Acute haemoabdomen associated with *Angiostrongylus vasorum* infection in a dog: A case report

Willesen, J.L.,Bjornvad, C.R. and Koch, J.

Department of Small Animal Clinical Sciences, Faculty of Life Sciences, University of Copenhagen, Dyrlaegevej 16, 1870 Frederiksberg C, Denmark

Abstract

A one-year-old intact female, Danish shorthaired pointer was referred to the emergency service with a history of acute collapse and pale mucous membranes after a month of reduced activity but with no other clinical signs. An ultrasound examination of the abdomen indicated the presence of a large amount of free fluid with no obvious cause such as neoplasia or splenic rupture. Fluid analysis had the macroscopic appearance of blood with no signs of infection or neoplasia. Multiple *Angiostrongylus vasorum* L1 larvae were revealed on a direct rectal faecal smear. The dog was treated with fenbendazole 25 mg/kg orally once daily for 20 days and given supportive treatment. The dog was stabilised on this treatment. Haemoabdomen is a clinical sign where surgical intervention is often considered an integral part of the diagnostic investigation (i.e., *laparotomy*) or treatment. Failing to make the diagnosis of canine angiostrongylosis before performing surgery may have a serious adverse affect on the outcome. Consequently, in areas where *A. vasorum* is enzootic, a Baermann test and a direct faecal smear should be included in the initial diagnostic investigation of all dogs presenting with bleeding disorders of unknown origin.

Keywords: *Angiostrongylus vasorum*, coagulopathy, haemoabdomen, treatment

Corresponding author:

Jakon L Willesen
Department of Small Animal Clinical Sciences,
Faculty of Life Sciences, University of Copenhagen,
Dyrlaegevej 16, 1870 Frederiksberg C, Denmark
Email: jwi@life.ku.dk
Phone: + 45 3533 2955
Fax: + 45 3533 2929

Angiostrongylus vasorum (French heartworm) is a nematode causing verminous pneumonia in dogs. Dogs and other Canidae such as foxes serve as definitive hosts, while snails and slugs act as intermediate hosts. It has a worldwide distribution and in Europe it is considered enzootic in certain areas in France, Denmark, Ireland and the UK (Bourdeau, 1993; Brennan *et al*., 2004; Chapman *et al.*, 2004; Koch and Willesen, 2008). The adult metastrongyle (13-21 mm) resides in the pulmonary arteries and the right side of the heart (Rosen *et al*., 1970). First-stage (L1) larvae migrate through the respiratory system via the trachea to the gastrointestinal-tract and are excreted in faeces (Bolt *et al.*, 1994). The migration of the L1 larvae through the blood-air barrier and the subsequent verminous pneumonia and pulmonary thrombosis causes the clinical signs (i.e., cough, exercise intolerance, dyspnoea) that are commonly associated with the pulmonary system (Martin *et al*., 1993; Brennan *et al*., 2004; Chapman *et al.*, 2004). Haematological changes such as neutrophilia, thrombocytopaenia and anaemia have been reported (Chapman *et al*., 2004) whereas the most frequent changes in biochemistry are increased globulin levels and decreased fructosamine (Chapman *et al*., 2004; Willesen *et al*., 2006). A fatal outcome of infection is often associated with coagulation disorders. Suggested

mechanisms behind the coagulopathy are induced immune-mediated thrombocytopaenia, disseminated intravascular coagulation (DIC) or secretion of anticoagulants by the adult worms (Schelling *et al*., 1986; Ramsey *et al.*, 1996; Gould and McInnes, 1999; Cury *et al*., 2002; Whitley *et al*., 2005). Clinical presentation of associated bleeding disorders may vary between petechial or ecchymotic bleeding on mucosal surfaces, dermis or sclera to intracranial or CNS bleeding (Cury and Lima, 1996; Brennan *et al*., 2004; Chapman *et al*., 2004; Garosi *et al*., 2005; Wessmann *et al*., 2006). To the authors' knowledge, this is the first reported case of haemoabdomen associated with an *A. vasorum* infection. A one-year-old intact female Danish shorthaired pointer (body weight 25 kg) was referred to the emergency service at the Department of Small Animal Clinical Sciences at the University of Coprnhagen with a history of acute collapse and pale mucous membranes. The owner had noted the dog to be less active over the past month, but with no other clinical signs more commonly related to canine angiostrongylosis such as cough, dyspnoea or exercise intolerance. The dog presented with a temperature of 37.1°C, pulse 120/min, respiration rate of 28/min and pale pink, dry mucous membranes with a prolonged capillary refill time greater than two seconds. A single petechia was
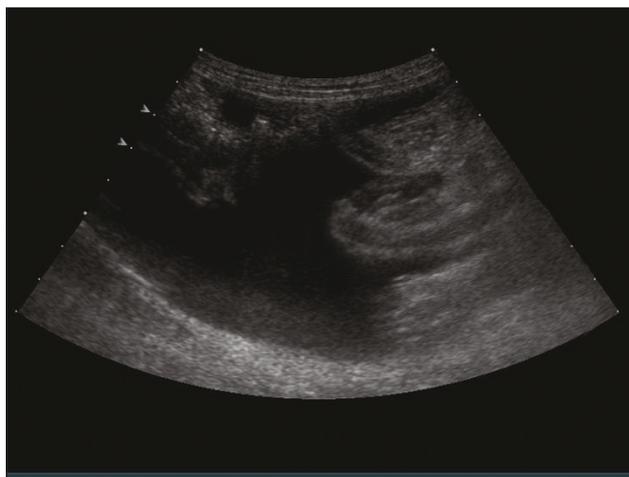
Figure 1: Abdominal ultrasound of a dog diagnosed with *A. vasorum*. A large amount of free intraabdominal fluid was observed. PCV was 35% in a sample obtained by abdominocentesis. No signs of neoplasia or infection were observed.

present on the gingival mucosa. The most predominant changes in haematological and biochemical profiles were neutrophilia, packed cell volume (PCV) of 24%, elevated urea and creatinine and reduced fructosamine (**Table 1**).

An ultrasound examination of the abdomen (**Figure 1)** suggested a large amount of free fluid with no obvious cause such as neoplasia or splenic rupture. Abdominocentesis was performed and the aspirate had the macroscopic appearance of blood, a PCV of 35% and no signs of infection or neoplasia on a cytological examination. The coagulation profile showed prolonged Prothrombin time (PT) and increased D-dimer (**Table 1**). Phytomenadion (Konakion, Roche A/S, Hvidovre, Denmark) treatment was initiated due to potential coumarin poisoning and for initial stabilisation, the dog received two transfusions; one unit of full blood (18 ml/kg) and one unit of fresh frozen plasma (9 ml/kg). A PCV of 24% is not usually a clear indication for a blood transfusion. However, in the present case, the authors chose to carry out the procedure as a continuing loss of blood could not be ruled out at this stage. Urinalysis of a voided sample was unremarkable except that a single *A. vasorum* L1 larva was detected on microscopy. Subsequently, multiple L1 larvae were revealed using a direct faecal smear technique (Willesen *et al.*, 2004). Due to the rapid establishment of the diagnosis, a buccal mucosal bleeding test was not performed. The dog was treated with fenbendazole 25 mg/kg orally once daily for 20 days following a protocol known to be efficient in the treatment of *A. vasorum* infections (Willesen *et al.*, 2007). To avoid possible anaphylactic reactions, prednisolone acetate at 1 mg/kg (Prednisolon DAK, Nycomed, Roskilde, Denmark) was administered once daily for 12 days. The dog stabilised on this treatment and was discharged after two days of hospitalisation and monitoring. Four weeks later, a complete resolution of clinical signs and normalisation of haematological and coagulation blood parameters were found. Haemoabdomen associated with canine angiostrongylosis has not been reported before, although spontaneous bleeding at other sites has been reported. In the present case, no history of either surgical or accidental trauma existed. Neoplasia could not be demonstrated and treatment with phytomenadion was initially started in case of a rodenticide poisoning, although the owner reported it unlikely that the dog had been in contact with such compounds. Coumarin poisoning is not usually associated with neutrophilia and

Table 1. Haematological, biochemical and coagulation parameters at time of diagnosis

Haematological parameters	(Reference range)	Measurement	Changes
Packed cell volume (PCV)	0.39-0.55 L/L	0.24	↓
Total red blood cells (RBC)	4.6-8.4 x 10 9/L	3.4	↓
Platelets	200-500 x 10 9/L	90*	
Total white blood cells (WBC)	6.5-18.1 x 10 9/L	26.8	↑
Segmented neutrophils	3.2-12.1 x 10 9/L	22.0	↑
Lymphocytes	1.0-4.8 x 10 9/L	3.1	
Monocytes	0.0-1.2 x 10 9/L	1.6	↑
Eosinophils	0.0-1.2 x 10 9/L	0.02	
Biochemical parameters			
Alanine aminotransferase (ALAT)	6-120 U/L	124	↑
Alkaline phosphatiase (BASP)	19.8-174 U/L	109	
Glucose	3.9-6.55 mmol/L	9.24	↑
Urea	3.3-9.4 mmol/L	17.3	↑
Creatinine	44-130 mmol/L	179.2	↑
Amylase	186-798 U/L	1706	↑
Lipase	6-498 U/L	217.4	
Cholesterol	3.5-6.99 mmol/L	2.5	↓
Bilirubin	1.0-5.0 µµmol/L	4.0	
Albumin	26.0-44-0 g/L	26.8	
Protein	57.0-82.0 g/L	53.1	↓
Fructosamine	235-344 µµmol/L	212	↓
Bile acid	1-6.4 µµmol/L	1	
Calcium	2.2-3.3 mmol/L	3.2	
Magnesium	0.63-1.05 mmol/L	0.94	
Phosphate	0.91-1.96 mmol/L	2.47	↑
Potassium	3.81-5.07 mmol/L	3.8	↓
Sodium	142.2-153.6 mmol/L	141.9	↓
Coagulation parameters			
Fibrinogen	(1.0-4.0 g/L) pool 0.64	0.05	
Prothrombin time (PT)	(pool 8.2 sec)	19.2	↑
Activated prothrombin time (APPt)	(pool 18.5 sec)	15.0	
D-dimer	(0.0-0.5 mg/L) pool 0.1	3.2	↑

* aggregates seen on blood smear at 40x magnification.

decreased fructosamine, as in this case, but could account for the prolonged PT. Prolonged PT is also often reported in dogs infected with *A. vasorum* (Ramsey *et al*., 1996; Cury *et al*., 2002). Increased D-dimer indicates formation of thrombi, but is non-specific regarding the underlying cause. Prolonged PT and elevated D-dimer could be indicative of disseminated intravascular coagulation (DIC) as is often reported in cases of canine angiostrongylosis (Ramsey *et al*., 1996; Garosi *et al*., 2005). Immune-mediated thrombocytopaenia has been reported in association with *A. vasorum* infection (Gould and McInnes, 1999). However, with a platelet count of 90 x 10 ^{9}/L and aggregates present on the blood smear, it was considered unlikely to have caused the bleeding, since bleeding caused by low platelet number usually occurs only with platelet count below 40 x 10 ^{9}/L. The acute onset of clinical signs might also have been caused by a ruptured small vessel. Aberrant migration of adult worms probably occurs frequently (Oliveira-Junior *et al*., 2004) and rupture of the femoral artery has been reported previously in a case report of an experimentally infected dog (Cury and Lima, 1996). Finally, the possible role of the parasites secreting an anticoagulant may contribute to the development of bleeding problems (Cury *et al*., 2002) This mechanism, however, needs to be further investigated. The finding of L1 larvae in the urinalysis may be explained by ectopic L1 larvae (Oliveira-Junior *et al*., 2004) or faecal contamination of the voided urine sample. However, due to the presumed hypocoagulable state of the dog, sampling by cystocentesis was not performed.

Haemoabdomen is a clinical sign where surgical intervention is often considered an integral part of the diagnostic investigation (i.e., laparotomy) or treatment. Failing to make the diagnosis of canine angiostrongylosis before performing surgery may have an adverse affect on the outcome for the patient. In conclusion, in areas where *A. vasorum* is enzootic, a Baermann test and a direct faecal smear should be included in the initial diagnostic investigation of all dogs presenting with bleeding disorders of unknown origin.

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