



PROCEEDINGS

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ANGIOSTRONGYLUS VASORUM IN DOGS: THE UNSUSPECTING KILLER

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Angiostrongylus vasorum also known as "French worm" is a Nematode that is located at the adult stage in the lungs of dogs and other canids such as foxes (the main reservoir) and wolves. In Europe, this parasite has recently become a priority for veterinarians because of a number of reasons^{1,2}. First, *A. vasorum* is spreading by increasing its prevalence in regions already known as endemics and reaches areas previously exempt. Secondly, Angiostrongilosis has a serious and significant impact on the health of infested dogs. Thirdly, although therapy is often simple and successful, proper diagnosis can be problematic or inadequate.

BIOLOGY

Angiostrongylus vasorum has an indirect life cycle that is based on land gastropods (slugs and snails) as intermediate hosts. Some animals, such as amphibians and birds, can act as paratenic hosts. The *A. vasorum* first generation larvae (L1) reach the environment through the feces of infested dogs and penetrate into the foot of the competent gastropods, reaching the third stage (L3), the infectious stage for vertebrates at risk. Dogs are infected by swallowing the intermediate host for direct predation or for accidental swallowing during digging or while eating grass, or very seldom eating a paratenic host. After ingestion, the L3 penetrate the intestinal mucosa, migrate to the mesenteric lymph nodes, where they molt twice to the pre-adult stage, then reach the right ventricle and pulmonary arteries through the lymphatic vessels. Worms reach the adult stage into the pulmonary arteries. The eggs laid by adult *A. vasorum* females disclose the L1 larvae that penetrate into bronchioles and alveoli through the lung capillaries, thus exploiting the ciliary mucus clearance and following coughing are ingested and then released with feces in the environment. The prepatent period ranges from 1 to 4 months, with an average of 1–2 months.

GEOGRAPHICAL DISTRIBUTION

Angiostrongylus vasorum has long been considered to have a leopard stain distribution exclusively in certain endemic European regions such as southwestern France, south of the UK, Denmark and Switzerland, with occasional and sporadic reports outside these areas. Over the last decade, there has been an increase in the number of cases documented in the classically endemic territories, and at the same time, new infection outbreaks have appeared in several previously endemic countries and areas. For example, in the United Kingdom, *A. vasorum* is spread throughout the country, and increased reports of individual clinical cases or significant prevalence rates have been reported in the North (Denmark) and Central Europe (Poland, Germany) and in the Mediterranean area (Greece, Italy)^{1,2}. In addition, the first indigenous cases of Angiostrongilosis in eastern countries (Slovakia and Serbia) have been described. Other European countries where *A. vasorum* has been recently found or is endemic with variable rates are Belgium, Hungary, Finland, the Netherlands and Spain¹. Veterinarians should always remember that the supposed absence of *A. vasorum* in a given geographical region does not imply that the parasite is really absent. Therefore, the geographical area should not be considered as a criterion for including or excluding *A. vasorum* in dogs with compatible clinical signs.

CLINICAL SIGNS

All dogs of all ages and breeds are potentially at risk of infection throughout the whole year. However, younger dogs (under 2 years) are at higher risk, probably due to the behavior that leads them to swallow more often the intermediate host. Even some breeds (Bull Terrier, American Staffordshire, Labrador, Beagle, Cavalier King Charles, Jack russel) are most likely reported to be infected for the same reason such as hunting dogs and truffles searching dog for lifestyle. Clinical forms can occur throughout the whole year but winter and spring are the seasons in which they are more frequently

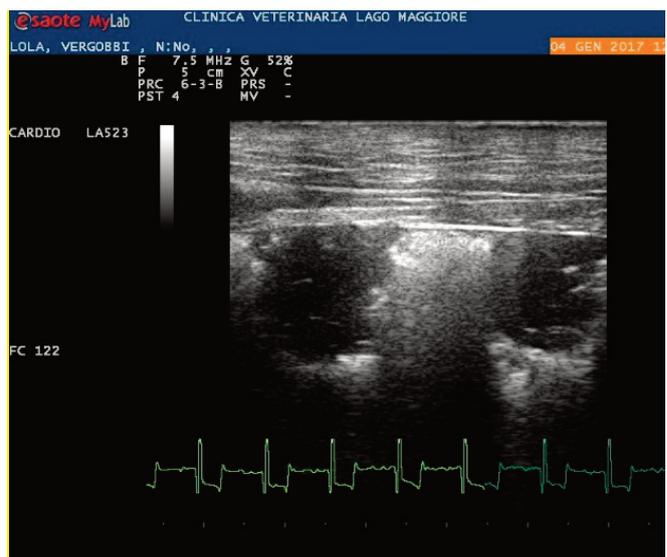
observed due to the length of the prepatent period. Clinical manifestations of angiostrongilosis in the dog are usually acute, but many subjects may live with infestation without apparent symptoms for a long time, and in some cases suddenly present serious clinical forms³. The most common clinical scenario is characterized by respiratory symptoms: cough, dyspnea, tachypnea, pulmonary hypertension (Cor pulmonale), tachycardia, pale mucous membranes and syncope. Pulmonary hypertension is less commonly observed and usually disappears after treatment but significant increases in pulmonary pressure values are possible and associated with poor prognosis. *A. vasorum* often causes coagulation disorders. Affected dogs may have petechiae or ecchymosis, but also spontaneous bleeding forms the nose, hematomas, post-surgical hematomas, anemia and / or chronic thrombocytopenia^{3,4}. Potentially fatal hemorrhages may occur in the central nervous system⁵.

DIAGNOSIS

Canine angiostrongilosis should always be included in differential diagnosis in dogs that also have a single compatible clinical sign, regardless of whether the parasite is endemic or not in a given area, or if it is more likely that pathologies more frequently diagnosed in the past (taking it is noteworthy that a large part of the dogs as in most parasitic diseases can be asymptomatic or with subclinical symptoms.) A definitive diagnosis can only be obtained by detecting *A. vasorum* larvae (L1) in the feces and/or circulating antigen of the parasite in serum of the infected dogs⁶.



Clinical examination, thoracic radiographs echocardiographic findings can lead to a strong suspicion. The same applies to hematologic or biochemical results. Specifically, at the radiograph level, the most commonly detected pattern is a focal interstitial pulmonary with centripetal distribution sometimes associated with increased size of the major pulmonary artery^{3,4}.



On lung sonography sub-pleural nodular-focal lesions are the typical pattern

TREATMENT AND CONTROL

The treatment is based on the use of benzimidazoles (Fenbendazole) and some macrocyclic lactones (Moxidectin, Milbemycin oxime). Fenbendazole oral at 25-50 mg / kg for 5-21 consecutive days is an effective and well-received treatment, although in many countries this molecule has no claim for the treatment of *A. vasorum*^{3,4}. At present, in Europe, medicines authorized for the treatment of angiostrongylosis in the dog are two: the milbemycin / praziquantel oral combination and the imidacloprid / moxidectin in spot formulation. Although it is evident that activity against parasites is carried out by macrocyclic lactones in these associations. Symptomatic therapy that may be associated varies in relation to each clinical scenario. In dogs with severe dyspnea, oxygen supplementation, corticosteroids and bronchodilators may reduce the severity of the symptoms. Corticosteroids at immunosuppressive doses may also be useful for the treatment of secondary immune mediated thrombocytopenia. Fresh whole blood transfusion or frozen plasma is indicated in dogs with hemorrhagic diathesis while inhibitors of type 5 phosphodiesterase (sildenafil) in case of severe pulmonary hypertension. The routine use of heparin therapy in case of DIC secondary to infestation due to the underlying inflammatory state is questionable and not recommended. Dogs at risk of infection, especially those living in the same environment in which they have been reported, even earlier, individual clinical cases should undergo chemoprophylaxis. Again, monthly administration of Moxidectin in spot formulation and Milbemycin oxime in oral formulation are considered effective. The use of specific poisons against slugs and snail for environmental prophylaxis must be avoided because it does not guarantee a true reduction of the gastropod populations, being at the same time dangerous for the environment and for dogs, and leading also paradoxically to a more frequent access of dogs to the dead snails^{1,2}.

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