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CASE REPORT

Small Cell Anaplastic Carcinoma of Primary Lung Tumor in a Miniature Schnauzer Dog

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ABSTRACT

A seven-year-old male, an intact miniature Schnauzer dog with history of vomiting, abdominal distention, anorexia, and dyspnea was referred for further evaluation and treatment. Thoracic radiographs showed the well marginated solitary mass with soft density in the right caudal lung field, and abdominal radiographs showed signs of ascites, such as abdominal distention and moderate serosal detail loss. On ultrasonograph and computed tomograph, it was observed that the mass compressed the caudal vena cava (CVC) and adhered to the heart. Exploratory thoracotomy was performed, and then it was showed that mass adhered heart, CVC, and diaphragm. The mass was fully resected although adhered part of CVC could not be completely resected. On histopathological findings, the mass was diagnosed as small-cell anaplastic carcinoma.

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INTRODUCTION

Lung tumors are classified with primary, metastatic, and multiple tumors according to their origination pattern (Kim *et al*., 2005). Among them, primary lung tumors are greatly uncommon disease that occurrence rate is under 1% (Withrow and MacEwen, 2001). Therefore, only a few studies about primary lung tumors were reported, that those tended to develop in larger/older dogs, and did not showed breed or sex predilection (Ogilvie *et el*., 1989; McNiel *et al*., 1997). In addition, lung tumors are also classified into nine types in domestic animals; bronchial gland carcinoma, squamous cell carcinoma, adenocarcinoma, adenosquamous carcinoma, small-cell carcinoma, large-cell carcinoma, neuroendocrine tumor, pulmonary blastoma and combined carcinoma (Dungworth *et al*., 1999). Small-cell carcinoma is a relatively rare with a prevalence of three out of 210 cases of primary lung tumors (Ferreira *et al*., 2005).

This case describes the diagnoses of small-cell anaplastic carcinoma of primary lung tumor for treatments in a miniature Schnauzer dog.

CASE PRESENTATION

A 7-year-old intact male miniature Schnauzer dog was referred to the Veterinary Medical Center of Chungbuk National University with chief complains of mild dyspnea, vomiting, anorexia for one month. On physical examinations, the dog was mild obesity, and showed abdominal distention and depression. Complete blood count (CBC) showed mild neutrophilic leukocytosis (17,180 cell/μl), polycythemia ($9.32x10^6$/μl), and elevated alkaline phosphotase (321 IU/L) and alanine transminase (250 IU/L). On ventrodorsal views of chest radiograph, well-marginated soft tissue mass was observed at the right caudal lung field, that it moved the mediastinum to the left (Fig. 1). On a lateral radiograph, same mass was represented at the caudal thoracic region, overlapping over caudodorsal part of the cardiac silhouette (Fig. 2). Abdominal radiographs showed abdominal distention and moderate serosal detail loss. Ultrasonographic findings revealed 3.17 x 2.66 cm sized mass was located between the heart and the diaphragm. Moreover, compressed caudal vena cava (CVC), narrowed CVC lumen, turbulent flow in the lumen, hepatic vein congestion and ascites were observed. Under ultrasonographic guidance, ascites was suctioned by fine needle aspiration, then it was identified as a transudate (total protein = 4 mg/dl, TNCC = 1,390 cell/μl). Computed tomography (CT) scan revealed a well-defined round mass which compressed CVC and attached to the heart (Fig. 3).

For definitive diagnoses, an exploratory intercostal thoracotomy was performed at the right eighth intercostal space under general inhalation anesthesia with isoflurane.

Manual positive pressure ventilation was initiated from the start to the end of surgery. After opening of right thoracic cavity, a mass, approximately 4 cm in diameter, appeared at the caudal lung field and it was adherent to the right middle lung lobe, the caudodorsal pericardium near the cardiac base, the CVC, and the diaphragm (Fig. 4). Mass adherent region of right middle lung lobe was atelectatic. There was no evidence of metastasis grossly. Complete lobectomy of the right middle lung lobe was performed, and partial resection of the diaphragm and partial pericardectomy were also performed to remove the mass invasive area. However, complete resection of the mass adhering CVC was not performed, because it was extremely, broadly adhered to CVC. The excised mass appeared rough, bumpy, solid and not cavity (Fig. 5).

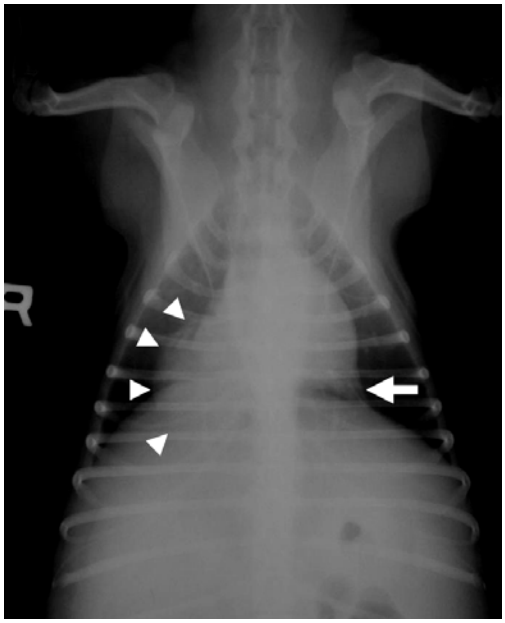

Fig. 1: Preoperative radiograph (thoracic, ventrodorsal) revealed well-marginated soft tissue mass at the right caudal lung field (white arrowheads), that it moved a mediastinum to the left (white arrow).

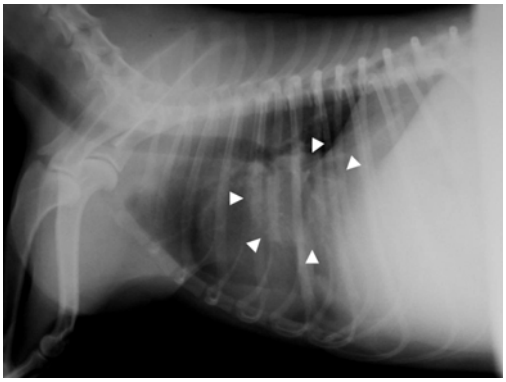

Fig. 2: Preoperative radiograph (thoracic, lateral) revealed mass showing soft tissue density at the caudal thoracic region, overlapping the caudodorsal portions of the cardiac silhouette (white arrowheads).

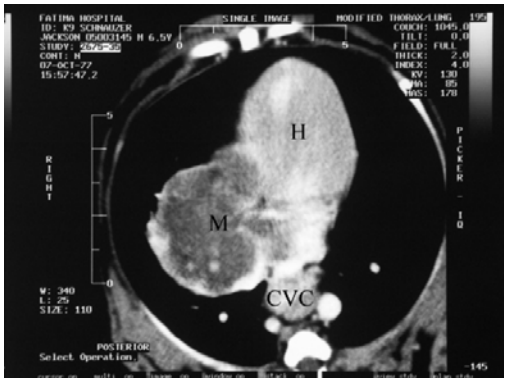

Fig. 3: Computed tomography (axial view) revealed mass occupying right thoracic cavity (M), attached and compressed the heart (H) and caudal vena cava (CVC).

Excised mass was fixed in 10% buffered formalin for histopathology. After routine embedding in paraffin, 5 µm sections were cut and stained with hematoxylin and eosin at necrotic center of the mass (Fig. 6). It was observed that packed, small, undifferentiated cells with scant cytoplasm destroyed normal alveolar structures. These cells characterized by large nuclei with eosinophilic cytoplasm, those profiles were a fusiform, elliptical or polygonal appearance. Anisocytosis and anisokaryosis were observed and frequently mitoses were also detected. According to above results, the mass was diagnosed small-cell anaplastic carcinoma of the lung.

Just after surgery, thoracic radiographs were rechecked. On lateral radiograph, mass occupying thoracic cavity disappeared, and cardiac silhouette could be fully identified (Fig. 7). On ultrasonograph, it was observed that hepatic vein congestion, CVC narrowing, and ascites was alleviated after surgery. Hematocrit value returned to normal after surgery, and total white blood cell count was also decreased. The dog improved rapidly until 7 days postoperatively. However, clinical signs were recurred at nine days postoperatively, so shallow and rapid respiration, vomiting, and ascites were reemerged. But, the patient died at 3 weeks postoperatively.

DISCUSSION

Primary lung tumor, small-cell anaplastic alveolar carcinoma, is extremely rare disease below 1% occurrence of primary lung tumors (Ogilvie *et al*., 1989). Therefore, studies about small cell analplastic carcinoma were very few in veterinary medicine.

Characteristic clinical signs of these lung tumors are various from location, size, and type of tumors. Most general sign is nonproductive cough for weeks or months (Mehlhaff and Mooney, 1985). Except this, there are lethargy, anorexia, hemoptysis, and severe cases represent dyspnea, pneumothorax, or pleural effusion (Kim *et al*., 2005). Moreover, in case of lung tumor adjacent to vertebrae, neurologic deficits or lameness could be occurred (Ferreira *et al*., 2005). If tumors invade or compress the great vessels, systemic signs including ascites, hepatic insufficiency and congested heart failure are possible.

Small-cell anaplastic carcinoma could not be distinguished from another pulmonary tumor before histological findings. Because lung tumor showed similar appearance on radiograph, and CT or magnetic resonance image. Therefore, the diagnosis of small-cell carcinoma was based on the histological characteristic described by previous studies (Dungworth *et al*., 1999; Wilson and Dungworth, 2002). According to these studies, the cell origin of small-cell carcinoma was not completely identified (Ferreira *et al*., 2005). However, it has characteristic histological figures which were small, round to polygonal cells with scant cytoplasm, aggregate by fine fibrovascular stroma and arranged in a continuous loose pattern (Ferreira *et al*., 2005; Wilson and Dungworth, 2002). Especially, these cells are sometimes interpreted as filling of preexisting alveolar structures by the neoplastic population. This pattern could be distinguished these tumors from lymphoma (Wilson and Dungworth, 2002). In this study, similar histologic figures with previous studies were observed that round, undifferentiated cells with scant cytoplasm presented near the alveoli.

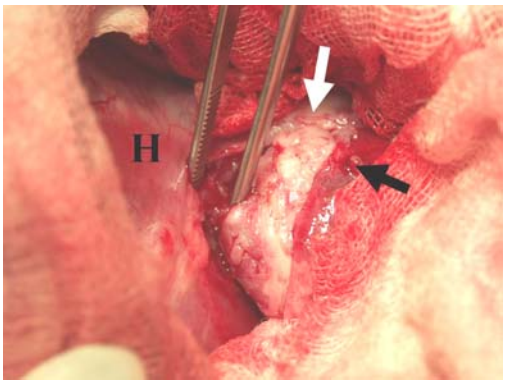

Fig. 4: The mass was carefully separated from caudodorsal pericardium. The white, solid mass was observed at center (white arrow), the heart was showed at left (H), atelectatic lung was showed at right side in this picture (black arrow).

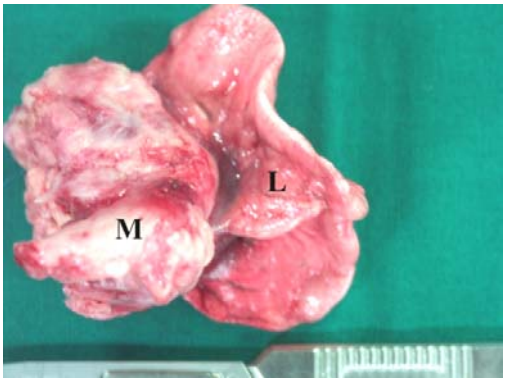

Fig. 5: There was excised mass (M) adhering right middle lung lobe (L). Mass had the rough, bumpy surface and it did not have cavity.

In addition, as further diagnostic methods, immunohistochemistry was recently introduced to veterinary medicine for identification of small cell anaplastic carcinoma (Ferreira *et al*., 2005; Wilson and Dungworth, 2002). In human medicine, small cell carcinomas have been thought to arise from airway neuroendocrine cells, and have recognized those neuropritides components by immunohistochemical examination. Especially, synaptothysin was detected in 100% of small-cell carcinoma (Delellis and Shin, 2002). On the other hand, in veterinary medicine, information about the response of small-cell carcinomas to neuroendocrine of the dog is very few, although small-cell carcinoma in dogs revealed positive staining for vimentin, strongly positive neurospecific enolase, and moderately positive for synaptophysin (Ferreira *et al*., 2005). Therefore, further studies for identifying information about neuroendocrine markers of small-cell carcinoma in dogs are required to diagnose those tumors.

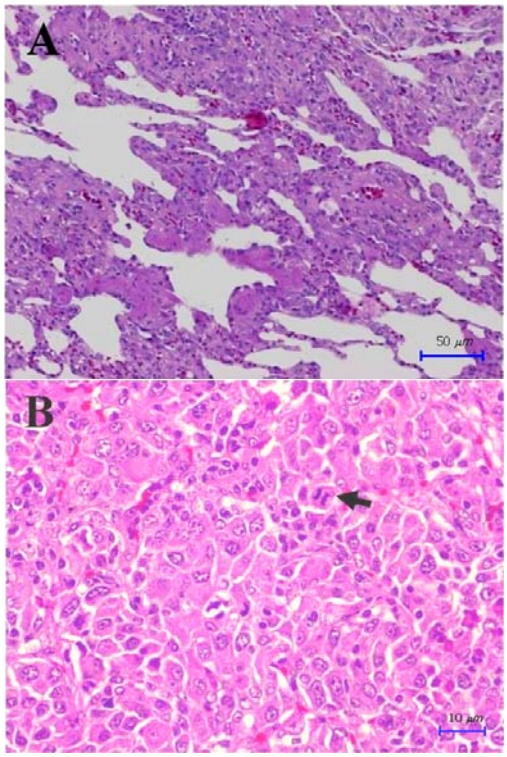

Fig. 6: Mass was identified to small cell anaplastic carcinoma of the lung. A; Alveoli infiltrate small, undifferentiated cells with scant eosinophilic cytoplasm. (H&E stain, X100) B; These cells had large nuclei and eosinophilic cytoplasm, represented a fusiform, elliptical or polygonal appearance. Anisocytosis and anisokaryosis, and mitoses (arrow) were also detected (H&E stain, x 400).

First choice for treatment of primary lung tumors is recommended surgical excision regardless of tumor type, if tumor is solitary and does not metastasize (Mehlhaff and Mooney, 1985). However, when tumors are adhered to major thoracic organ like heart or great vessels, completely surgical excision may be impossible, and systemic metastases are suggested (Fukuse *et al*., 1997). Therefore, in those cases, prognoses could be poor to grave. In these cases, radiotherapy or chemotherapy could be applied before and after surgery (Macchiarini *et al*., 1994; Martini *et al*., 1994), however efficacy of method is still questionable (Fukuse *et al*., 1997). On the contrary, in cases of tumors which are severely invaded around tissue, adequate extended operation using replacement with

grafts, heterologous or autologous patch or cardiopulmonary bypass were showed better treatment outcomes in human medicine (Fukuse *et al*., 1997; Piccione *et al*., 1999; Spaggiari *et al*., 2004). In present study, the tumor could not be completely excised because it was invaded considerably heart and CVC. After surgery, another treatment like radiotherapy or chemotherapy could not be used, because the client did not want these methods, and their efficacy could not be guaranteed.

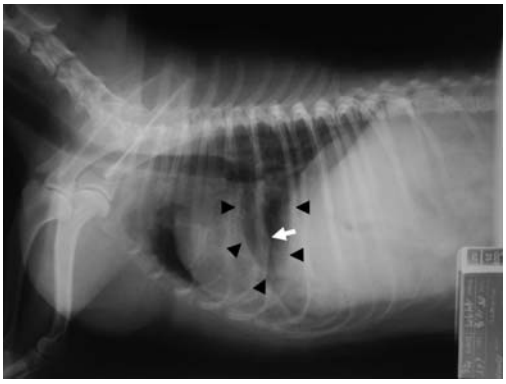

Fig. 7: Lateral radiographic view after mass excision revealed that the mass occupying area was replaced to radiolucent zone after surgery (black arrowheads). Caudodorsal cardiac silhouette could be confirmed (white arrow).

In this case, small-cell anaplastic carcinoma of primary lung tumor in a miniature Schnauzer was treated by surgical excision. After surgery, although clinical signs seemed to be alleviated, however, those were recurred immediately. There were various reasons such as systemic metastasis, progression of heart failure and liver insufficiency, and pulmonary insufficiency. Of them, it was thought that main reason of deterioration after mass excision was incomplete surgical excision from severe invasion into around tissue of the tumor. Therefore, continuous studies for small-cell anaplastic carcinoma and its extended operation techniques for complete mass excision should be required in veterinary medicine.

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