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Imaging Diagnosis: Heartbase Tumor in a Dog

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Abstsact : A ten-year-old Yorkshire Terrier developed serious abdominal distension and respiratory distress. Radiography and ultrasonography revealed a hyperechoic mass around the aorta that was contiguous with the right atrium and main pulmonary artery. It was resulted in failure of the right side of the heart including tricuspid regurgitation, hepatomegaly with dilation of the hepatic vein and severe ascites due to a large, expansile mass. Computed tomography (CT) identified a large mass originating at the cardiac hilar region and spanning from the cranial vena cava to the caudal vena cava. The tumor had invaded the cranial vena cava, caudal vena cava, heart and pleural wall. A tentative diagnosis of chemodectoma was assigned to the tumor through a fine needle aspiration. This report focuses on the typical features of imaging diagnosis of heartbase tumors by radiography, ultrasonography and CT.

Key words **:** Heartbase tumor, chemodectoma, computed tomography, dog.

Introduction

'Heartbase tumor' is a general term used to designate any mass at the base of the heart related to the ascending aorta and pulmonary trunk but without right atrial involvement (7, 13). The term is also often used synonymously with chemodectoma, aortic body tumor, or cardiac paraganglioma; however, it is actually no more than a topographic description for a neoplasia occurring at the base of the heart (7,10). Chemodectomas of the aortic body are the most commonly reported heartbase masses in dogs (1,15). They mostly occur in aged males of brachycephic breeds such as Boxers, Boston Bull Terriers and Bulldogs (1,7,10,15). The nature of this mass is nonfunctional, often locally invasive, and rarely metastasized (11). Clinical signs depend on the secondary outcome of its space-occupying behavior (15). CT, as well as thoracic radiography and echocardiography, is essential for diagnosis of a heartbase mass. The purpose of the report is to discuss several advantages of different imaging modalities and characteristic descriptions of the heartbase mass.

Case study

History and Examination

A ten-year-old, castrated male, Yorkshire Terrier was admitted with a history of abdominal distension and increased respiratory effort. On physical examination, there was severe abdominal distension due to ascites. There were no specific findings except for mild leukocytosis ($20.1 \times 10^3/\mu l$) and moderate hyperphosphatemia (11.2 mg/dl) in a blood screening profile.

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Imaging findings

On thoracic radiographs (Fig 1), there was a soft tissue mass with ill-defined margins extending from the base of the heart into the cranial mediastinum and a consequent enlarged cranial waist. Cranial and middle mediastinal widening with its left-sided prominent bulging were observed accompanying right dorso-lateral elevation of the trachea. An enlarged cardiac silhouette, tortuous and dilated right caudal pulmonary vessels, and a focal increased opacity of caudodorsal lung field were apparent. On abdominal radiographs (Fig 2), severe abdominal distension due to a large amount of ascites was observed. Caudal displacement of the gastric axis and loss of abdominal details, including floating gas-filled intestinal structures, were visible. Incidentally, there was narrowing of the intervertebral space with sclerotic change and spur formation at the ventral endplates from the 5^{th} to 7^{th} cervical vertebrae.

Upon echocardiographic examination (Fig 3), a hyperechoic mass adjacent to the aorta, right atrium and main pulmonary artery was identified (Fig 3-A). It was difficult to image and evaluate the exact contour, size, and margin of the mass because of its dorsal location. Dilation of the right atrium, right ventricle and pulmonary artery were also found. Additionally, there was a high-velocity jet (4.23 m/s) of tricuspid regurgitation (Fig 3-B). An overall large amount of fluid was present in the abdominal cavity during the abdominal ultrasonographic examination. Hepatomegaly, with dilation of hepatic veins, was apparent (Fig 3-C).

Two helical CT scans, pre and post contrast study were performed according to protocol with 3mm slice thickness and pitch of 1.3 from the thoracic inlet to abdominal cavity. An ill-demarcated large mass with nonuniform contrast enhancement was observed encompassing the entire cranial

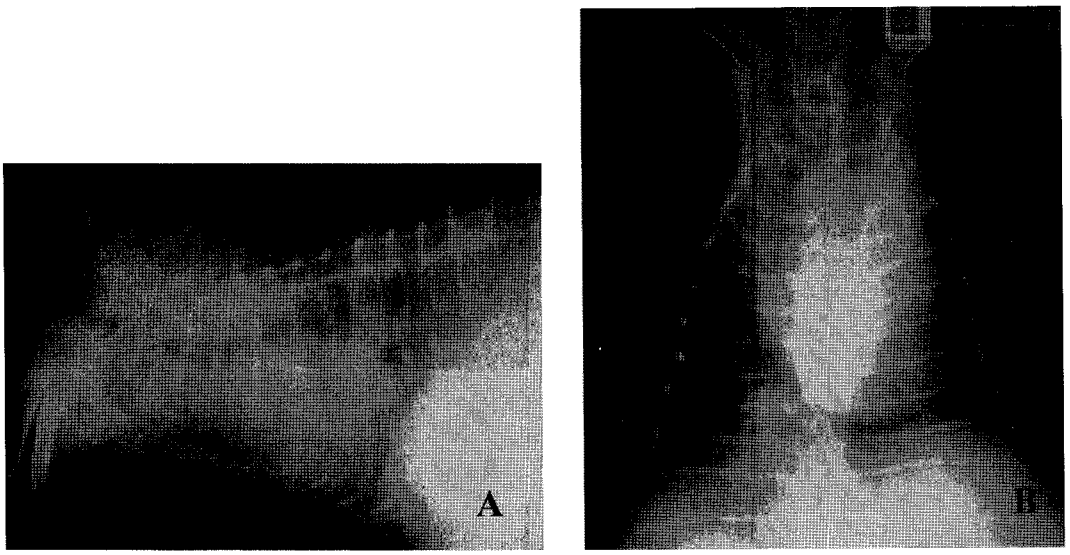

Fig 1. (A) A right lateral radiograph depicting a large and soft tissue opacity mass with unclear boundaries surrounding the aortic region and extending to the cranial mediastinum. (B) A ventrodorsal radiograph showing severe widening of the cranial mediastinum with predominant left bulging and mild tortuosity and dilation of the right caudal pulmonary artery.

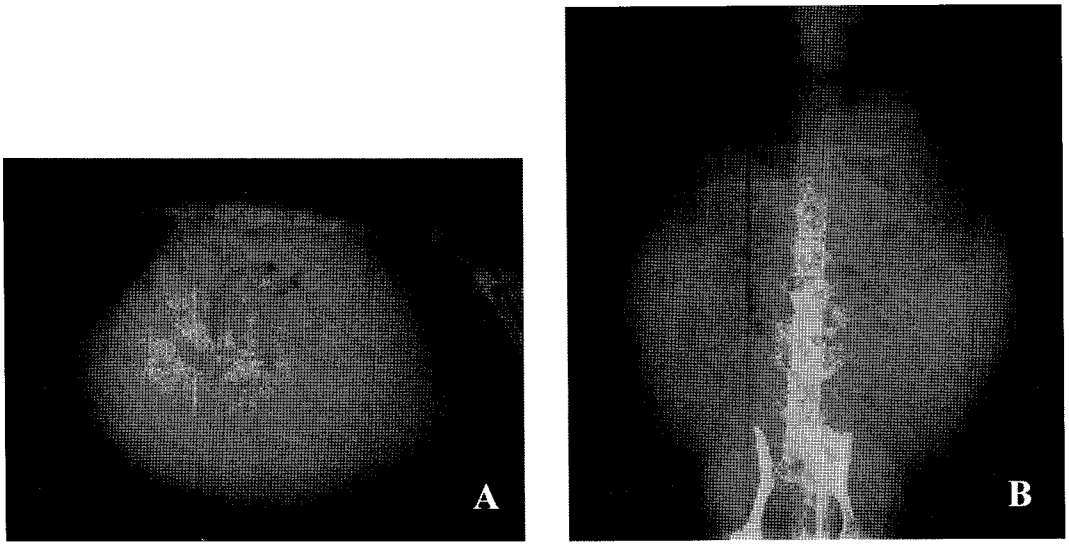

Fig 2. Diffuse loss of abdominal details including floating gas-filled intestinal structures and severe abdominal distension from right lateral (A) and ventrodorsal (B) abdominal radiographs.

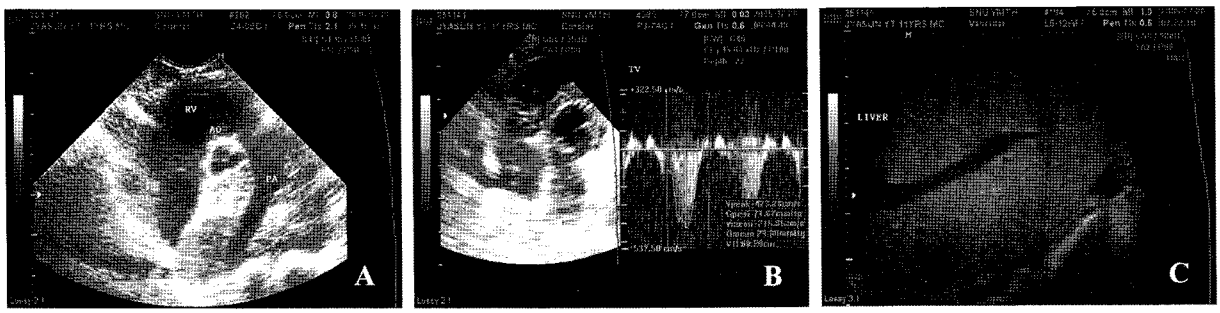

Fig 3. (A) A hyperechoic mass attached to the aortic root and adjacent pulmonary artery from a right parasternal short-axis view. (B) A high-velocity (4.23 m/s) tricuspid regurgitant flow from a left apical four-chamber view. (C) Diffuse fine echotexture and engorged hepatic vein within the liver.

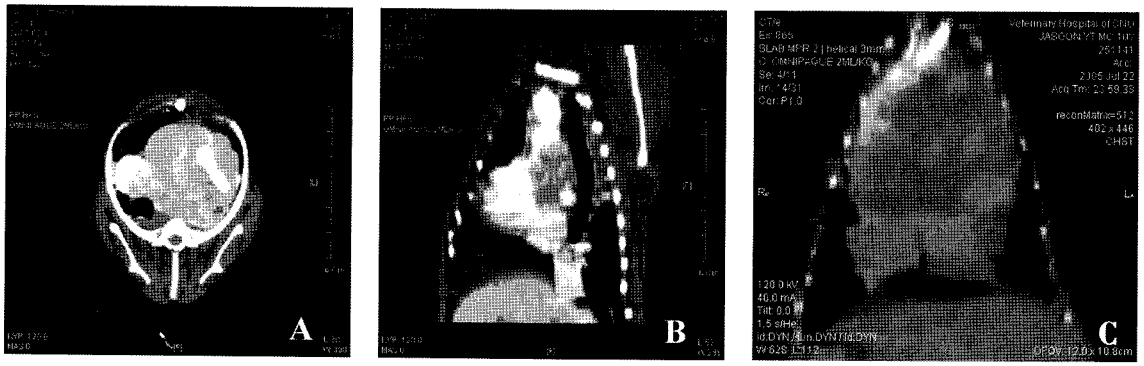

Fig 4. A mass with heterogeneous contrast enhancement, partial invasion and loss of details in the cranial vena cava, right lateral and dorsal displacement of the cranial vena cava and trachea inform a transverse 3.0 mm computed tomogram at the level of the fourth thoracic vertebra (A) and a reformatted image (C), (B) An ill-circumscribed large mass surrounding the aortic region and involvement and dilation of the cranial vena cava from a reconstructive reformatted image.

mediastinum and spanning to the surrounding aorta. The mass was found to be dominant on the left side of the thorax (Fig 4-C). A heterogeneous mass, 3.5 × 5 cm in dimensions, had invaded into the cranial vena cava, heart, pleural wall and caudal vena cava (Fig 4). The cranial vena cava was displaced to the right and was moderately dilated. This mass caused deviation of the trachea and mainstem bronchi to the right and dorsally.

Discussion

Thoracic and abdominal radiographs are helpful in identifying heartbase masses, metastatic changes and secondary diseases associated with the primary tumor. The detection of the heartbase mass depends on the size of the mass and the deviation or shift of adjacent extra-cardiac structures that it causes, such as the trachea, esophagus, cardiac silhouette and mediastinum. Radiographic analysis is a less informative tool unless the size of the mass is large enough to be recognized. It was a useful screening test for this patient in order to determine the cause of presented clinical signs.

Two-dimensional echocardiography readily distinguishes between soft tissue and fluid structures, making it valuable in identifying intracardiac and extracardiac masses associated with the pericardium, atrial and ventricular walls and chambers, valves, and other structures (3,5,9). While there are some limitations, such as the possibility of failing to notice the extent of the mass at the extrapericardial region due to lung interference and the inability to approach this location (13). This method was able to provide evidence of the structural and functional abnormalities for this case; a hyperechoic mass lesion, subsequent right-sided heart failure including tricuspid insufficiency, various mechanical disturbances resulting from the ascites caused by a space-occupying lesion (11).

CT, the more advanced imaging technique, is critical in order to assess the staging, exact extent and degree of invasiveness of the lesion, predict the prognosis of the patient, determine surgical options and suggest management protocols of cancer patients (2,12,14,16). The parameters for evaluation of CT images are contrast enhancement pattern, displacement, compression, and invasion of main adjacent vessels such as the aorta, subclavian vessels, cranial vena cava, and caudal vena cava, thoracic wall invasion, probability of metastasis at lung nodules, mediastinal lymphadenopathy, tracheal displacement and entrapment, and pleural effusion (16). In the case of this patient, the following parameters were identified; patchy and inhomogeneous contrast enhancement due to neovasculization within the mass lesions; regional invasion and dilation of the cranial vena cava with right-lateral and dorsal displacement; expansive distribution of the mass lesion throughout the cranial vena cava to the caudal vena cava, specifically surrounding aorta; right-lateral and dorsal deviation of the trachea; and an ill-circumscribed boundary between the mass lesion and the aorta, heart, pleural wall and caudal vena cava.

The heartbase tumor, and chemodectoma, in particular, has a marked tendency to invade local lymphatics and blood vessels but usually does not establish metastatic sites (4). It was possible to perform a detailed investigation of this patient's condition, using a variety of diagnostic imaging tools, especially CT.

This patient showed clinical signs of congestive heart failure such as obstruction of blood flow within the heart and great vessels. In general, heartbase tumors are most often associated with pericardial involvement of the tumor and accompanying pericardial effusion (8). Heartbase masses are a common cause of cranial vena cave syndrome due to tumor pressure on the cranial vena cava (6,8). Fortunately this patient had no evidence of pericardial, pleural effusion or cranial vena cave syndrome; however the prognosis is poor because of aggressive local invasion of great vessels as observed through CT examination.

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개의 심기저부 종양의 영상진단학적 특징

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요 약 : 심한 복부팽만과 호흡 곤란 증세를 보이는 10살의 요크셔 테리어가 내원하였다. 방사선과 초음파 검사로 우심방과 주폐동맥에 인접한 대동맥 주위로 고에코성의 큰 종괴를 확인하였다. 확인된 종양은 심장 기저부 주위에 존재하는 확장성 종양으로 삼첨판 역류, 대량의 복수와 간정맥 확장을 동반한 간종대와 같은 우심 부전 소견을 보였다. 전산화단층촬영법으로 확인된 이 종괴는 전대정맥에서 후대정맥까지 위치한 심장 기저부 주위에 존재하는 크고 비균질성을 띤 종괴였다. 이 종괴는 전대정맥, 심장, 후대정맥 및 흉벽까지 침습되어 있었으며, 세침흡입술을 통한 잠정적인 진단은 Chemodectoma였다. 본 증례로 다양한 진단 영상학적 수단을 통한 심기저부 종양에 대한 특징 및 역할을 알 수 있었다.

주요어 : 심기저부 종양, Chemodectoma, 전산화단층촬영법, 개