

EFFICACY OF IVERMECTIN (IVOMEC®) AGAINST INTESTINAL CAPILLARIOSIS IN FALCONS

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Summary:

52 captive falcons out of 3,988 (1.3 %) raptors microscopically examined for intestinal parasites in the Middle East proved infested with hairworms (capillariid parasites). 26 of these (50 %) showed concurrent parasitoses. In the group of 26 falcons diagnosed with capillariosis as sole infestation (50 %) compatible clinical signs such as anorexia, weight loss, weakness, dyspnoea, regurgitation of food and blood, diarrhoea and dark tarry faeces, were recorded. These birds were treated intramuscularly with ivermectin at doses of 2 mg/kg. In fecal samples examined 10-15 days later, the eggs of capillariid parasites had disappeared, in association with complete clinical recovery.

KEY WORDS : falcon, bird of prey, hairworms, *Capillaria* spp., ivermectin, Ivomec®, Kuwait, Dubai.

Résumé : EFFICACITÉ DE L'IVERMECTINE (IVOMEC®) SUR LA CAPILLARIOSE INTESTINALE CHEZ DES FAUCONS

Chez 52 faucons (1,3 %) sur 3988 oiseaux de proie examinés au Moyen-Orient, un diagnostic à *Capillaria* spp. a été porté par examen coprologique. 26 oiseaux (50 %) présentaient une polyinfection alors que les 26 autres avaient seulement une capillariose intestinale et présentaient des signes cliniques compatibles tels qu'anorexie, perte de poids, faiblesse, dyspnée, vomissement de nourriture et de sang, diarrhée avec selles brunâtres. Ces faucons ont été traités par voie intramusculaire avec de l'ivermectine (Ivomec®) à la posologie de 2 mg/kg. Lors des examens coprologiques effectués 10-15 jours plus tard, les œufs avaient disparu avec une complète guérison clinique.

MOTS CLÉS : faucon, oiseau de proie, *Capillaria* spp., ivermectine, Ivomec®, Koweït, Dubaï.

Capillariids nematodes are common in birds of prey (Krone, 2001). Hairworms have long been recognised in falconiform birds under the incorrect name of *Capillaria* (Barus & Sergejeva, 1989a). It's today acknowledged that *Eucoleus dispar* (Dujardin, 1845), easily distinguishable from the other species on account of its dotted egg surface and the spicule sheath armed with long fingerhair-like spikes, is the only capillariid species parasite of the oesophagus in terrestrial birds including falcons (Barus & Sergejeva, 1989a).

A second capillariid worm, member of the genus *Capillaria*, that is often found in the small intestine of raptors, is *Capillaria tenuissima* (Rudolfi, 1803), which can be differentiated from *Eucoleus dispar* by its reticulated egg surface and its spicule sheath armed with short, thick spikes (Barus & Sergejeva, 1989b). The third species of hairworm found in the intestine of falcons is *Baruscapillaria falconis* (Goeze, 1783), which has an egg surface that is very similar to *C. tenuissima*, but bears an unarmed spicule sheath (Barus & Sergejeva, 1990).

Ingestion of infected birds such as gulls and crows, invertebrates such as earthworms, and mammals such as ptarmigans, plays a major role in the transmission

of *Capillaria* in birds of prey (Heidenreich, 1997). A direct cycle is possible as well (Santiago *et al.*, 1985). Larvae burrow in the intestinal mucosa and develop into adult worms in 3-4 weeks (Heidenreich, 1997), causing necrosis and haemorrhages in the oral cavity, oesophagus and small intestine (Santiago *et al.*, 1985; Zucca, 2003).

Diagnosis is made upon examination of fresh fecal samples, oral scrapings and washes for the identification of typically lemon-shaped capillariid ova (55-70 × 24-35 µm) (Fig. 1) (Zucca, 2003).

Unfortunately, discrimination between hairworm species cannot be based on the egg's morphology alone in most cases. Although these parasites are harmless in moderate numbers (Keymer, 1972), they are undesirable because liable to multiply rapidly under predisposing conditions (Lawrence, 1984). Intestinal *Capillaria* was not uncommon in both captive and free-living raptors in United Kingdom and Iceland, where wild gyrfalcons (*Falco rusticolus*) possibly contracted capillariosis from the ptarmigan (*Lagopus mutus*) on which they prey (Keymer, 1972). In a survey on Icelandic gyrfalcons, *Capillaria contorta*, synonym of *Eucoleus dispar*, was found to be the cause of mortality in more than 1/3 of the birds examined (Clausen & Gudmundsson, 1981).

The aim of this survey was to report incidence, clinical signs, concurrent parasitoses and response to therapy

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Fig. 1. – Lemon-shaped capillariid oval egg, 70 × 30 µm in size, showing the typical bipolar plugs (× 400).

with ivermectin in captive falcons naturally infected with capillariid parasites in the Middle East.

MATERIALS AND METHODS

From May 2003 to November 2006, microscopic examination for the presence of capillariid spp. eggs (Fig. 1) was done on fresh fecal samples obtained from 1,706 captive falcons from Kuwait and 2,282 falcons from Dubai. Totally 3,988 birds were examined. The ova were not quantified. As far as possible, concurrent parasitoses (Table I) and clinical signs

Concomitant parasitoses	Kuwait Dubai (UAE)	
	(n = 14)	(n = 38)
None	10	16
<i>Serratospiculum seurati</i>	3	14
Trematodosis due to <i>Strigea falconispalumbi</i>	2	10
Coccidiosis due to <i>Caryospora</i> sp.	1	8
Cestodes	–	6
<i>Porrocoecum</i> sp.	–	2

Table I. – *Capillaria* spp. infestation in falcons from Kuwait and Dubai.

Clinical signs	Kuwait Dubai	
	(n = 10)	(n = 16)
Weight loss	8	9
Poor appetite/anorexia	7	12
Regurgitation	7	10
Diarrhea/dark feces	5	6
Dysphagia	5	3
Lethargy	4	7

Table II. – Clinical signs of capillariosis in falcons.

(Table II) were recorded. Infested birds were treated with ivermectin (Ivomec[®], Merial), injected intramuscularly once at the dose recommended by Lierz (2001) in falcons, thus 2 mg/kg. Ten-fifteen days after treatment, a physical check and a microscopic examination of the faeces were again performed in birds of prey showing capillariosis as sole infestation (n = 26; 50 %).

RESULTS

The presence of capillariid's sp. oval eggs showing the typical bipolar plugs (Fig. 1) was microscopically confirmed in 52 out of 3,988 (1.3 %)

birds of prey examined: 14 (0.83 %) from Kuwait and 38 (1.7 %) from Dubai. Capillariosis as sole infestation was recorded in 26 (50 %) falcons: 10 from Kuwait and 16 from Dubai (Table I). Concurrent parasitoses noted are listed in Table I. Clinical signs recorded in birds with sole capillariosis are listed in Table II. No side effects occurred in the birds in the study as a result of the ivermectin therapy.

No worm eggs were microscopically found 10-15 days after therapy in fecal samples obtained from 26 falcons diagnosed with sole capillariosis and showing remission of compatible clinical signs (Table II) within 48 hours after therapy.

DISCUSSION

The 1.3 % infestation rate determined in a large study group of 3,988 falcons from the Middle East is low if compared with results of surveys made elsewhere, such as the 19.3 % prevalence observed in birds from the United Kingdom (Lawrence, 1983) and the 42 % prevalence recorded in Germany (Krone, 2001). This may be due to the fact that rarely captive falcons in the Middle East are fed with intermediate hosts for capillariids.

Historically, *Capillaria* spp. are considered the most pathogenic nematodes infesting birds of prey (Cooper, 1969a, b; Keymer, 1972), producing clinical signs such as anorexia, regurgitation of food or blood, tarry faeces (Lawrence, 1984), convulsions (Cooper, 1969b) diarrhea, dysphagia, weight loss and cachexy (Zucca, 2003). Signs are often similar to those of trichomonosis (Lacina & Bird, 2000) and the condition is recognized as a relatively common cause of mortality (Cooper, 1969b). A similar range of clinical signs was recognized in infested falcons in this study (Table II), with the only exclusion of mortality records, most probably due to the efficacy of treatment with ivermectin.

Diagnosis is done by identification of *Capillaria* spp. ova (Fig. 1) in faecal samples (Zucca, 2003). Failure to identify such eggs does not prove that the bird is free of parasites when the infestation is recent. The prepatent period is approximately four weeks (Heidenreich, 1997).

In this survey, diagnosis of hairworms (capillariid parasites) was done in 52 falcons on the basis of detection of lemon-shaped capillariid oval eggs in association with compatible signs. 50 % of cases were associated with other parasitoses, such as *Serratospiculum seurati*, *Strigea falconispalumbi* or *Caryospora* sp. (Table I), thus complicating the clinical appearance and the therapeutic outcomes. Therefore this group was ruled out of records.

In 26 (50 %) falcons in this study diagnosed with sole capillariosis, concomitant remission of compatible cli-

nical signs (Table II) and disappearance of eggs from fecal samples soon after administration of an eligible therapy were indirectly diagnostic for the elimination of adult stages and seem to confirm the pathogenicity of capillariids.

A wide range of anthelmintics have been suggested against capillariosis in birds of prey, including mebendazole, levamisole (Zucca, 2003), ivermectin (Kollias *et al.*, 1987) and fenbendazole (Lawrence, 1983) with most dose rates being extrapolated from those proving successful in the domestic fowl. The relative inefficiency of fenbendazole against *Capillaria* was thought to be the result of reinfestation from a contaminated environment (Lawrence, 1983).

More recently, pigeons treated for capillariosis with fenbendazole at 30 mg/kg for five days exhibited negative side effects such as anorexia, lethargy, dehydration, hemorrhagic enteritis and death (Gozalo *et al.*, 2006). On this account, fenbendazole is no more advisable for treating hairworms in falcons.

On the other hand, ivermectin administered at doses lower than 2 mg/kg to pheasants infected by *Capillaria* spp. was partially effective against adult worms and the clinical signs of helminthoses were reduced only (Lamka *et al.*, 1997).

For this reason, in infested birds in this study, ivermectin was injected at a dose of 2 mg/kg, which is recognized as safe and highly effective in falcons (Lierz, 2001).

Capillariids can produce severe tissue lesions or even kill their host, causing inflammation of the upper and lower alimentary tract. Affected birds present reactive hyperplasia, hemorrhage and necrosis of the epithelium (Krone, 2001).

In order to prevent such damages and eradicate the parasites even when they are present in moderate numbers, treatment with ivermectin at the dose of 2 mg/kg is strongly suggested, and it proved highly effective without showing side effects.

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