

Haycocknema perplexum: life threatening disease of humans

Fact sheet

Introductory statement

Haycocknema perplexum is a parasite causing rare cases of life-threatening myositis in humans. It is suspected to be a zoonotic disease.

Aetiology and natural hosts

Haycocknema perplexum is a nematode, superfamily *Muspiceoidea*, family *Robertdolfusidae*. The natural host of *H. perplexum* is unknown (Spratt et al. 1999). The *Muspiceoidea* are minute, specialised nematodes occurring as adults in the subcutaneous and vascular tissues of vertebrates (Anderson and Bain 1982; Bain and Nikander 1983; Rausch and Rausch 1983; Spratt and Gill 1997).

The *Muspiceidae* family contains the genus *Muspicea*, from the subcutaneous tissues and inguinal glands of mice (*Mus* spp.) (Brumpt 1930) and genera *Riouxgolvania*, *Lukonema*, *Pennisia* and *Maseria* from the subcutaneous tissues of the patatgia (wings) and feet of bats.

The *Robertdolfusidae* family contains the genera *Robertdolfusa* (from the eye of corvids and the brain of falconids), *Durikainema* (from the portal and intracardiac veins and epicardial lymphatics of kangaroos and wallabies) (Speare and Spratt 1981) and the pulmonary arteries of koalas (Spratt and Gill 1997) and brushtail possums (DM Spratt pers. comm. 2008), and *Lappnema* (from the subcutaneous capillaries of the ears of reindeer (Bain and Nikander 1983). In addition, larvae of a presumed muspiceoid are known from white-tailed deer (Beaver and Burgdorfer 1984; Beaver and Burgdorfer 1987) and infective larvae of a presumed new species of *Robertdolfusidae* have been reported from the gut of *Simulium damnosum* (a species of black fly) in Cameroon (Bain and Renz 1993).

Four, possibly five other species of muspiceoid nematode are known from Australian mammals:

- *Muspicea borreli* in house mice (*M. domesticus*) (Singleton and Redhead 1990)

- *Durikainema macropi* in the eastern grey kangaroo (*Macropus giganteus*), western grey kangaroo (*M. fuliginosus*), eastern wallaroo (*M. robustus*), red-necked wallaby (*M. rufogriseus*), agile wallaby (*M. agilis*), spectacled hare-wallaby, (*Lagorchestes conspicillatus*) (Spratt et al 1991), Tasmanian pademelon (*Thylogale billardierii*) and Lumholtz's tree kangaroo (*Dendrolagus lumholtzi*)
- *D. phascolarcti* in the koala (*Phascolarctos cinereus*) (Spratt and Gill 1997)
- an undetermined species in the common brushtail possum (*Trichosurus vulpecula*) in Tasmania and its northern subspecies, *T. vulpecula arnhemensis* in the Northern Territory (Obendorf et al. 1998)
- *Riouxgolvania beveridgei* from the uropatagium of the common bent-wing bat (*Miniopterus schreibersi*) (Bain and Chabaud 1979).

In addition, larval *Durikainema* sp. have been found in the biting midge, *Culicoides victoriae* at Atherton in far north Queensland, in the same general region where *D. macropi* has been found in tree kangaroos.

A number of morphological features distinguish *H. perplexum* from these species of muspiceoid nematodes in Australian wildlife.

World distribution and occurrences in Australia

All known human cases of *H. perplexum* have occurred in Australia. Nine human cases *H. perplexum* are known from Australia, all arose either from Tasmania and/ or from tropical north Queensland (Koehler et al. 2016; Vos et al. 2016).

The global distribution is unknown. A parasite similar to *H. perplexum* was found in muscle fibres of a 14-year-old horse imported to Switzerland from Ireland (eight years previously) which was showing signs of difficulty chewing, muscular atrophy and severe chronic myositis (Eckert and Ossent 2006).

Epidemiology

Nothing is known of the life cycle of *H. perplexum*. Infection in humans may originate from vertebrates, invertebrates, plants, soil or water (De Ley and Blaxter 2002; Spratt and Nicholas 2002). It has been speculated that *H. perplexum* may have an arthropod intermediate host and that humans are an accidental host, or that humans become infected through consumption of undercooked bush-meat of infected native fauna (Koehler et al. 2016).

The only life cycle knowledge amongst members of the *Muspiceoidea* is from *Muspicea borreli*, which has a direct life-cycle in house mice. Infection is known not to occur by a transplacental, transmammary nor transseminal route and is suspected to occur via penetration of skin or mucous membranes possibly associated with allo-grooming (Spratt et al. 2002).

Male and female *H. perplexum* are minute and live inside individual muscle fibres. Eight to twelve eggs hatch inside the uterus of the female, develop to third-stage infective larvae and burst from the head region killing the adult nematode; this offers an efficient mechanism for auto-re-infection of a host. Nematodes subsequently invade uninfected muscle cells.

Clinical signs and diagnosis

Diagnosis in humans remains challenging. There is progressive muscle weakness, myopathy with eosinophilia and elevated creatine kinase (CK), which may become life threatening through marked bulbar and respiratory muscle compromise. Muscle biopsy shows eosinophilic polymyositis but no reaction within the invaded muscle cell itself. Molecular diagnosis using PCR (nuclear and mitochondrial markers) has been established (Koehler et

al. 2016). The phylogenetic relationships using nuclear and mitochondrial gene data contrast the findings obtained using morphological data (Koehler et al. 2016; Bain and Chabaud 1968,1979; Spratt and Nicholas 2002).

Treatment, prevention and control

In humans, albendazole may be given for a prolonged period. Steroid treatment of patients exacerbates their infections to a life-threatening illness and may delay diagnosis by masking a key diagnostic feature, peripheral blood eosinophilia and exacerbate pathogenesis (Dennett et al. 1977). As the life-cycle is unknown there are no current recommendations for prevention and control.

Research

Key research questions:

1. What is the origin of this nematode: vertebrate, invertebrate, plant, soil or water?
2. Is there any indication of a similar condition/infection occurring in horses in Australia?

Research activities/future directions:

1. Refinement of molecular diagnostic techniques in humans and use of these techniques to investigate other possible hosts.

Conclusions

Haycocknema perplexum is considered a zoonosis although the source of infection of humans - water, soil, plants or animals - remains unknown. Early human diagnosis by muscle biopsy is imperative in cases of progressive myopathy associated with blood eosinophilia and elevated CK.

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Acknowledgments

We are extremely grateful to the many people who had input into this fact sheet and would specifically like to thank David Spratt, Honorary Fellow, Australian National Wildlife Collection, CSIRO. Without their ongoing support production of these fact sheets would not be possible.

Updated: September 2018

To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

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