

Meningeal nematodiasis in a red deer (*Cervus elaphus*) in northeastern Italy - a case report

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ABSTRACT

A case of meningeal nematodiasis in an adult female red deer (*Cervus elaphus*) in the Trento Province, northeastern Italy is described. The red deer was found dead in the month of March after having been noticed with neurological signs. The carcass was emaciated. Adult nematodes were found in the cerebral meninges. They were identified as *Elaphostrongylus cervi*. The finding of the neurotropic nematodes was associated with haemorrhagic foci in the occipital region. Histopathological examination revealed the presence of mild astrocitosis and lymphocytic perivascular cuffs, but worms were not present in the brain parenchyma. Bacteriological analysis and research for CWD lesions and agent were negative. To the authors' knowledge this is the first report of cerebral nematodiasis in a red deer in Italy.

Key words: red deer, cerebral nematodiasis, *Elaphostrongylus cervi*

Introduction

Nematodes of the family *Protostrongylidae*, subfamily *Elaphostrongylinae*, genus *Parelaphostrongylus* and *Elaphostrongylus* are parasites of wild cervids that may cause neurological disorders. *Parelaphostrongylus tenuis* is a common parasite of white-tailed deer (*Odocoileus virginianus*) and can cause severe neurological disease in other species of North American cervids. The genus *Elaphostrongylus* includes three species: *E. cervi* mainly of red deer (*Cervus elaphus*), *E. alces* of moose (*Alces alces*) and *E. rangiferi*

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of reindeer (*Rangifer tarandus*) (MASON, 1994). In Europe *E. cervi* has been described and is common in countries such as Scotland (CAMERON, 1931), Spain (VICENTE et al., 2005), Germany (REHBEIN et al., 2002), Poland (CISEK et al., 2003) Sweden and Norway where *E. alces* and *E. rangiferi* occur (SKORPING, 1982; HANDELAND, 2002). The genus *Elaphostrongylus* was recently first reported in central Italy in the lungs of red deer (MORANDI et al., 2003). Elaphostrongylinae have an indirect life cycle. First stage larvae are shed with the faeces; they penetrate the foot of a snail or a slug and moult to the infective third stage larva. If the gastropod is ingested by a cervid, third stage larvae are set free in the gastrointestinal tract and migrate to the central nervous system (CNS) or to CNS-associated tissues, where they moult twice and develop to the adult stage. The adults either stay in the CNS (*P. tenuis*), or associate with the spinal cord subarachnoidal and subdural spaces (*E. rangiferi*) or epidural space (*E. alces*), and then continue migrating to muscle fasciae, depending on species (STÉEN et al., 1997).

Red deer populations in the Trento Province are under sanitary surveillance through examination of dead deer found and specific investigations and research concerning paratuberculosis and chronic wasting disease, carried out on found dead as well as on hunted deer. The population densities range from 2.61 to 3.15 deer/100ha (SIEFF, 2004). The present study presents a case report of meningeal elaphostrongylosis in an adult red deer.

Materials and methods

A 13 year old female red deer, with a history of neurological signs, consisting in posterior paresis, was found dead in March 2004. The carcass was necropsied and gross pathological data was recorded. The skull was split in the sagittal plane. Standard parasitological examinations on red deer include the search for *Dictyocaulus* spp. adults and hepatic trematodes. Bacteriological analysis was performed for *Listeria* spp. (LEBB-ALOA) from brain tissue and *Mycobacterium avium* subsp. *paratuberculosis* (HYEMS) from ileocecal junction and associated lymph nodes. The brain and the medulla oblongata at the obex were fixed in 10% neutral buffered formalin. Three transverse oriented sections of the brain (occipital, parietal, and frontal lobes) were trimmed, routinely processed and embedded in paraffin for histological examination. Sections were cut at 4 µm and stained with haematoxylin & eosin. The obex was also tested by Western Blot (Prionics Check-Western®) for transmissible spongiform encephalopathy (TSE).

Some nematodes were found in the sub-meningeal space; they were extracted from formalin fixed brain samples, progressively hydrated, cleared in lactophenol and then morphologically identified (GIBBONS et al., 1991; PUSTERLA et al., 2001).

Biometric data and the kidney fat index (KFI) were collected in order to investigate a possible relationship between constitutional and physical condition parameters and sanitary state (RINEY, 1955).

Results

The carcass was emaciated and the skin was infected by ectoparasites *Lipoptena* spp. and lice. Subcutaneous nodules indicative of larvae of the genus *Parafilaria* were detected along the back. Massive pulmonary infestation due to *Dictyocaulus* spp. along with larval nodules in the lung parenchyma was found, but no sign of pneumonia was present. Several *Setaria cervi* adults were seen in the peritoneum and a fibrinous perihepatitis was present. *Dicrocoelium dendriticum* and *Fasciola hepatica* are parasites encountered in the deer populations, but no trematodes were found in the liver. Catarrhal ileitis was also observed.

Haemorrhagic foci were visible in the occipital region and four adult nematodes were observed in the meninges at necropsy (Fig. 1). Histologically, mild multifocal astrocytosis (Fig. 2) and perivascular lymphocytic cuffs were observed in the cerebral cortex, while no nematodes were evident in brain tissue. Furthermore, multifocal haemorrhages of the meninges were evident (Fig. 3).

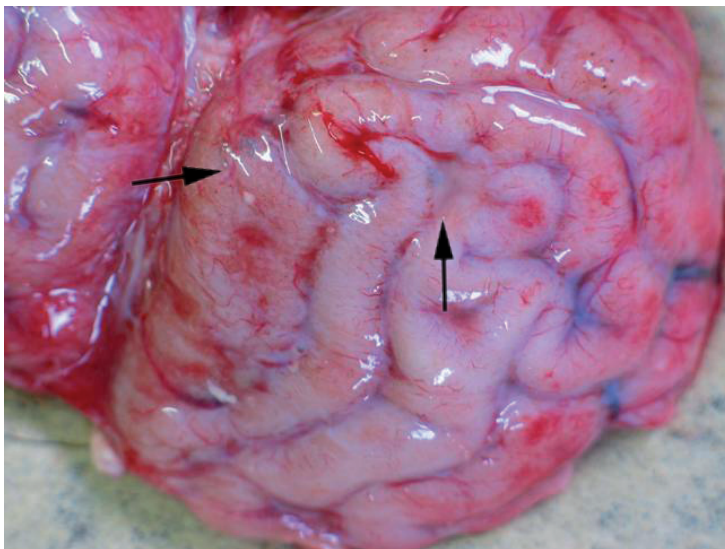


Fig. 1. Adult nematodes in the meninges (arrows)

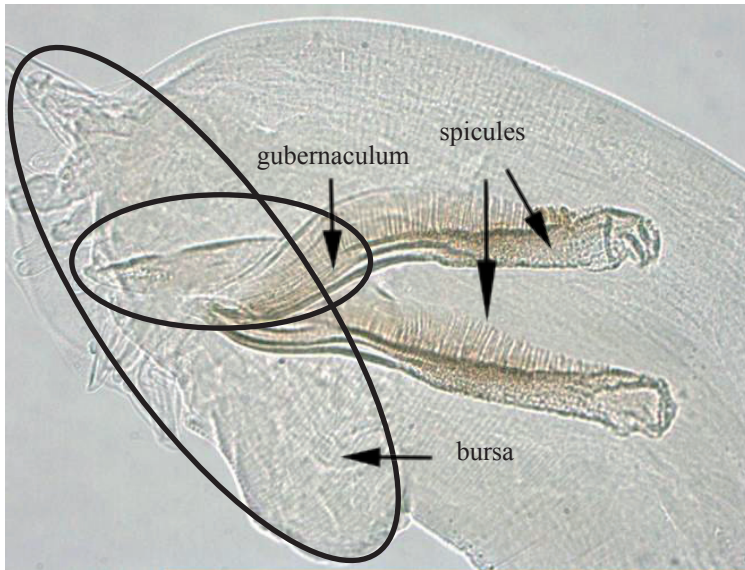


Fig. 2. Caudal end of the parasite

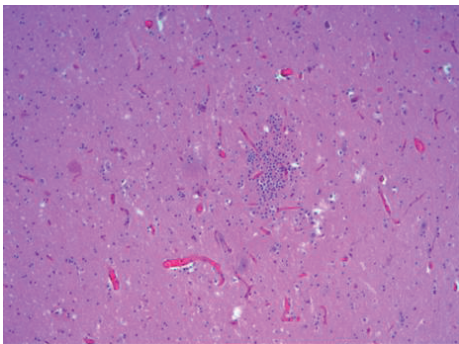


Fig. 3. Focal astrocytosis of the white matter was observed, particularly in the parietal cortex (E-E, 10x)

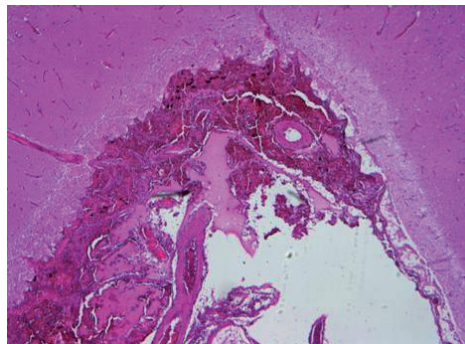


Fig. 4. Multifocal haemorrhages of the meninges (E-E, 5x)

The cultural examination for *Listeria* spp. and *Mycobacterium avium* subsp. *paratuberculosis* was negative. The rapid test was negative and no histological lesions suggestive of CWD were detected.

The sub-meningeal nematodes were morphologically identified as adults of *Elaphostrongylus cervi* (GIBBONS et al., 1991; PUSTERLA et al., 2001) (Fig. 4). The KFI value was 8.28.

Discussion

Neurological disorders in deer are rare events in the area in question. They are usually caused by traumatic injuries or by toxæmia. Emaciation is common and the main reasons are winter starvation and chronic enteric diseases such as paratuberculosis, which affects an average of 20% (S.E.+ 9%) of red deer examined in the area (BREGOLI et al., 2003). Chronic wasting disease has never been recorded in Italy.

Meningeal worm associated lesions are more often described, including eosinophilic meningitis, focal malacia and areas of haemorrhage (HANDELAND, 2002; LANKESTER, 2002). In this case only haemorrhagic lesions in the meninges and mild inflammatory reaction of the brain were observed. The apparent poor condition of the carcass was confirmed by the low KFI value. Nevertheless, this value cannot be compared with reference population data, because the red deer was not found during the hunting season. Nematodes of the family Protostrongylidae (*Muellerius*, *Protostrongylus*) have been previously detected in wild ruminants in the area, but never of the genus *Elaphostrongylus*. The environment in the study area is suitable for intermediate hosts. The cerebral cavity has not been examined for adult meningeal protostrongylids before, because they were not expected in the area. *E. cervi*, was recently reported in central Italy, but neurological signs or neurotropic localization were not described (MORANDI et al., 2003). Red deer is the common definitive host for *E. cervi*, but the parasite can also infect roe deer (*Capreolus capreolus*) and sika deer (*Cervus nippon*) (MASON, 1994; LANKESTER, 2002). The only free ranging cervids living in Trentino are red deer and roe deer.

The finding of *E. cervi* draws attention to the distribution, ecology and pathological effects of this nematode's presence in local deer populations. Furthermore, the possible infection of small ruminants in pastures must be considered, as natural and experimental cross-infections have been described (HANDELAND and SLETTBAKK, 1995; HANDELAND et al., 2000; PUSTERLA et al., 2001)

To the authors' knowledge this is the first report of meningeal nematodiasis in a red deer in Italy.

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SAŽETAK

Opisan je slučaj invazije odrasle košute jelena običnoga (*Cervus elaphus*) moždanim nematodima na području provincije Trento u Italiji. Predmetna košuta uginula je tijekom ožujka, uz naglašene simptome poremećaja živčanoga sustava. Leš je bio izrazito lošeg gojnog stanja. Odrasli oblici identificirani kao *Elaphostrongylus cervi* pronađeni su u moždanim ovojnicama. Nalaz ovih oblića upotpunjen je i nalazom žarišnih krvarenja u zatiljnoj regiji. Histopatološka pretraga otkrila je prisutnost umjerene astrocitoze i perivaskularnog nakupljanja limfocita, ali ne i nalaz oblića u moždanom tkivu. Bakteriološka pretraga i pretraga na kroničnu bolest slabljenja (CWD) bile su negativne. Prema saznanjima autora ovo je prvi opis invazije moždanim oblicima u jelena običnog na području Italije.

Ključne riječi: jelen obični, moždani oblici, *Elaphostrongylus cervi*
