

Synchronous Pleural and Peritoneal Mesothelioma in a Dog and its Diagnosis

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Mesothelioma is a rare neoplasm of older dogs affecting the epithelial lining of a coelomic cavity (Moberg *et al.*, 2022; D'Angelo and Di Francesco, 2014), that could arise from the lining cells of the peritoneal, pleural, and pericardial cavities or the tunica vaginalis of the testis (Merlo and Rosciani, 2012). All coelomic cavities can be involved, separately or simultaneously (Vascellari *et al.*, 2011). Though malignant mesothelioma can metastasize by lymphatic routes, they are prone for a low-grade malignancy with a minimal tissue invasion and rarely lead to metastasis in drainage lymph nodes or more distant sites (Head *et al.*, 2002). Exposure to asbestos may be an important contributing factor to mesothelioma in dogs and risk factors could include exposure to iron or asbestos dust in industrial settings (Vural *et al.*, 2007), owners with an asbestos-related occupation, an urban residence, exposure to flea repellents, viral and genetic factors (Reggeti *et al.*, 2005; Echandi *et al.*, 2007). Pleural effusion is one of the most classical characteristic feature of mesothelioma (Sundararajan *et al.*, 2022). There are only a very few reports on the incidence of pericardial or pleural mesothelioma in dogs and incidence of peritoneal mesothelioma has been occasionally reported. This leads to poor understanding of the natural history of the tumour and limited knowledge on mesothelioma (Martins *et al.*, 2011). Hence, this paper reports a rare incidence of an invasive mesothelioma in both thoracic and peritoneal cavities of a two and a half years old Labrador Retriever dog and its diagnosis by cytological analysis, radiography and ultrasonogram.

CASE HISTORY AND OBSERVATIONS

A male Labrador Retriever dog of two years and six months old was presented to the Teaching Veterinary Clinical Complex Veterinary College and Research Institute, Tirunelveli (Tamil Nadu, India) with the complaint of distended ventral abdomen (Fig. 1a), respiratory distress, and exercise intolerance since 4 months and hyporexia since 7 days. Clinical examination revealed the 'fluid thrill' by percussion on ventral abdomen, pink conjunctival mucosae, enlarged popliteal lymph nodes, heart rate 130/min, respiration rate 45/min and normal rectal temperature. Radiological examination and ultrasonogram were performed to identify the lesions in the thoracic and

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abdominal cavities (Martins *et al.*, 2011). Thoracocentesis and abdominocentesis were performed using a sterile 22 gauge needle and approximately 250 mL of serosanguinous, odourless fluid (Fig. 1b) could be collected from the thorax and abdomen, and subjected to cytological analysis. Blood in EDTA and serum samples were collected for haemato-biochemical analysis.



Fig. 1a: Distended ventral abdomen and abdominocentesis revealing haemoperitoneum



Fig. 1b: Serosanguinous and frothy peritoneal fluid collected from the haemabdomen

RESULTS AND DISCUSSION

Fluid tapped from this patient by abdominocentesis was serosanguineous and frothy with pH 8.0, specific gravity 1.02 and high protein content (30 gm/litre), and cytological examination revealed haemoperitoneum with the presence of moderate number of red blood cells, clusters of neoplastic cells with coarse chromatin, anisokaryosis, prominent nuclei with high nuclear to cytoplasmic ratio (Fig. 2a) and binucleated mesothelial cells (Fig. 2b). The findings were in accordance with those of Reggeti *et al.* (2005), D'Angelo and Di Francesco (2014) and Sundararajan *et al.* (2022). Though definitive diagnosis of mesothelioma has been a challenge in diagnosis in the early stages, effusion, the most classic characteristic of mesothelioma (Vural *et al.* 2007; Rizzi *et al.*, 2009), and biopsies or fluid analysis (Kavula *et al.*, 2009) could be useful in the diagnosis and cytological analysis could lead to a rapid and accurate diagnosis (Martins *et al.*, 2011).

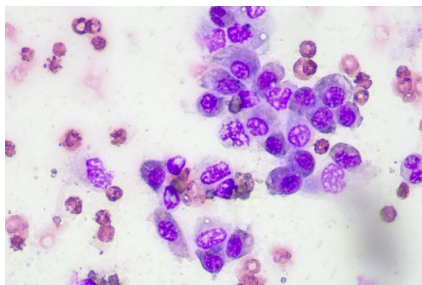


Fig. 2a: Clusters of neoplastic cells with coarse chromatin, anisokaryosis, prominent nuclei by microscopic examination of Giemsa stained peritoneal fluid (x1000)

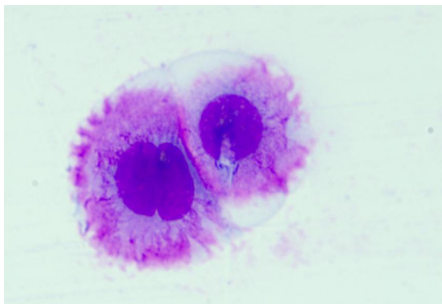


Fig. 2b: Binucleated mesothelial cells from the peritoneal fluid by microscopic examination of Giemsa stained peritoneal fluid (x1000)

Ultrasonogram of the abdomen revealed a hyper echoic localized nodular mass in the peritoneal cavity, echogenic peritoneal effusion and floating fibrin tags (Fig. 3a, 3b), as mesothelioma generally appear as focal, multifocal or diffuse proliferative lesions and all mesotheliomas are reported to be potentially malignant (Merlo and Rosciani, 2012). Martins *et al.* (2011) also observed fibrin deposits in the abdominal cavity by exploratory laparotomy. Radiography revealed pleural effusion and with indistinct cardiac silhouette and ground glass appearance in abdomen, however, there was no apparent cardiac disorder by cardiac auscultation. Martins *et al.* (2011) and Mohanambal *et al.* (2020) also observed similar findings. Hence, based on fluid cytology, radiography and ultrasonogram, the case was diagnosed as concurrent mesothelioma in pleural and peritoneal cavities.

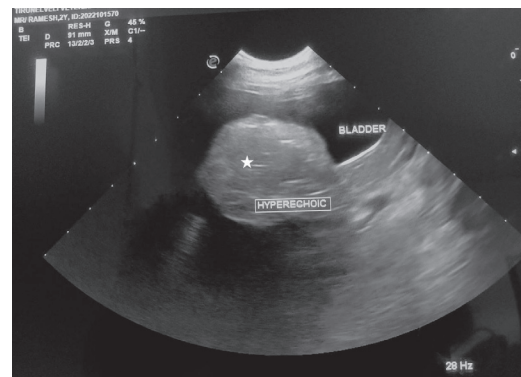


Fig. 3a: Sagittal plane ultrasound imaging of abdomen showing hyper echoic nodular mass in the peritoneal cavity



Fig. 3b: Sagittal imaging of mid-abdomen showing echogenic peritoneal effusion (white stars) and hyper echoic fibrin tags (black stars) with reverberation shadow in the peritoneal cavity

Haematological analysis revealed leukocytosis and lymphocytosis, whereas, serum biochemical analysis revealed hyperkalemia, hypernatremia and hypoalbuminemia (Table 1). Reggeti *et al.* (2005) also observed hyperkalemia in a 11year old dog affected with pleural and peritoneal mesothelioma and in contrast hyponatremia, hyperphosphatemia, hypochloremia, neutrophilia, monocytosis and thrombocytosis were reported. Sundararajan *et al.* (2022) also reported leukocytosis associated with Neutrophilia, with other serum biochemical

Table 1: Haemato-biochemical values in the dog affected with pleural and peritoneal mesothelioma

Haematological Parameters	Values	Serum Biochemical Parameters	Values	Serum Biochemical Parameters	Values
Haemoglobin (g/dL)	12.7	BUN (mg/dL)	87.7	Direct bilirubin (mg/dL)	0.08
Packed cell volume (%)	39.5	Creatinine (mg/dL)	1.7	Calcium (mg/dL)	8.8
TEC (x10 ⁶ /μL)	6.67	Total protein (g/dL)	4.6	Phosphorus (mg/dL)	5.3
WBC(x10 ³ /μL)	17.5	Albumin (g/dL)	1.9	Glucose (mg/dL)	31.0
Platelets (x10 ³ /μL)	254	Globulin (g/dL)	2.7	Sodium (mmol/dL)	207.4
Neutrophils (%)	75.0	ALP (IU/dL)	11.0	Potassium (mmol/dL)	6.5
Lymphocytes (%)	25.0	ALT (IU/dL)	39.0	Chloride (mmol/dL)	109.9
Eosinophils (%)	6.0	Total bilirubin (mg/dL)	0.5		

values being normal in a 14 year old female non-descript dog. The liver and kidney function tests revealed normal values, except elevated blood urea nitrogen and this finding was in accordance with that of Martins *et al.* (2011) and Sundararajan *et al.* (2022). This could be due to the fact that mesothelioma being a superficial tumour.

Body cavity effusions may be due to lowered absorption, altered vascular pressure or lowered albumin in the blood and inflammation, neoplasia, and circulatory disturbances could interfere with the fluid balance (Leisewitz and Nesbit, 1992). In this reported case, the incidence of mesothelioma could be attributed to exposure to the asbestos primarily (Caswell and Williams, 2007), as the case belonged to Nanguneri town of Tirunelveli district, where an asbestos manufacturing unit was located. Secondly, exposure to the acaricides could also be a predisposing factor (Ogilvie and Moore, 2006), as the case had a history of frequent tick infestation and frequent topical application of acaricides. Asbestos particles spread to the pleura after inhalation through the lymphatic system, causing chromosomal defects in mitotic mesothelial cells and loss of tumour suppressor genes (p53) which lead to genetic mutation in mesothelial cells (Jaurand and Fleury-Feith, 2005) with different physical and carcinogenic properties (Carbone *et al.*, 2002).

Mesothelioma is mostly reported in dogs of four to thirteen years old (Head *et al.*, 2002), however, juvenile and epitheloid mesothelioma had also been previously recorded (Vural *et al.*, 2007). Previously, canine sclerosing mesotheliomas had been reported more commonly in German shepherd dogs (D'Angelo and Di Francesco, 2014) and in contrast no breed predisposition was also recorded (Leddecka *et al.*, 2010).

The case was treated with parenteral administration of amoxicillin and cloxacillin @ 22 mg/kg b.wt. to prevent complications like peritonitis, furosemide @ 4 mg/kg b.wt. to reduce the ascites in the abdomen, prednisolone @ 0.5 mg/kg b.wt. to reduce neoplastic response (lymphocytosis), multiple amino acids (Astymin®) to alleviate hypoalbuminemia. The treatment was continued with thoracocentesis and abdominocentesis periodically for 7 days to reduce the respiratory distress. However due to a poor prognosis (Martins *et al.*, 2011), an exploratory surgery was recommended (Reggeti *et al.*, 2005), as no single agent or combination

of drugs has been reported to yield satisfactory results in cases of mesothelioma (Reggeti *et al.*, 2005). Due to owners' constraint on surgical intervention, the case succumbed to death and was not presented for necropsy.

In conclusion, the definitive diagnosis of mesothelioma can be based on effusion of cell sediment which could provide us a quick and low cost diagnosis. This may be supplemented with the complementary tests like clinical pathology, imaging and pathology which are considered important tools for arriving a diagnosis and prognosis of the mesothelioma. Therapeutic options for mesothelioma include surgical resection, radiotherapy, and chemotherapy, though a low incidence of the cases in dogs lead to difficulty in assessment of therapeutic efficacy of drugs.

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