Aelurostrongylus abstrusus – a cause of respiratory disease¹⁾

MARIA B. STUDZIŃSKA, MARTA DEMKOWSKA-KUTRZEPA,
RENATA KOMSTA*, KRZYSZTOF TOMCZUK, ALEKSANDRA KRUCZEK**,
ANDRZEJ JUNKUSZEW***, PAULINA DUDKO***

Department of Parasitology and Invasive Diseases, Faculty of Veterinary Medicine,
University of Life Sciences in Lublin, Akademicka 12, 20-033 Lublin, Poland

*Laboratory for Radiology and Ultrasonography, Department and Clinic of Animal Surgery, Faculty of Veterinary Medicine,
University of Life Sciences in Lublin, Głęboka 30, 20-612 Lublin, Poland

**student of the Faculty of Veterinary Medicine, University of Life Sciences in Lublin, Poland

***Department of Small Ruminants Breeding and Agriculture Advisor, Faculty of Biology, Animal Sciences and Bioeconomy,
University of Life Sciences in Lublin, Akademicka 13, 20-033 Lublin, Poland

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Summary

The data on the invasion of *Aelurostrongylus abstrusus* in domestic cats is limited, both for Europe and for the rest of the world. The diagnosis is difficult and the invasion is often not considered in the differential diagnosis of respiratory diseases. Consequently, this invasion is diagnosed late and leads to the death or euthanasia of the animals as the infection is usually asymptomatic. During an intensive invasion, symptoms of the respiratory system disorders and sometimes diarrhoea and anorexia may be observed. A 7-year-old cat, treated in a veterinary clinic in Poland showed the signs of a chronic cough, shortness of breath, nasal mucopurulent discharge, accelerated breathing and a loss of appetite. The first diagnosis was pneumonia. Additionally, parasitological examination was used by a standard flotation technique and decantation method. The flotation test result was negative, the decantation method revealed the presence of one *A. abstrusus* larva. In order to confirm the diagnosis we used the Baermann's method. The result was positive, larvae were counted and identified basing on their morphology and morphometry, which demonstrated numerous L1 larvae of *A. abstrusus*. Aside from the symptomatic treatment, a causal cure using a combination of 10% imidacloprid and moxidectin 1% spot-on was applied. The control examination of faecal samples was performed using the Baermann's method 7, 14, 30 and 60 days after therapy. One and two weeks after the treatment had found larvae, whereas no larvae were found 30 days and 60 days after therapy. The health status of the cat began to return to normal. A parasitology examination performed 6 months after the completion of treatment failed to confirm the presence of *A. abstrusus* larvae. The cat is under constant medical supervision and in spite of recurrent symptoms its state of health is stable.

Keywords: *Aelurostrongylus abstrusus*, aelurostrongylosis, diagnosis, lungworm, treatment

Cats which spend some time outdoors are exposed to various infections. It should be stressed that the parasites which are often overlooked during diagnosis may cause pulmonary and cardiovascular disorders. A wrong diagnosis or delayed treatment may lead to the death of the host. *Aelurostrongylus abstrusus* (Nematoda, Strongylida) is a nematode which lives in the bronchi and alveoli (1, 7, 9). Females are 10 mm to 14 mm long and males 6 mm to 7 mm (11). Larvae L1 reach the length of 360 to 390 µm and have characteristically

notched and S-shaped tips at the posterior (1, 26). Cats and felines are the definitive hosts, whereas a variety of slug and snail species (for example *Agriolimax* sp., *Helicella* sp., *Helix* sp., *Lavantina* sp., *Limax* sp., *Retinella* sp., *Theba* sp.) are intermediate hosts. Paratenic hosts such as small mammals, rodents, birds, lizards and frogs play an important role in the spread of invasion (1). Cats may become infected by eating the intermediate or the paratenic hosts containing L3 larvae (1). These larvae penetrate the lining of the oesophagus, stomach and upper intestine and migrate to the lungs. The prepatent period is 39 days (1, 11).

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The diagnosis of invasion is difficult, because clinical signs are not characteristic. The infection is usually asymptomatic. However, in the case of an intensive infection of the respiratory system, symptoms such as a chronic cough, dyspnea, nasal discharge, accelerated breathing, loss of appetite and sometimes diarrhoea and anorexia may be observed (4, 18, 23). The laboratory diagnosis during the prepatent period also presents difficulties due to the lack of diagnostic tests. The diagnosis of the invasion is based on the examination of faeces using the Baermann's technique, or standard saturated salt solution flotation technique with zinc chloride and sodium chloride (specific gravity, 1.3) (4) which is based on finding characteristic L1 larvae. Carrying out such a test is only possible during the patent period (1).

Aelurostrongylus abstrusus is a cosmopolitan parasite found not only in Europe but also in North and South America, Africa and Australia, where in most cases its diagnosis has only been possible as a result of pathological examinations. In recent years in several European countries, including Italy, Spain, Portugal, Germany, Denmark and Hungary, an increase in the number of cases of invasion of nematode has been observed (5, 17, 19, 25, 27). In Albania, the prevalence of the nematode in cats is 50% (15). In other countries, the prevalence attains double figures in several cases: Germany – 6.6% (4), Romania – 14.1% (16), Denmark – 15.6% (18), and Italy – 16-18.5% (27). The prevalence of this nematode in Eastern Europe is not known. Our report seems to be especially important because so far in the few cases noted in Europe all the animals were diagnosed too late, which led to their death or euthanasia (9, 21).

The occurrence of *A. abstrusus* in wild felids is quite rare. In Europe, this nematode was recorded only in the Iberian lynx (*Lynx pardinus*) from Spain and the Eurasian lynx (*Lynx lynx*) from Switzerland and Poland. The first record of *A. abstrusus* in Poland was described in the Białowieża Primeval Forest in 2001-2004. At that time 38 faecal samples were analysed using decantation and flotation methods. The prevalence was 21.05% and the intensity of invasion ranged from 1 to 33 larvae per sample (an average of 11.6) (24).

Case description

In April 2015 a 7-year-old male cat of European breed, short-haired, weighing 5 kg with symptoms of respiratory disease with dyspnea was examined in the Veterinary Clinic of the University of Life Sciences in Lublin. The findings of clinical examination were emaciation and apathy as the cat had been sleepy for a few months and had lost its appetite. The clinical examination also revealed intense coughing, mucopurulent discharge, dyspnea, wheezing and normal temperature without enlarged peripheral lymph nodes. The radiographic examinations at the Laboratory of Radiology and Ultrasonography showed caudal displacement of a flattened diaphragm, and intercostal space. The major fundamental changes in lung tissues included thickening of bronchial walls, which made it difficult to distinguish the pulmonary vessels. Additionally, atelectasis in the right middle lobe and moderately enlarged

tracheobronchial lymph nodes were found. All the changes in the thorax indicated an advanced chronic feline lower airway disease. The cat needed computed tomography, but due to its poor clinical condition its owner did not accept anaesthesia.

Fig. 1. Right lateral thoracic radiograph of the cat. There is prominent bronchial wall thickening. Additionally tracheobronchial lymph nodes are enlarged

Fig. 2. *Aelurostrongylus abstrusus* L1 larvae of obtained by the Baermann's method

Fig. 3. First stage larva (L1) of *Aelurostrongylus abstrusus* with a characteristically notched and S-shaped tip at the posterior end

The clinical symptoms and X-ray results led us to diagnose pneumonia (Fig. 1). The haematological examination indicated leukocytosis, lymphocytosis, an acute eosinophilia, elevated hematocrit, and a lower RDW. The other haematology values were normal.

Additionally, parasitological examinations of the faeces were performed in the Department of Parasitology and Invasive Diseases, University of Life Sciences in Lublin. Faecal samples were examined for gastrointestinal parasites and lungworm nematodes. The examinations involved a standard saturated salt solution flotation technique with a sugar solution (specific gravity = 1.2) and decantation method. The flotation test result was negative, the decantation method revealed the presence of one *A. abstrusus* larva. In order to confirm the diagnosis we used the Baermann's method (11). The result was positive (Fig. 2, 3), larvae were counted and identified based on their morphology and morphometry, which demonstrated numerous L1 larvae of *A. abstrusus* (3 larvae in 1 g of faeces). A causal treatment of *A. abstrusus* was introduced using a combination of 10% imidacloprid and moxidectin 1% spot-on (Advocat®).

The control examination of faecal samples was performed using the Baermann's method 7, 14, 30 and 60 days after treatment. One week after the treatment had begun the number of excreted L1 larvae increased: a 70 g sample contained 1,381 larvae (20 L1 larvae/1 g of faeces). However, after 2 weeks of treatment, a 50 g sample contained only one L1 larva, whereas no larvae were found 30 days and 60 days after treatment.

The health status of the cat began to return to normal, coughing and shortness of breath abated, and the cat regained vigour and the desire to play. A good state of health remained for the next four months, but thereafter the disorders of the respiratory tract reoccurred. A parasitology examination performed 6 months after the completion of treatment failed to confirm the presence of *A. abstrusus* larvae. The cat is under constant medical supervision and in spite of recurrent symptoms its health state is stable.

Discussion

Cats and felines in contact with the external environment should undergo periodical parasitological examinations including larvoscopic methods which cannot be overlooked especially when changes in the respiratory system are present.

Classical coprological methods used for the diagnosis of lungworm are not always effective as it has been proved by the research of the other authors where in the routine examination the prevalence amounts to 0.5-1%, while in the specific section tests it is decidedly higher (10-15%) (4). The diagnostic difficulties arose due to various factors, including the life cycle of the nematode, the lack of (commercially available serological or DNA) diagnostic tests, the irregular excretion of larvae and lack of characteristic symptoms.

The data from literature confirms that quite frequently in cats the lack of typical symptoms is noted (28). The respiratory signs are often observed in young, debilitated and immunosuppressed cats and are connected with a disorder of the respiratory system (29). Additional diagnostic difficulties are due to irregular excretion of

the larvae *A. abstrusus* into the environment. Barutzki and Schaper (4), in their research analysis considering the seasons, observed higher infection rates in winter than in summer (most of the larvae in the faeces occurs in January). The next difficulty is connected with application of the appropriate coprological method. The samples were examined using the flotation technique with sugar solution (specific gravity 1.2), zinc sulphate solution (1.35 s.g.), salt solution with zinc chloride and sodium chloride (1.3 s.g.) (4, 27). While a number of scholars apply the standard decantation method (24) our own research indicates that this method is imprecise, since using this method detected only a single larva. In our research, contrary to the decantation method, the Baermann's method was the most effective, revealing a larger number of larvae. The effectiveness and usefulness of this method is confirmed in the research of other authors who additionally recommend the examination of the faeces samples taken on the three consecutive days (4, 27). The data from literature confirms that *A. abstrusus* larvae have also been found with the application of the flotation technique with zinc sulphate solution (1.35 s.g.), or salt solution with zinc chloride and sodium chloride (1.3 s.g.) (27). For example, Barutzki (4) found *A. abstrusus* larvae with a prevalence of 6.6% using the flotation method with salt solution with zinc chloride and sodium chloride (specific gravity 1.3). However, the application of the flotation technique with sugar solution brought negative results for *A. abstrusus*, which confirms our own results. In our own research, *A. abstrusus* larvae have not been found with the usage of the flotation technique with sugar solution. In recent years in some European countries, despite the diagnostics difficulties, the rise in the prevalence of *A. abstrusus* in cats and the endemic appearance of this invasion have been observed (4, 25). It was also shown that the PCR was able to identify parasites in actually infected cats where the classical diagnostic was negative (29). Similarly the serological detection of specific antibodies against *A. abstrusus* using ELISA represents a valid alternative for reliable individual diagnosis of *A. abstrusus* in cats (30).

In some countries mixed invasions of *A. abstrusus* and *Troglostrongylus* sp. in cats have been observed (6, 8). In both cases these nematodes may cause similar clinical symptoms corresponding to respiratory system disorder. Even though L1 *A. abstrusus* and *Troglostrongylus* sp. larvae are morphologically similar they might be diversified in a detailed analysis based on the body length (a mean value of 399.1 µm and 338.8 µm for *A. abstrusus* and *T. brevior*, respectively), the position of the oral opening (terminal for *A. abstrusus* and sub-terminal for *T. brevior*) and the tail morphology (an evident knob-like appendage for *A. abstrusus* and a less pronounced knob-like appendage for *T. brevior*) (2).

Various drugs are used for the treatment of aelurostrongylosis in cats, e.g.: 45 mg selamectin; a combination of fipronil 8.3%, (S) – methoprene, 10% eprinomectin 0.4% and 8.3% praziquantel; or 18.75% fenbendazole (8, 10, 13, 14, 26, 27). According to Roberson and Burke (20)

fenbendazole at 50 mg/kg bw provides a positive effect over more than three consecutive days. Similar effects were reported by Hamilton (12), Schmid and Duewel (22) and Barrs et al. (3). More recently Traversa et al. (26) published a report of successful elimination of *A. abstrusus* larvae involving the 18.75% fenbendazole paste administered in the same manner as mentioned above. These examinations confirmed the efficacy of a macrocyclic lactone moxidectin (in combination with imidacloprid) (26), and emodepside (29), both administered once as a spot-on. All products successfully eliminated *A. abstrusus* and the application of a spot-on treatment for cats was suggested as easier to use in comparison to orally administered drugs.

Cats and felines that are in contact with the external environment should undergo periodical parasitological examinations including larvascopic methods which specifically cannot be overlooked when changes in the respiratory system of the animal are observed.

Considering the case reported in this paper it is worth noting that an accurate diagnosis at an early stage of the disease is difficult. Aelurostrongylosis should include appropriate PCR or ELISA tests which are important in the diagnosis of this invasion. The data from literature as well as our own research suggest that *A. abstrusus* may be effectively eliminated with the application of the available medicine. Regularly administered anti-vermin products may protect the animal against this invasion. As our case report shows the importance of an accurate diagnosis and appropriate treatment to save the life of infested animals cannot be overestimated. Therefore, the broad view of respiratory diseases should also include parasitic invasions.

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Corresponding author: Maria Studzińska, DVM, PhD, Akademicka 12, 20-033 Lublin, Poland; e-mail: maria.studzinska@up.lublin.pl