

Description of peritoneal cavity dirofilariosis caused by *Dirofilaria immitis* (Filarioidea: Onchocercidae) in a dog: a case report

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ABSTRACT: We describe *Dirofilaria immitis* occurring in the peritoneal cavity of a dog from Korea. Two worms were found in the fat of the umbilical cord area during operation for an umbilical cord hernia in a dog (four year old, female, Maltese). In gross findings, the worms were slender white and measured 132 mm (female), 111 mm (male). The tail of the male was spirally coiled. In light microscopy, the uterus was filled with not fully developed eggs. Scanning electron microscopy revealed that the cuticle was smooth on the head but those of the tail exhibited complex cuticular striation in the male. Head papillae were located in a cephalic plate forming a rectangular pattern dorsoventrally, with 4 inner labial papillae and four outer cephalic papillae. The mouth opening was very small and the bursal cavity was absent. Laterally there was a pair of amphids.

Keywords: dog; *Dirofilaria immitis*; peritoneal cavity

The genus *Dirofilaria* includes various species: *D. immitis*, *D. repens*, *D. ursi*, *subdermata*, *D. lutrae*, *D. roemari*, *D. corynodes*, etc. Those worms are natural parasites of dogs, cats, foxes and wild mammals. It is well known that identifying the species in this genus is difficult because of their sizes, proportions, spicules and caudal papillae. *D. immitis*, commonly known as dog heart worm, is a species occurring in the right ventricle and pulmonary artery of dogs. The worm is widely dispersed and found in the tropics, subtropics and temperate zones. Another naturally occurring species commonly encountered in the subcutaneous tissues of dogs is *D. repens* which has also been reported from different parts of the world (Soulsby 1982; Wright et al. 1989; Anderson 2000). Adult *Dipetalonema* spp. are usually found in the body cavity and subcutaneous tissue of the final host and the microfilariae in the blood stream. The vectors of the parasites are biting midges in the genus *Culicoides*. (Eberhard et al. 1979; Travi et al. 1985). *Dipetalonema* species are discriminated on the basis of the morphology of the spicules, vagina vera, area rugosa, the disposi-

tion of muscles in males and microfilariae (Petit et al., 1985; Bain et al., 1987; Notarnicola et al., 2007).

Dipetalonema reconditum is a spirurid nematode parasite that infects the subcutaneous tissues of dogs and cats in temperate and tropical countries worldwide (Tarello 2004). Unlike *D. immitis* in dogs and cats, *D. reconditum* differs in that it primarily infects the subcutaneous regions of the host rather than the heart (Holmes and Kelly 1973). It is difficult to distinguish *D. immitis* from *D. reconditum* in canine blood smears because of the similarity in their morphology, but PCR tests are now available. *D. reconditum* differs dramatically to other filarids in the vector and site of occurrence in the adult worm. *D. reconditum* is relatively harmless to the host and has only rarely been reported as an incidental finding in autopsies (Lindemann and McCall 1984).

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(Eberhard et al. 1979; Travi et al. 1985). The species of *Dipetalonema* are categorised based on the morphology of the spicules, vagina vera, area rugosa, the disposition of muscles in males and microfilariae (Petit et al. 1985; Bain et al. 1987; Notarnicola et al. 2007).

The present study describes the cuticular morphology of adult *D. immitis* from the peritoneal cavity of a dog in Korea.

Case description

In July 2011, two worms were found in the fat mass of the umbilical cord area during an operation for umbilical cord hernia in a dog (four year old, female, Maltese). The worms were tentatively

identified under the light microscope before precise classification using a scanning electron microscope (SEM). For light microscopy, the worms were placed in a lacto-phenol solution (glycerin 20 ml, lactic acid 10 ml, phenol 10 ml, distilled water 10 ml) for 24 h. After light microscopy, the worms were washed five times with 0.2M cacodylate buffer (pH 7.3). For the SEM, the parasites were fixed in 2.5% glutaraldehyde and post fixed in 1% osmium tetroxide. The specimens were dehydrated in a graded ethyl alcohol series, dried with CO₂ critical point, coated with gold and examined using SEM (S-4800, Hitachi) at 15kV.

In gross analysis, the worms were slender white and measured 132 mm (female), 111 mm (male). The tail of the female was straight, large and tapering and in the male it was spirally coiled (Figure 1).

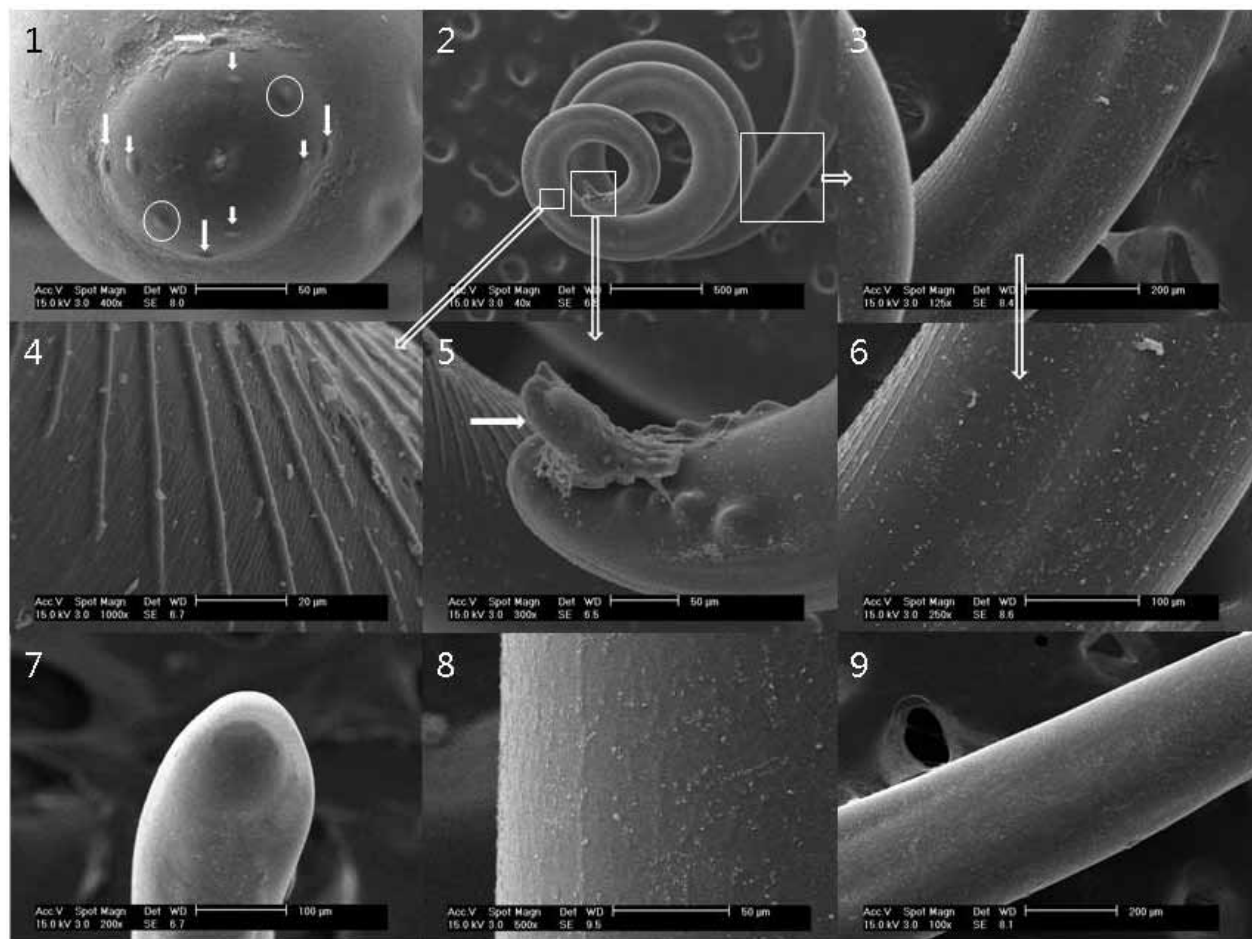


Figure. 1–9. SEM finding of *Dirofilaria immitis*. 1. The anterior end of male. A pair of amphid (circle), four labial papillae (small arrows) and four cephalic papillae (large arrows) are located on the raised ridge. 2. The posterior end of male is spirally coiled. 3, 6. Longitudinal ridges are more developed on the ventral aspect than on the lateral and dorsal aspect. 4. The transverse striation. 5. Spicle (arrow) and four pairs pre-anal papillae. 7. The anterior end of female has no marking. 8. The ventral view of the anterior region of tail. Longitudinal ridges were slightly seen. 9. The anterior aspect of female has no marking

Microscopy showed that the uterus was filled with eggs but that these were not fully developed and microfilaria could not be detected. The bursal cavity in both sexes was absent.

In SEM, the anterior end showed no difference between sexes in the papillae and cuticular patterns. The cuticle of the parasites had no marking. The head papillae lay on the raised ridge radiating out from the mouth opening with four inner labial papillae and 4 outer cephalic papillae. The pair of amphids were lateral (Figure 1). The mouth was simple and without lips. The cuticle was smooth on the head, midbody and tail region but the pattern of ridges and striations on the ventral portion of the coiled last tail of male was artistic (Figure 2). The midbody regions in both sexes had slit longitudinal ridges (Figure 8). The ornamental tail of the male is shown in Figures 2–6. The posterior end of the male was dramatically changed on a portion of the tail curve in the cuticular pattern and was characterised by longitudinal ridges and a more beaded appearance terminating just anterior to the coiled region. The beads on the dorsal portion of the first coil didn't continue anteriorly. However, on the tail of the female transverse cuticular striation and longitudinal ridges were not found (Figure 7). Four pairs of preanal papillae were also readily observed in the male (Figure 5).

DISCUSSION

Cuticular markings are key in the classification of *Dirofilaria* species. In this study we report a description of the cuticular morphology of adult *D. immitis* from the peritoneal cavity of a dog in Korea.

Ming and Brummer (1978) described the cuticular markings of five species of *Dirofilaria*; *D. immitis*, *D. repens*, *D. tenuis*, *D. corynodes* and *D. magnilarvatum*. The anterior end of the five species showed no differences between sexes while cuticular patterns did show differences among the species. They pointed out that the cuticle of the anterior end was without marking only in *D. immitis*. This pattern was also observed in our study. The four *Dirofilaria* species all had transverse cuticular striations on the midbody region except for *D. immitis*. The members of the subgenus *Nochtiella* had prominent longitudinal ridges. In *D. immitis*, the pattern of ridges and striations on the ventral portion of the coiled last tail in the male was artistic. This pattern was unlike those of other *Dirofilaria* species.

A previous report reported variation in the number and arrangement of the preanal papillae based on micrographic observation of the tails of two males (Ming and Brummer 1978). In this study we could observe four pairs of preanal papillae in the tails of a male *D. immitis*.

The genus *Dirofilaria* includes various species: *D. immitis*, *D. repens*, *D. ursi*, *subdermata*, *D. lutrae*, *D. roemari*, *D. corynodes*, etc. These worms are natural parasites of dogs, cats, foxes and wild mammals. It is well known that identifying the species in this genus is difficult because of their sizes, proportions, spicules and caudal papillae. *D. immitis*, commonly known as dog heart worm, is a species which occurs in the right ventricle and pulmonary artery of dogs. The worm is widely dispersed and found in the tropics, subtropics and temperate zones. Another naturally occurring species commonly encountered in the subcutaneous tissues of dogs is *D. repens* which has also been reported from different parts of the world (Soulsby 1982; Wright et al. 1989; Anderson 2000). Adult *Dipetalonema* spp. are usually found in the body cavity and subcutaneous tissue of the final host and the microfilariae in the blood stream. The vectors of the parasites are biting midges of the genus *Culicoides* (Eberhard et al. 1979; Travi et al. 1985). The species of *Dipetalonema* are discriminated by the morphology of the spicules, vagina vera, area rugosa, the disposition of muscle in males and microfilariae (Petit et al. 1985; Bain et al. 1987; Notarnicola et al. 2007).

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