Chondrosarcomas occur in bones and at various extraskeletal sites [8, 9, 19]. Extraskeletal chondrosarcomas involving cardiac chambers or large vessels such as the aorta, however, are very rare, both in humans and animals [1, 2, 5, 6, 14]. The diagnosis of primary aortic malignancy is challenging because it is generally accompanied by nonspecific clinical signs, such as acute onset of pain and lameness of the extremities, symptoms also observed in thromboembolism [3, 22]. Primary aortic malignancies can be treated by palliative resection, chemotherapy and/or radiation therapy, but it has not been shown that resection prolongs survival nor that adjuvant therapy in the form of radiation or chemotherapy alters the natural course of the disease [15, 16, 22]. We described here a dog with a primary chondrosarcoma originating in the distal abdominal aorta.

A 14-year-old, spayed female, mixed breed dog was referred for acute onset of pain and paresis of the hindlimbs. The dog had a 3-day history of progressive pelvic limb ataxia. On admission, the dog was depressed and had ambulatory paraparesis, with delayed proprioceptive deficits, while forelimbs were normal. No other remarkable neurological problems were noted. Femoral and dorsal pedal pulse quality was poor and pelvic limbs were cool. Heart rate was 104 beats/min and systolic blood pressure, measured from the forelimbs, was 130 mmHg. A grade 2/6 systolic murmur with maximum intensity over the mitral valve was audible but no arrhythmia was detected.

Complete blood count was unremarkable. Serum biochemistry demonstrated mildly increased alanine aminotransferase (107 U/l; reference range, 19–100 U/l), aspartate aminotransferase (316 U/l; reference range, 15–43 U/l), alkaline phosphatase (233 U/l; reference range, 15–127 U/l), and amylase (2236 U/l; reference range, 185–700 U/l). The D-dimer concentration was within the normal range (0.06 μg/dl; reference range, 0–0.25 μg/dl). Lactate concentration was higher in the hindlimbs (4.7 mmol; reference range, 0.6–2.9 mmol) than in the forelimbs (0.9 mmol). The dog was negative for heartworm (SNAP 4Dx test; IDEXX laboratories). Thoracic radiography revealed a mild, left-sided cardiomegaly (Vertebral Heart Score=11), with a prominent left auricle. The diameters of caudal pulmonary arteries were at the upper normal limit. Lung fields appeared unremarkable. There were no vertebral column abnormalities. Abdominal ultrasonography showed a homogeneous, hypechoic mass about 16.2 mm in length and 4.5 mm in height located in the distal abdominal aorta just proximal to the aortic trifurcation (Fig. 1). Color-flow Doppler imaging showed that this mass almost completely occluded the vessel. Both adrenal glands were of normal shape and the width of left adrenal gland was 6 mm and that of right adrenal gland was 4.7 mm.

The dog was hospitalized and maintained on intravenous 0.9% normal saline (Isotonic Sodium Chloride Inj.; Daehan Pharm. Co.) and cefazolin sodium (Cefazoline; Yuhan Corporation). Because the aortic mass was suspected to be a thrombus, dalteparin (Fragmin; Pfizer Pharmaceuticals) 150 IU/kg was administered subcutaneously three times a day in hopes of preventing continued thrombosis at the site of the presumed thrombus and elsewhere. The dog was also administered 1 unit of fresh plasma per day intravenously, together with 75 mg clopidogrel (Plavix; BMS Pharm.) orally once per day.

Echocardiography showed that the cardiac chambers were not enlarged and that myocardial contractility and echogenicity were normal. Mild mitral regurgitation with a peak velocity of 3.92 m/sec was observed. There was no
evidence of an intracardiac tumor or thrombus, or of valvular abnormalities suggesting infective endocarditis.

On adrenocorticotropic hormone (ACTH) stimulation test, basal cortisol concentration was 4.4 μg/dl and post-ACTH plasma cortisol concentration was 15.1 μg/dl. On low-dose dexamethasone suppression test (LDDST), a 4 hr post cortisol was 3.1 μg/dl and an 8 hr post cortisol was 9.8 μg/dl. On high-dose dexamethasone suppression test (HDDST), the cortisol concentration, 7.2 μg/dl, was decreased to 2.9 μg/dl after 8 hr. Pituitary-dependent hyperadrenocorticism was tentatively diagnosed on the basis of the adrenal function tests and adrenal ultrasonography.

Despite treatment with various analgesics, the condition of the dog continued to deteriorate during 7 days of hospitalization. The owner refused any further medical therapy. After euthanasia of the dog, a local incision was made and the aortic mass was removed, but postmortem examination was not permitted.

A 2-cm segment of the distal abdominal aorta bulged at the level of aortic trifurcation. The bulge was due to a yellowish white, multilobulated, elastic mass (Fig. 2), which completely occluded the vascular lumen from an area proximal to the aortic trifurcation to the external and internal iliac arteries. The intraluminal mass was removed, fixed in 10% neutral-buffered formalin, processed, embedded in paraffin, and stained with hematoxylin and eosin. Five serial sections from the mass were examined microscopically and revealed similar histological changes. The intraluminal mass was lobulated and consisted of well-differentiated neoplastic chondrocytes with mild to moderate anisokaryosis and anisocytosis (Fig. 3). The nuclei were plump to fusiform, with 1 or 2 magenta nucleoli and finely stippled chromatin. Mitosis was rare in a high power field.
No tumor embolus was noted.

Extraskeletal chondrosarcomas involving the cardiovascular system are very rare in all animal species as well as in humans [1, 2, 4, 6, 14]. Only a few such tumors involving the leaflets of the mitral or tricuspid valve, the atrium, or the large vessels have been reported in dogs [1, 2, 4, 6, 14]. To date, aortic chondrosarcoma has been identified in two dogs and the tumors were originating from the brachiocephalic trunk and left subclavian arteries [2, 6]; one of them obstructed completely the true aortic lumen and was associated with an aortic dissection that caused pulmonary artery compression, and an aortopulmonary fistula [6]. In humans, only 2 primary aortic chondrosarcomas have been described, one each in the thoracic and abdominal aorta [7, 15]. In one patient, a myxoid chondrosarcoma was incidentally identified from the resected infrarenal abdominal aneurysm [15], which had the appearance of a ‘thrombus’, with an unusual color, texture and consistency. The macroscopic description of that tumor was identical to that of the aortic mass in our case.

In our case, thrombosis was initially suspected based on ultrasonography, which showed an almost complete loss of vessel contents, the presence of an intraluminal mass and the disappearance of blood flow signals [12]. Differential diagnosis of aortic thrombosis, however, should also include other causes of total or partial obstruction, including intraluminal tumor seeding and a primary vascular tumor [11, 25]. Heart base tumors and pheochromocytomas are examples of tumors involving the aorta in dogs [10, 18, 20]. Appropriate laboratory tests excluded other causes of aortic thromboembolism, including sepsis, glomerular disease, immune-mediated hemolytic anemia, and DIC, and the possibility of a primary adrenal tumor was estimated to be low on the basis of adrenal function tests and adrenal ultrasonography [13]. Blood pressure was measured three times per day during hospitalization, but there was no indication of a pheochromocytoma [17]. An aortic thromboembolism caused by pituitary-dependent hyperadrenocorticism was tentatively diagnosed based on the results of the ACTH stimulation test, LDDST, and HDDST. Thrombolytic agents may be attempted to dissolve the lesion and anticoagulants to prevent the thrombus from enlarging if diagnostic methods are indefinite and a large isolated intra-aortic mass has been identified [21, 25]. This dog was therefore treated with low-molecular-weight heparin and fresh plasma, but not with a thrombolytic agent due to concerns about possible secondary hemorrhage, hypersensitivity and reperfusion injury [21, 25].

An organized approach to determine the source of thromboembolism and to differentiate between thromboembolism and aortic tumor is essential [21]. A diagnostic algorithm has been proposed in humans and may be extended to animals [23]. First, the heart should be evaluated by echocardiography for atrial tumors or mural thrombi [21, 23]. Embolism of the kidneys, spleen and elsewhere is a reasonably common complication of canine infective endocarditis, however emboli of cardiac origin are relatively infrequently encountered following vascular damage from inflammation in dogs with heartworm infection, or circulatory stasis in valvular diseases, especially in those with atrial fibrillation [13]. The dog described here had no evidence of intracardiac abnormalities except for mild mitral regurgitation. The diagnosis of aortic chondrosarcoma was confirmed histopathologically. A systematic approach using diagnostic methods commonly used for thromboembolism and tumor indicated that the aortic tumor was a primary lesion, however this study had a limitation that CT or MRI assessments or a complete postmortem necropsy were not performed.

This case is the first extraskeletal chondrosarcoma originating from distal abdominal aorta in dogs. To our knowledge, there have been no previous reports of ultrasonographic localization of a mass in a dog with a primary aortic chondrosarcoma. We described here a dog with an unusual presentation of a primary aortic chondrosarcoma, clinically mimicking a thromboembolism. Our findings indicate that aortic neoplasm should be considered in differential diagnosis when an intraluminal mass is suspected in the aorta.

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