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A rare case of thoracic and abdominal malignant mesothelioma in a dog

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Abstract

A six year old male German Shepherd dog was presented with the condition of emaciated, recumbent, dyspnoea, muffled heart and lung, nonproductive cough, and enlarged abdomen and the animal collapsed while examination. Post mortem examination revealed a large quantity of exudation in the thoracic and abdominal cavities. Multiple, exophytic, pedunculated, yellowish-red, soft to firm masses ranging from 2 mm to 8mm in diameter were attached to the pericardium, pleura, mediastinum, lungs, peritoneum, serosal surfaces of the stomach and intestines, mesentery, mesenteric lymph nodes, liver, and spleen. Histopathological examination revealed the arrangement of neoplastic cells in sheets predominantly epithelial components with fine stroma and the neoplastic cells were round to spherical in shape with vesicular nuclei, anisokaryosis, multiple nucleoli, and numerous mitotic figures confirming the case as malignant mesothelioma in the thoracic and abdominal cavity.

Keywords: Dog – mesothelioma - thoracic cavity- abdominal cavity – malignancy

Introduction

Mesothelioma is a very rare tumor in dogs representing approximately 0.2% of all canine tumors (D'Angelo *et al.*, 2014) [3] that arises from the mesothelium, a monolayer of flattened epithelial cells lining the surface of the pericardial, pleural, and peritoneal cavities including the tunica vaginalis of the testes (Garrett, 2013) [4]. Mesothelioma disseminated in both the peritoneal and pleural cavity seems to be rarer (Toledo, *et al.* 2018) [14], and visceral metastases from mesotheliomas are also a rare condition (Kim *et al.* 2002) [7]. The present report records a rare case of mesothelioma in both thoracic and abdominal cavities along with metastasis in all the internal organs of a six year old dog.

Case History and Observations

A six year old male German shepherd dog was presented to Veterinary Clinical Complex, Veterinary College and Research Institute, Theni, Tamil Nadu with a history of general weakness, progressive weight loss, coughing, vomiting, exercise intolerance, and abdominal distension for the past two and a half months and the animal was treated by local veterinarians without any improvement. Clinical examination revealed that the animal was very weak, emaciated, recumbent, with dyspnoea, muffled heart and lung, nonproductive cough and enlarged abdomen. The visible mucous membranes were blue-violet in colour, which suggested cardiopulmonary insufficiency. There was a large quantity of fluid in the thoracic and abdominal cavity. Simultaneous auscultation confirmed the presence of fluid in the pericardium as well as its surroundings. Whilst being examined and planned for radiological examination, the dog collapsed.

Post mortem examination revealed a large quantity of exudation in thoracic and abdominal cavities. Multiple, exophytic, pedunculated, yellowish-red, soft to firm masses ranging from 2 mm to 8mm in diameter were diffusely distributed over, and attached to the pericardium, pleura, mediastinum, lungs, peritoneum, serosal surfaces of the stomach and intestines, mesentery, mesenteric lymph nodes, liver, and spleen were observed (Fig.1, and 2). Plaques on the inner surface of the pericardial sac were also observed. The samples of all the visceral organs were fixed in 10% buffered formalin and routinely processed for histopathological examination and stained with hematoxylin and eosin. Microscopically, the neoplastic cells were arranged in sheets of predominantly epithelial components with fine stroma. Neoplastic cells were round to spherical in shape with vesicular nuclei, anisokaryosis, multiple nucleoli, and numerous mitotic figures confirming the case as malignant mesothelioma (Fig.3 to 8).

Discussion

Mesotheliomas are rare, aggressive tumors and are the result of abnormal division and replication of mesothelial cells, and their migration to other sites in the body. This cellular behavior can occur in the thoracic cavity, the abdominal cavity, the pericardial sac around the heart, and for male dogs, in the scrotum. In canines, the site of predilection in dogs is the pleural cavity, with a lower incidence of pericardial and peritoneal origin (D'Angelo *et al.*, *loc.cit.*, Reggeti *et al.*, 2005, Avakian *et al.* 2008) [12, 2]. In the present case, both thoracic and abdominal cavities were involved.

It is reported that mesotheliomas occur mostly in dogs of a mean age above 7 years (Merlo *et al.* 2007) [15] and the age of the present case was six years. Among the dog breeds, the Bouvier des Flandres, Irish Setters, and German Shepherds are predisposed to mesotheliomas, and the occurrence of these tumors is higher in male dogs, compared to females (Amaya and Arevalo, 2008) [1]. The present case is also the six year old male German Shepherd dog and agrees with the previous reports.

Exposure to chemicals, in particular, asbestos, iron and silicate, and pesticides play a major role in the development of mesotheliomas (Ogilvie and Moore, 2006) [11]. Asbestos can have an effect directly and also indirectly in connection with phenotypical and genetic changes in the affected cells. However, it is reported that genetic factors and viruses also lead to the development of these tumors (Head *et al.*, 2002) [6]. Moreover, idiopathic and spontaneous tumors have also been reported in animals (Yamate *et al.*, 2007) [15].

Classical mesotheliomas are diffuse nodular multifocal masses that cover body cavities. The resultant tumors will often displace internal organs, causing gastrointestinal or cardiac symptoms. The main clinical manifestation of mesothelioma is effusions of the affected coelomic cavities (Lajoinie *et al.*, 2022) [8]. Extensive effusions in cavities arise due to infiltration and exudation of tumorous surfaces or lymphatic vessels that have been compressed by tumorous tissue. Therefore, the most significant and trustworthy signs of mesothelioma in the thoracic cavity are dyspnoea, decreased tolerance to load, and cough caused by pleural effusion (Rizzi *et al.* 2009, Moberg, *et al.*, 2022) [13, 10]. The process of mesothelial cells becoming intraperitoneal tumours causes typical clinical signs such as ascites, weight loss, and the presence of palpable abdominal masses, which can be identified through physical examination of the animal (Merlo *et al.* 2007) [9]. Visceral metastases from mesotheliomas are rare (Geninet *et al.* 2003, Kim *et al.* 2002) [5, 7], but in the present case, tumor masses were found all over the internal organs.

According to many authors, there is no established standard of care and successful therapy of mesotheliomas exists. The absence of consensus on diagnostic procedures and the rarity of the disease may be partly responsible for the paucity of information regarding the therapeutic approach to canine mesothelioma (Lajoinie *et al.*, 2022) [8]. Surgical procedures are often proposed to decrease the effusion's consequences and the outcome associated with these surgical procedures is poorly documented. Since the penetration of chemotherapy into tissues is only on the surface, local forms of chemotherapy have been unsuccessful in cases of large mesothelioma (Garrett, 2013) [4]. A better outcome in a larger cohort of 34 dogs with mesothelioma treated with chemotherapy was reported recently by Moberg *et al.*, 2021. Observations on the evolution of the disease suggest that the

larger the area covered by the neoplasm, the more intense or severe the clinical signs are, and has a poor prognosis which results in death through the natural worsening of the disease (Geninet *et al.* 2003; Reggeti *et al.* 2005; Avakian *et al.* 2008) [5, 12, 2] as also observed in the present case.



Fig 1: Papillary mesothelioma in spleen

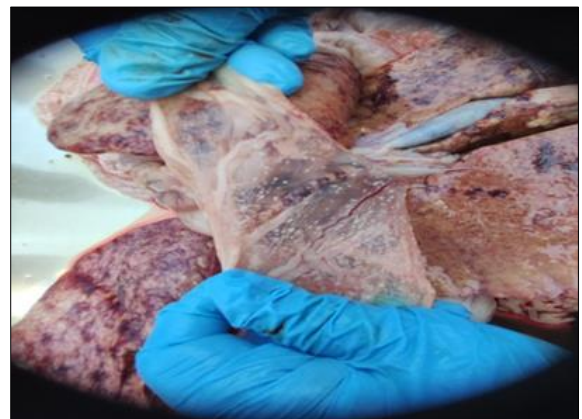


Fig 2: Papillary mesothelioma in liver and mesentery

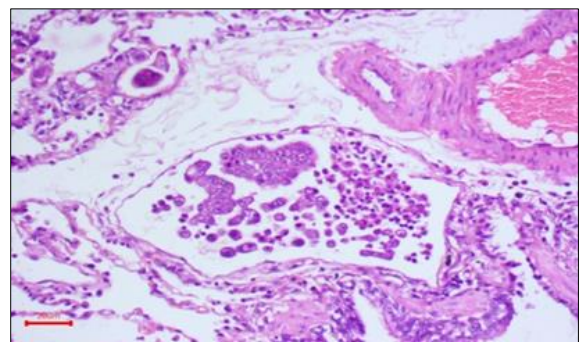


Fig 3: Histopathology of lung mesothelioma

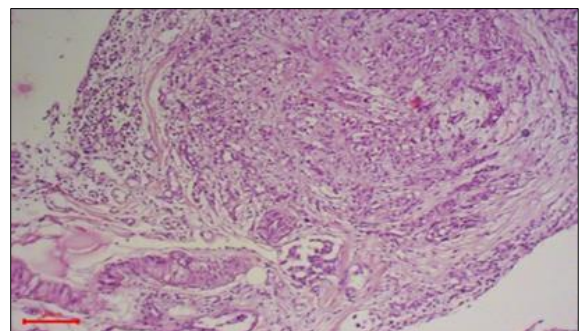


Fig 4: Histopathology of mesenteric mesothelioma

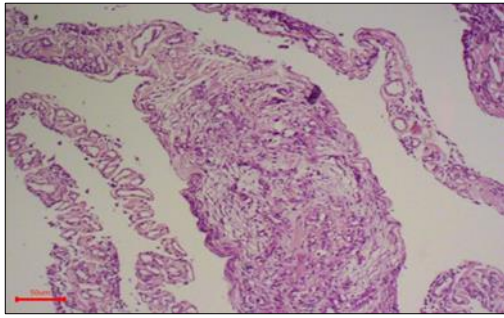


Fig 5: Histopathology of peritoneal mesothelioma

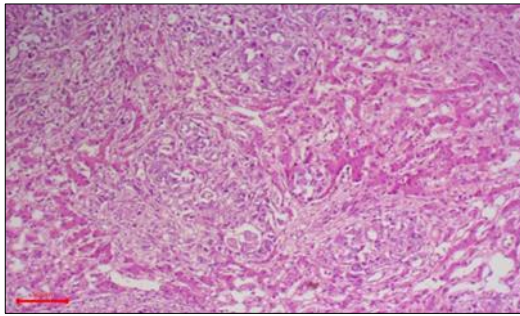


Fig 6: Histopathology of liver mesothelioma

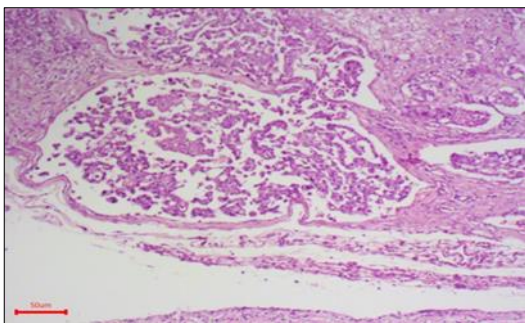


Fig 7: Histopathology of Intestinal mesothelioma

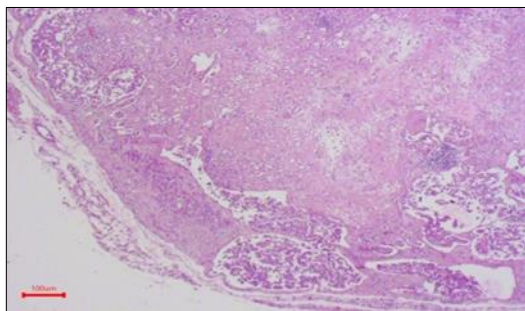


Fig 8: Histopathology of Lymph node mesothelioma

Fig.3 to 8: Histopathology of mesothelioma - Arrangement of neoplastic round to spherical shaped cells with vesicular nuclei, anisokaryosis, multiple nucleoli and numerous mitotic figures cells in sheets predominantly epithelial components with fine stromain various organs.

Summary

A rare case of mesothelioma in thoracic and abdominal cavities along with metastasis in all the internal organs of a six year old male German Shepherd dog is reported.

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