RESEARCH CASE REPORT

INTESTINAL IMPACTION WITH *PARASCARIS EQUORUM* IN A CAPTIVE ZEBRA *(EQUUS QUAGGA BOEHMI)* – A CASE REPORT

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ABSTRACT

The present report describes the case of small intestinal impaction with *Parascaris equorum* in a captive zebra (*Equus quagga*) from the zoo "Pionirska dolina" in Sarajevo, Bosnia and Herzegovina. A massive burden of nematodes occluding the lumen of the small intestine was observed. In addition to severe trauma of the muscle of the left rear leg, intestinal impaction was probably the main cause of death in the presented case. Regular control of the feces for the presence of parasitic eggs, deworming and husbandry measures were commented.

Key words: *Equus quagga*, intestinal impaction, *Parascaris equorum,* zebra

INTRODUCTION

Parascaris equorum (Nematoda: Ascarididae) is one of the most important non-strongyloid nematodes in equids, especially in young animals, six to nine months old (Cribb et al., 2006; Nielsen, 2016). The predilection site of *P. equorum* is the small intestine, where adult females lay eggs (up to 50 million eggs per female/day), which then pass via feces in the environment, where the infective larvated stage develops (Clayton, 1986). Equids usually get infested while grazing on pastures contaminated with larvated eggs that are shown to stay viable in the soil for up to 10 years (Clayton, 1986; Reinemeyer, 2009; Nielsen, 2016). In addition to the extended survival ability of eggs, a major problem represents the resistance of the parasite to ivermectin, which appears to be inherited by eggs in the environment (Craig et al., 2007; Schougaard and Nielsen 2007; Reinemeyer, 2009).

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Foals six months to one year old are shown to be most susceptible to *Parascaris* infection due to the lack of immunity and the presence of a large quantity of *Parascaris* eggs in the environment. Most commonly, severe infestation with *Parascaris* parasites will lead to small intestinal impaction, which, followed by depression and chronic weight loss, usually leads to colic and death due to the perforation of the impacted intestine (Cribb et al., 2006; Nielsen, 2016; Sakhaee and Radfar 2011; Yang et al., 2004).

Prevalence of *Parascaris* spp. in free-ranging zebras reaches up to 35% with subadults and adults being more commonly infected (Wambwa et al., 2004; Muoria et al., 2005; Seeber et al., 2020). Similar results have been documented in zebras from a safari park in Germany (Epe et al., 2001). Adult parasites were observed at low numbers (Wambwa et al., 2004) with a total egg count ranging from 25 to 1625 eggs per gram (Epe et al., 2001; Seeber et al., 2020). Massive infestations in zebras are rare (Scullion, 1982), however, sporadic cases of intestinal impaction and perforation have been reported in adult zebras in captivity (Yang and Lim, 2011). The present report aimed to describe the case of intestinal impaction with *P. equorum* in adult captive zebra (*Equus quagga*) housed in Zoo "Pionirska dolina" in Sarajevo, Bosnia and Herzegovina.

CASE DESCRIPTION

Adult 10-year-old female zebra was delivered for necropsy to the Laboratory for Pathology on the Veterinary Faculty of Sarajevo after she was found dead in Zoo "Pionirska dolina" in Sarajevo. A post-mortem examination revealed autolysis in most internal organs. The small intestine was distended, with an edematous intestinal wall and a massive burden (more than 600) of 15 to 35 cm long, grey-white to tan cylindrical nematode parasites (Figure 1) (Lucio-Forster and Lejeune, 2021). Mesenteric lymph nodes were enlarged and hyperemia of mesenterial blood vessels was present. In addition, a focally extensive area of necrosis and hemorrhage in the medial femoral muscle close to the left coxofemoral joint was observed. Histopathology revealed moderate infiltration of lymphocytes and plasmocytes admixed with small numbers of eosinophils in the lamina propria of the small intestine. The surface epithelium was sloughed into the intestinal lumen. At cross-sections of *P. equorum* thick outer cuticle, hypodermis with lateral alae and chordae, and coelomyarian musculature encircling the large pseudocoelomic cavity were noted (Figure 2A). Centrally located in the pseudocoelom there were intestine and multiple uterine loops packed with thick-shelled eggs (Figures 2B) (Miller, 2021). In the femoral muscle, there was diffuse necrosis of myocytes with the proliferation of connective tissue, and focal necrosis of minor arterial blood vessels.

DISCUSSION

Parascaris equorum is the most pathogenic parasite of juvenile and debilitated adult equids and can cause poor growth, ill-thrift, weight loss, colic, and death after intestinal impaction or perforation (Cribb et al., 2006; Nielsen, 2016).

Free-ranging zebras are commonly infected with *P. equorum*. However, the course of infection is subclinical due to the development of acquired immunity over time (Wambwa et al., 2004; Muoria et al., 2005; Seeber et al., 2020). Only rarely, infections with abundant parasites result in severe intestinal impaction with perforation and death of animals in captivity (Yang and Lim, 2011). In the case presented here, numerous *P. equorum* worms occluded the small intestine, however, no perforation was observed. In our opinion, the

death of zebra presented here was probably the result of combined effects of intestinal impaction with *P. equorum* and the trauma of muscles of the left rear leg.

Figure 1 Numerous adults of *P. equorum* occluding the jejunal segment of adult zebra.

Heavy infections with *P. equorum* might result from repeated ingestion of eggs from enormously contaminated floors of enclosures and soil of limited outdoors (Scullion, 1982). Furthermore, captive animals are frequently dewormed, and repeated administration of a sub-optimal dose of a single antiparasitic drug might lead to the development of resistance (Lim et al., 2008; Maesano et al., 2014). In this particular case, unfortunately, data on the parasitic egg load in the enclosure of the zebra and its deworming history are missing. If infection with ivermectin-resistant *P. equorum* occurs, ineffective therapy will lead to the heavy burden of adult nematodes with fatal outcome (Yang and Lim, 2011). Some of these animals will succeed to overcome infestation and develop age-dependent immunity, but they will become persistently infected and shed resistant *P. equorum* in the environment (Reinemeyer, 2009; Seeber et al., 2020). Consequently, regular control

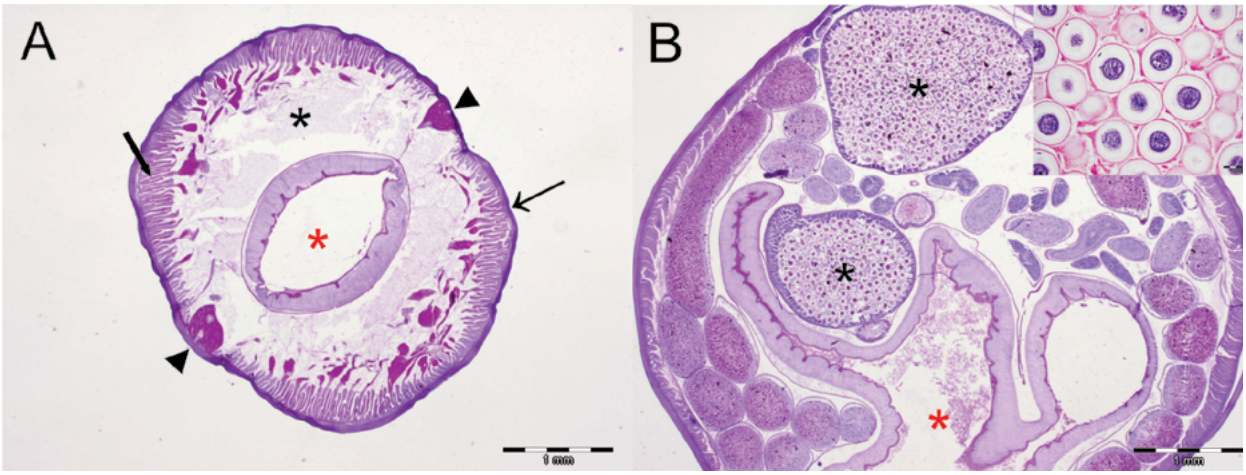

Figure 2 Cross-section of adult male *P. equorum* (A). Note the thick cuticle (arrow) with hypodermis and coelomyarian musculature (full arrow) and prominent lateral chords (arrowheads). Centrally located in the celomic cavity (black asterisk), there is a large intestinal lumen (red asterisk). Periodic acid stain, *scale bar* 1mm. Cross-section of adult female *P. equorum* (B). The coelomic cavity is filled with multiple loops of the uterus with numerous eggs (asterisks), and the large intestine (red asterisk). Periodic acid stain, *scale bar* 1mm. Insert: Thick-shelled eggs in the uterus. Hematoxylin-eosin *scale bar* 50 micrometers.

of parasites and parasitic egg counts in the feces with advanced techniques (Maesano et al., 2014), along with intermittent changes of antiparasitic drugs complemented with high standards of husbandry, increased cleaning and disinfection of enclosures and outdoor spaces (Lim et al., 2008; Maesano et al., 2014) should be implemented in captive animals.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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IMPAKCIJA CRIJEVA SA *PARASCARIS EQUORUM* KOD ZEBRE U ZATOČENIŠTVU (*EQUUS QUAGGA BOEHMI*) – PRIKAZ SLUČAJA

SAŽETAK

Ovaj izvještaj opisuje slučaj impakcije tankog crijeva sa *Parascaris equorum* kod zebre *(Equus quagga*) iz zoološkog vrta "Pionirska dolina" u Sarajevu, Bosna i Hercegovina. Ustanovljena je okluzija lumena tankog crijeva izazvana velikim brojem nematodnih parazita. Paralelno sa teškom traumatskom ozljedom muskluture zadnje lijeve noge, impakcija crijeva je vjerovatno glavni uzrok uginuća u ovdje prikazanom slučaju. Regularna kontrola fecesa na prisustvo jaja parazita, antiparazitarna terapija i mjere upravljanja su diskutovane.

Ključne riječi: *Equus quagga*, impakcija crijeva, *Parascaris equorum*, zebra