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Spontaneous pneumothorax secondary to granulomatous pneumonia caused by *Angiostrongylus vasorum* in a dog in Denmark

- A case report

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**Summary**
Granulomatous pneumonia secondary to *Angiostrongylus vasorum* was diagnosed in a dog presenting with bilateral pneumothorax. A 2-year-old, female, intact Whippet presented to the University Hospital for Companion Animals at the University of Copenhagen with an acute history of progressing dyspnoea, exercise intolerance and anorexia. On thoracocentesis, 760 ml air was evacuated from the left hemithorax while 7200 ml air was emptied from the right hemithorax without achieving a vacuum on this side. Thoracic radiographs revealed a gas-filled bulla in the right caudal lung lobe with marked bilateral lobar collapse in addition to a bilateral pneumothorax. Thoracic CT examination confirmed pulmonary consolidation, collapse and a bulla in the caudal part of the right caudal lung lobe. On lobectomy of the right caudal lung lobe, consolidated, granuloma-like lung tissue was identified. Histological examination revealed numerous, often coalescing, granulomata centred on parasitic *A. vasorum* larvae and eggs in the collapsed and fibrotic lung parenchyma. Faecal samples were positive for *A. vasorum* L1-larvae, and the dog was treated with fenbendazole for 20 days. The dog made a full recovery.

**Sammendrag**
Recently, pulmonary thromboembolism was identified as the cause of spontaneous pneumothorax in a dog with pituitary-dependent hyperadrenocorticism (14). Identification of the underlying cause is important for the prognosis and treatment of pneumothorax.

Case History
A 2-year-old, female, intact Whippet presented to the University Hospital for Companion Animals at the University of Copenhagen with a 2-days history of rapidly progressing dyspnoea, exercise intolerance and anorexia. The dog was current on vaccinations, had no travel history outside Denmark and had not been wormed for the last 12 months. It lived in a multi-dog household in a rural environment and none of the other dogs (all Whippets) were reported to show signs of illness.

Physical examination confirmed tachypnoea (respiratory rate 80 breaths/minute), a severely increased, mainly expiratory, respiratory effort, bilaterally muffled dorsal lung sounds and increased ventral lung sounds. On thoracocentesis, 760 ml air was evacuated from the left hemithorax while 7200 ml air was emptied from the right hemithorax without achieving a vacuum on this side. Nonetheless the dog’s condition improved and the respiratory rate decreased to 40 breaths/minute. Thoracic radiography and ultrasound, a complete blood count, serum biochemistry, urinalysis and a faecal analysis (collected rectally for a direct faecal examination) were performed.

On thoracic radiographs, a gas-filled bulla in the right caudal lung lobe and marked bilateral lobar collapse was seen in addition to a bilateral pneumothorax (Figure 1). With no history of trauma or oesophageal foreign body, spontaneous pneumothorax with ongoing leakage of air into the right hemithorax without achieving a vacuum on this side. Nonetheless the dog’s condition improved and the respiratory rate decreased to 40 breaths/minute. Thoracic radiography and ultrasound, a complete blood count, serum biochemistry, urinalysis and a faecal analysis (collected rectally for a direct faecal examination) were performed.

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Discussion
This dog presented with a spontaneous pneumothorax which had developed secondary to a single ruptured granulomatous lung lesion, ultimately caused by *A. vasorum*, indicating that canine angiostrongylosis should be considered as a possible cause of this clinical condition. There were no other signs of illness prior to the acute onset of dyspnoea to indicate *A. vasorum* as the cause in this dog.

Pneumothorax as a main presenting sign of angiostrongylosis has not been described previously, although it has been mentioned in one case series with the suggestion that the pneumothorax may have been secondary to the dog’s dyspnoea (11). Pneumothorax can present bilaterally with a unilateral lesion as the mediastinum of most dogs is fenestrated, allowing free communication between the two pleural sacs (17). The bilateral presentation of pneumothorax in this case is therefore not surprising despite the unilateral nature of the lesion. Pulmonary bullae can develop from destruction, dilatation, and confluence of adjacent alveoli secondary to pulmonary pathology (18). Rupture results ultimately in pneumothorax as seen in our case.

Granulomatous pneumonia has been a consistent finding in dogs infected with *A. vasorum* (19,20). Rupture of vessels due to tissue and vascular damage induced by *A. vasorum* resulting in severe blood loss, haemopneumothorax, haemothorax and haemoperitoneum have been described frequently in association with canine angiostrongylosis (8,10,21). Interestingly, bleeding to the thoracic cavity was completely absent in this case.

Postoperative and 3-weeks-follow-up thoracic radiographs did not reveal an abnormal lung pattern, bronchial thickening or any signs of disseminated granulomatous pulmonary changes which could have indicated canine angiostrongylosis. Radiographic changes in dogs experimentally or naturally infected with *A. vasorum* commonly show a bronchial, alveolar and/or interstitial pattern and bronchial thickening mainly affecting the peripheral and dorso-caudal parts of the lung (22,23). The duration of infection with *A.
**vasorum** is unknown in this case, but the clinical and histologic findings indicate chronicity and while radiographic signs of pulmonary infiltrates may be masked during the partial lobar collapse of pneumothorax, they would have been expected in the post inflation, delayed studies.

The clinical pathological findings registered in this case report were uninformative which is often reported in dogs naturally infected with *A. vasorum* (24). Larvae were not identified on a direct faecal smear while subsequent Baermann analysis made a diagnosis of *A. vasorum* possible. This report emphasises that it is important to consider *A. vasorum* as a cause of spontaneous pneumothorax secondary to underlying pulmonary pathology in dogs especially in areas endemic for this infection even in the absence of radiological changes supportive of an *A. vasorum* infection.

None of the authors of this article has a financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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