

## Two serious conditions, one sudden loss: mesenteric volvulus and dirofilaria immitis in a dog

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Article Info	Abstract
<b>Article history:</b>  Received: 12 March 2024 Accepted: 11 September 2024 Available online: 15 February 2025	Sudden death has been thoroughly well defined and investigated in human medicine and its definition is not as rigorously established in veterinary medicine. In this case a 7-year-old German Shepherd was brought to the Small Animals Clinic of the Faculty of Veterinary Medicine at the University of Belgrade in very poor state. Despite treatment, the dog died 15 min after being admitted to the clinic. Since poisoning was suspected, the owners requested an autopsy. The dog was taken to the Department of Forensic Veterinary Medicine, Faculty of Veterinary Medicine, University of Belgrade for necropsy. Pathomorphological examinations revealed rupture of the mesentery with mesenteric volvulus. In addition, a large number of adult forms of <i>Dirofilaria immitis</i> were found in the right atrium, ventricle and in <i>truncus pulmonalis</i> . Further examinations of the respiratory system revealed clusters with partially degraded adult parasites in the lobes. The dog died due to mesenteric volvulus which was a rare finding, with an even rarer finding that was lung nodules with adult <i>D. immitis</i> parasites.
<b>Keywords:</b>  Dirofilariosis German Shepherd Mesenterium Necropsy	© 2025 Urmia University. All rights reserved.

### Introduction

Gastric and intestinal displacements are major causes of sudden death in dogs.<sup>1</sup> Mesenteric volvulus is usually a fatal intestinal disorder where the bowel is twisted on its mesenterial axis.<sup>2</sup> Mesenterial rupture and intestine twisting cause compression of the blood vessels, intestinal lymphatic vessels and mesenteric plexus of nerves.<sup>3</sup> The cause of this condition in dogs is not clear yet, however, various predisposing factors such as breed, exercise, abdominal trauma, intestinal surgery, foreign bodies and intestinal infections have been identified. This disease can occur in many dog breeds such as Great Danes and Bloodhounds, and based on the literature German Shepherd dogs and Belgian Malinois are more predisposed compared to other breeds.<sup>4,5</sup> When it comes to survival rates, nearly all German Shepherd dogs with mesenteric volvulus died, whereas, other breeds such as Great Dane, mongrel dog and Doberman had higher survival rates.<sup>5</sup>

*Dirofilaria immitis* is nematode that primarily inhabits the pulmonary arteries of dogs. Depending on the number of parasites present and the animal's overall condition,

symptoms may develop over the course of years. The clinical presentation is typically characterized by chronic coughing, which may progress to dyspnea, and weakness. In advanced stages, right-sided heart failure develops, accompanied by ascites and anorexia. Death is usually preceded by respiratory distress and cachexia.<sup>6</sup>

The aim of this study was to present an example of complicity of diagnosis when dog suffer from different diseases at the same time. In this case a dog with mesenterial rupture, had additional health condition, severe dirofilariasis. It is important to illustrate the complexity of the case, taking into account the fact that dogs can suffer from more than one disease.

### Case Description

A 7-year-old, intact, male German Shepherd dog was presented with history of 8 hr of lethargy, loss of appetite and vomiting. All required vaccines were up to date, although regular ectoparasitic protection had not been performed. Based on the owner's anamnesis there was no history of trauma and the dog had not previously

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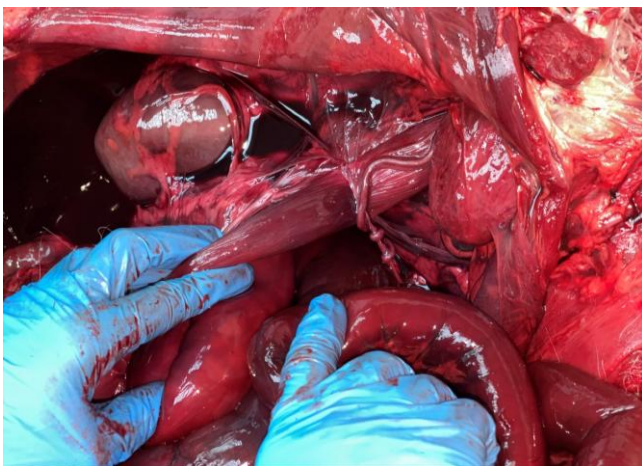
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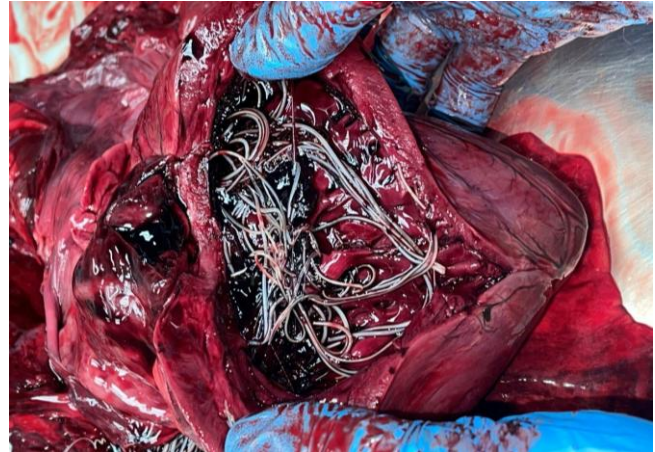
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displayed any symptoms of cardiovascular or gastrointestinal disease. The owner suspected that the dog was poisoned even though it was unlikely because he was kept in his cage in the yard. On presentation, the dog was minimally responsive, hypotensive, hypothermic with pale mucous membranes and a poor femoral pulse. Abdominal distension and abdominal pain were noted on clinical examination. Since the dog was admitted in a state of severe shock, anti-shock therapy started immediately. Unfortunately, the patient died 15 min after being admitted to the clinic. Laboratory post-mortem findings revealed stress leucogram, eosinophilia [Mindray BC-5000 Vet analyzer (Mindray, Shenzhen, China)], mild azotemia (urea 14.50 mmol L<sup>-1</sup>), hypoproteinemia and hypoalbuminemia [Mindray BS-240 (Mindray)].

Post mortem examinations revealed that the dog was in a good body condition. After skin removal two focal hemorrhagic areas on the right side of the abdomen wall were observed. After opening the abdominal cavity, a large amount of blood (approximately 1.50 L) was observed. The topographical position of the organs was unusual. The omentum was not covering the organs, however, was beneath them. The spleen, although not enlarged, was on the right side of the abdomen. The entire intestines were distended and dark red to almost black in color. After examination of abdominal organs, rupture of the mesentery was observed with the intestine volvulus and blood vessels occlusion (Fig. 1). Intestinal mucosa was diffusely hyperemic with hemorrhagic areas. After examination of the heart, adult heartworms were found in the pulmonary artery, right ventricle and right atrium (Fig. 2). Examination of the lungs revealed a large number of diffusely distributed nodules containing adult nematodes. The nodules with parasites were present in all lobes, however, mostly distributed in the right and left caudal lobe. When the nodules were dissected, 10 - 12 parasites were found inside each of them (Fig. 3).



**Fig.1.** Mesentery rupture with the intestine volvulus and blood vessels occlusion.



**Fig. 2.** *Dirofilaria immitis* in right ventricle and right atrium.



**Fig. 3.** Nodules with parasites in lungs.

The lung tissue was changed, hyperemic and with the changed consistency (rubbery). Examination of kidneys showed massive bleeding in the renal pelvis. No other gross pathological changes and no pathomorphological changes that would indicate poisoning were observed. Toxicological examination of gastric content was negative.

The collected nematodes from the lungs were transported to Department of Parasitology, Faculty of Veterinary Medicine for further identification which was performed using a light microscope (CX23; Olympus Corp., Tokyo, Japan). Prior to morphological identification, parasites were immersed in lactophenol solution for 24 hr to clear them (Sigma, St. Louise, USA). Most of the parasites collected from nodules were torn apart and inadequate for appropriate morphological identification. The parasites that were apparently preserved and had both ends of the body were in various stages of degeneration and were used for identification. The helminths had a long whitish filiform body, measured from 180 to 210 mm in length and 0.65 to 0.70 mm in width. Microscopically, a distinctive cuticular structure for filarial parasites was observed in the sample as well as the existence of transverse striations of various thicknesses. In



the anterior end of the parasite clearly recognizable four pairs of cephalic papillae as well as a long, cylindrical esophagus were observed. However, there was no a clear border between the muscular and glandular regions. In uteri of a few female nematode's microfilaria were found (Fig. 4). After extraction from the uteri, microfilariae were stained with Methylene-Blue (Sigma) and observed under light microscope. The microfilariae exhibited a pointed cephalic extremity and a straight tail with a pointed end corresponding morphologically to those of *Dirofilaria immitis* (Fig. 5). The body length of microfilaria ranged from 241 to 310  $\mu\text{m}$ . Based upon these morphological characteristics, the helminths were identified as *D. immitis*.



**Fig. 4.** Adult *Dirofilaria immitis* extracted from the lung nodules containing microfilariae in the uterus.



**Fig. 5.** Microfilaria recovered from the uterus of adult *Dirofilaria immitis* and stained with methylene blue possessing a pointed anterior extremity and a straight tail.

## Discussion

When a patient dies just a few hour after the onset of clinical symptoms of the disease, it is important to determine the cause of death and to eliminate possible poisoning as one of the main differential diagnoses. In this case, the owners suspected that their dog was poisoned,

however, the necropsy revealed that there were no signs of poisoning. Mesenteric volvulus is a severe and often fatal intestinal condition characterized by the twisting of the bowel around its mesenteric axis. This twisting, along with mesenteric rupture, leads to compression of blood vessels, intestinal lymphatic vessels, and the mesenteric nerve plexus<sup>3</sup>. Also, male dogs have been affected more than female dogs. This condition has acute onset and death is the consequence of a cascade of pathophysiological mechanisms including vascular obstruction, endotoxemia and shock.<sup>2,4</sup> Due to its fast development, there are no pathognomonic clinical signs that can be recognized in dogs with mesenteric volvulus.<sup>2</sup> Different clinical signs were described in the literature, but the most frequently noticed were acute vomiting, abdominal pain, hematochezia, abdominal distension and hypersalivation.<sup>4,5,7</sup> The diagnosis is based on clinical examination, ultrasonography, radiography and explorative laparotomy. A high mortality rate is associated with mesenteric volvulus with a prevalence of 58.00 - 100 %.<sup>8</sup> Consistent with what was described in the literature, sudden death was noticed in the present case, where the dog died within the first 8 - 9 hr from the onset of the first symptoms.

The etiology of this case was still uncertain. The owner stated that the dog had no history of surgical or medical treatment, such as gastropexy, abdominal surgery, gastrointestinal diseases or administration of nonsteroidal anti-inflammatory drugs. Although the owner of the dog did not report any kind of severe mechanical trauma, the potential cause of mesenteric rupture in this dog could have been blunt force trauma due to large hemorrhagic areas present on the abdominal wall. Extensive bleeding in the intestines as well as a huge amount of blood in the stomach were in accordance with literature data, where, shock was the most common cause of death in dogs with this condition.

When it comes to parasitology findings, *D. immitis* can cause severe cardio-pulmonary disorders in dogs and cats affecting pulmonary artery and the right heart ventricle.<sup>6</sup> In this case, the helminths were found in the pulmonary artery, right ventricle as well as in right atrium. Also, during autopsy, parasites were found in numerous nodules diffusely distributed throughout both lungs. Lungs nodules associated with *D. immitis* are often reported in human patients.<sup>9-11</sup> In canine dirofilariasis, lungs are variably affected with pathological changes of the pulmonary blood vessels, by proliferation of intima, dilatation and then by changes of lungs parenchyma consisting of hemorrhage, hemosiderosis, chronic inflammation and fibrosis.<sup>12</sup> Due to tissue lysis, histopathology could not be done, therefore, there is no information on whether tissue organization around the parasites occurred or whether they just accumulated in the blood vessel and became macroscopically visible as a nodule, as well as whether and what effect this had on the lung tissue and organism as a whole.

However, such a pathomorphological finding in dogs is not a frequent occurrence. The clinical signs of dirofilariasis vary widely from asymptomatic to congestive right heart failure. Evolution of the disease in dogs is usually chronic, but it can be life-threatening. Depending on the duration of infection, helminths burden, host-parasite interaction and exercise, symptoms develop gradually and may begin with chronic cough. This is followed by dyspnea, abnormal pulmonary and heart sounds. In the later stage of disease, the cardiac congestive failure and caval syndrome develops. Although it is not common, the disease can lead to sudden death which is preceded by respiratory distress. Life-threatening dyspnea and hemoptysis can occur as a result of thromboembolism caused by deceased parasites.<sup>13</sup> The owners did not report the existence of previous symptoms that could be associated with cardiovascular insufficiency or pulmonary embolism, although massive, the infection by parasites cannot be considered as the main cause of death. Even though mesenteric volvulus is a sufficient cause of sudden death, a severe infection with *D. immitis*, in conjunction with shock and changes in lung hemodynamics most likely led to a faster consequence.

This report showed an unusual pathomorphological finding in the lungs of a dog that died due to mesenteric volvulus. To the best knowledge of the authors, the finding of adult *D. immitis* in the lung nodules of a dog that did not show symptoms of cardiovascular or respiratory failure has not been reported so far.

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### Conflict of interest

The authors declare that no competing interests.

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