



Short communication

Fatal infection in two Icelandic stallions caused by *Halicephalobus gingivalis* (Nematoda: Rhabditida)

Matthías Eydal^{a,*}, Slavko H. Bambir^a, Sigurdur Sigurdarson^b, Eggert Gunnarsson^a, Vilhjámur Svansson^a, Stefán Fridriksson^c, Ellert Thór Benediktsson^d, Ólöf G. Sigurdardóttir^a

^a Institute for Experimental Pathology, University of Iceland, Keldur, Vesturlandsvegur, 112 Reykjavík, Iceland

^b Agricultural Authority of Iceland, Austurvegur 64, 800 Selfoss, Iceland

^c Artún 9, 550 Saudárkrókur, Iceland

^d Dýralæknamidstöðin ehf, Veterinary Clinic, Dynskálum 30, 850 Hella, Iceland

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ABSTRACT

Opportunistic infections with the free living nematode *Halicephalobus gingivalis* are infrequently reported in horses but the cases are widespread geographically. The nematodes are believed to penetrate wounds and subsequently reproduce within the host tissues. This paper reports two cases of a fatal disease in stallions of the Icelandic breed in Iceland. Case 1: a stallion, which sustained injuries to the mouth after an accident, developed severe neurological signs and had to be euthanatized. Histological examination revealed mild inflammation and malacia in the cerebellum associated with the presence of numerous *H. gingivalis* nematodes. Case 2: a stallion that started swerving to one side and lost balance was euthanatized due to lack of response to therapy and rapid deterioration. Histological examination revealed numerous *H. gingivalis* nematodes in the cerebellum, brain stem, cervical spinal cord and in the meninges, with minimal reactive changes. In case 1 the infection presumably was acquired by nematodes from soil penetrating through wounds in the mouth. The mode of the *H. gingivalis* infection in case 2 is uncertain. These are the first cases of *H. gingivalis* infection reported from Iceland and the second report from the Nordic countries.

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1. Introduction

The nematode *Halicephalobus gingivalis* (Stefanski, 1954), synonym *Halicephalobus deletrix* and *Micronema deletrix*, belongs to the order Rhabditida, which commonly inhabit soil, manure and decaying humus. Opportunistic infections with this free living nematode are infrequently reported but the cases are widespread geographically. There are only about 50 published cases in horses worldwide (Anon., 2005; Boswinkel et al., 2006; Blunden et al.,

1987; Bryant et al., 2006; Muller et al., 2008; Nadler et al., 2003; Takai et al., 2005; Vasconcelos et al., 2007), one in Grevy's zebra (Isada et al., 2000) and four cases in humans (Sarah et al., 2010). *H. gingivalis* – like nematodes have been reported from the brain of a cow (Montgomery and O'toole, 2006) and according to Muller et al. (2008) this nematode has been associated with encephalitis in a big horn sheep.

The pathogenesis, life cycle and route of infection of this nematode are not well known. The nematodes are believed to penetrate through contamination of oral, nasal or skin wounds and subsequently reproduce within the host tissues. Once in the host, these parthenogenetic nematodes seem to proliferate rapidly. Pathological effects in horses commonly include granulomatous inflammation

* Corresponding author. Tel.: +354 5855100; fax: +354 5673979.
E-mail address: meydal@hi.is (M. Eydal).

and destruction of infected tissues (Nadler et al., 2003). The most commonly affected organs include oral or nasal cavities, brain, spinal cord, kidneys, lymph nodes and adrenal glands (Spalding et al., 1990). The disease always appears to be fatal when the central nervous system becomes infected. Since infection is generally only diagnosed postmortem in horses that have exhibited neurological signs, it is not known how commonly nonfatal infections occur.

This paper reports two cases of a fatal disease in stallions of the Icelandic breed in Iceland.

2. Case presentations

2.1. Case 1

An eleven year-old stallion of the Icelandic breed developed a fatal infection following an accident. In the autumn of the year 2005 it was discovered that the horse apparently had been kicked by another horse and sustained injuries to the mouth. At this time the horse was on pasture at a farm in Gullbringu- and Kjosarsýsla, SW Iceland. Inspection showed that all six front teeth in the upper jaw were broken and/or loose with infected and inflamed wounds in the gingiva and hard palate. The teeth were removed by a veterinary surgeon and disinfectant tampons were put into the holes left from the teeth. Antibiotics (penicillin) were given for 10 days and the affected area treated with a disinfectant twice a day for several days.

On the 6th of February 2006, when the horse was in training at a farm in North-Hunavatnssýsla, North Iceland, a veterinary surgeon was called to inspect the stallion. The stallion displayed hypermetria and was treated with antibiotics (penicillin) as listeriosis was suspected. Over the next five days the stallion developed more severe neurological signs. He started to lose balance and to fall. In the end he was unable to rise again, lying with his head down but swerving to one side. The temperature during these five days ranged from 38.2 to 39.5 °C, but the stallion retained his appetite throughout the period. The stallion was treated with glucocorticoids (dexamethasone) the first two days, then with NSAIDs (flunixin meglumine). He received antibiotics (penicillin) and fluids throughout but was euthanatized on day 6 (February 11th) as he showed no signs of recovering. Blood samples taken on the 3rd day of illness (February 8th) showed no abnormalities in haemoglobin or hematocrit levels, or in the number of white blood cells. Blood chemistry revealed normal levels of alkaline phosphates and urea but increased levels of aspartate aminotransferase (1083 U/l).

When the stallion had been euthanatized, he was transported to The Institute for Experimental Pathology, University of Iceland, Keldur to be autopsied. The stallion was in good bodily condition. There were superficial wounds on the head over the left eye. The front teeth in the upper jaw were missing and there was a healed linear wound between the gingiva and the hard palate. There was a fibrous thickening in the affected area. A mild oedema and haemorrhage was in the cerebellum. There were subcutaneous haemorrhages over the left abdomen and in the muscles of the left thigh. Other than congestion in the internal organs due to euthanasia, organs were

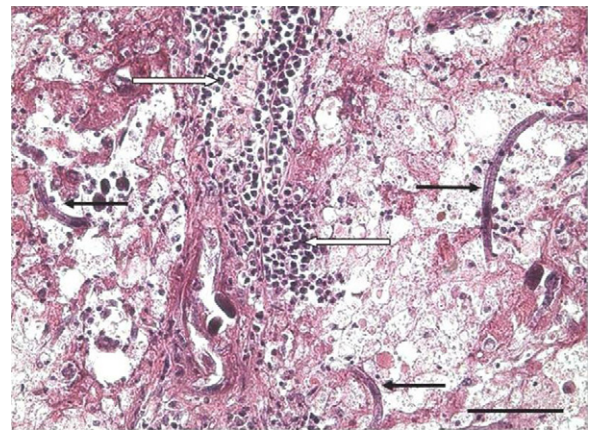


Fig. 1. Case 1 – cerebellum. Extensive malacia and perivascular cuffing (white arrows), with infiltration mainly of macrophages, lymphocytes and plasma cells. Numerous nematodes (black arrows) in the surroundings of a blood vessel – giemsa. Bar = 100 μ m.

without specific lesions. Samples from the brain, liver, heart and kidneys were fixed in 10% neutral buffered formalin, embedded in paraffin wax and sectioned at 5 μ m according to routine histological protocols. The sections were stained with haematoxylin eosin and giemsa and examined for histopathological changes.

Microscopic examination of histological sections of the cerebellum revealed severe multifocal malacia, with numerous intralesional nematodes. Mature nematodes, larvae and free nematode eggs were present in the perivascular space. There was a moderate, mononuclear perivascular cuffing and infiltration of mononuclear inflammatory cells in the meninges (Fig. 1). Inflammation in association with the worms was usually mild or absent.

The nematode was confirmed as being the species *H. gingivalis* based on its morphological features (Anderson et al., 1998; Anderson and Bemerick, 1965; Stefanski, 1954). In the cases where nematodes were found sectioned in a longitudinal plane, seemingly through the whole body length, mature worms measured 300–320 μ m in length and 15 μ m wide and larvae were 125–250 μ m long and 10–15 μ m wide. In most cases only fragments of nematodes were seen. Sections from the anterior part of the larger nematodes revealed the characteristic rhabditiform oesophagus (total length 77–88 μ m), which includes the corpus (length 43–44 μ m), isthmus (length 23–28 μ m) and the posterior bulb (length 11–16 μ m) (Fig. 2). Sections through the reproductive organs of the parthenogenic *H. gingivalis* females revealed the typical dorsoflexed ovary, the uterus and a fully developed uninucleated egg (50 μ m $\times$ 15 μ m) (Fig. 3). Intact free egg measured 43 μ m $\times$ 18 μ m.

2.2. Case 2

The second case was in an eight year-old stallion of the Icelandic breed with a history of swerving to the right. The horse was at a farm in Rangarvallasýsla, southern Iceland. On clinical examination on July 29th 2010 the only finding was hyperesthesia of the horse to touch of the right

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