichomonas gallinae, trihomonoza*