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Diagnostic and therapeutic approach to cardiac myxosarcoma in a dog

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Abstract: A 7-year-old Chow Pei was referred to an animal hospital for the evaluation of a 1-month history of abdominal distension and exercise intolerance. A systolic murmur was auscultated over the tricuspid valve (TV). Thoracic radiographs showed cardiomegaly, right atrial enlargement, and pulmonary edema. Electrocardiography revealed small QRS complexes and a right-bundle branch block. Echocardiography also showed right atrial enlargement and tricuspid insufficiency due to the presence of a mass on the posterior leaflet of the TV. The mass was excised by intracardiac surgery and histological evaluation revealed myxosarcoma. This is a case report of a diagnostic and therapeutic approach to myxosarcoma of the TV in a dog.

Key words: Cardiac myxosarcoma, tricuspid valve, dog

1. Introduction

In dogs, the primary tumors of the heart include heart base tumors and hemangiosarcoma. Myxoid tumors, rare cardiac tumors in dogs (1), are commonly reported in humans (2,3). Myxomas, benign tumors of connective tissue, are slow-growing tumors that cause organ-specific damage such as in the skin, kidney, joints, and heart (1). In dogs, there is little information on diagnostic approaches applied in myxosarcomas arising from the tricuspid valve (TV), despite a few previous histopathological examination reports (2,4–6).

A diagnosis of intracardiac myxosarcoma might be coincidental because of nonspecific symptoms of the patient such as lethargy, anorexia, and ascites (1). Unless thoracic radiography gives a clue pointing to chamber dilation, further investigations like echocardiography should be done to see and localize any mass in real time (3). In general, patients with cardiac tumors can receive medical and/or surgical treatments (1). However, in veterinary medicine, open-heart surgery is a restricted procedure mainly due to the scarcity of technical equipment and experienced personnel. To our knowledge, this is the first case report that presents clinical diagnostic procedures as well as medical and surgical treatments of myxosarcoma of the TV in dogs.

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2. Case history

A 7 year-old male Chow Pei (Chow Chow and Shar Pei mixed breed), weighing 24 kg, was referred to an animal hospital (Faculty of Veterinary Medicine, Uludağ University, Bursa, Turkey) with a 1-month history of progressive lethargy, abdominal distension, and exercise intolerance. Routine clinical and laboratory examinations (hematological and serum biochemistry analyses) were performed. The dog was also screened for antibodies of *Anaplasma marginale*, *Leishmania infantum*, *Ehrlichia canis*, and *Borrelia burgdorferi* as well as the antigen of *Dirofilaria immitis* by speed tests (Anigen Rapid Test, South Korea).

Ascites was observed by ultrasonography. Following abdominocentesis, an ascitic fluid sample was analyzed using a reagent strip (KRULAB Urine Strip, KRUSE, Denmark), hand-held refractometry (Atago, Japon), and a Diff-Quik smear. In the diagnostic work-up, thoracic radiography (Philips, DuoDiagnost, USA), electrocardiography (Esoate, Italy), and echocardiography (Caris Plus, Esoate, Italy) were performed (Figures 1A–1C, 2A, and 2B) as suggested (1). Atrioventricular and semilunar valves were examined on the right and left parasternal long axis views by 2-dimensional and color-flow echocardiography. An intracardiac mass was detected

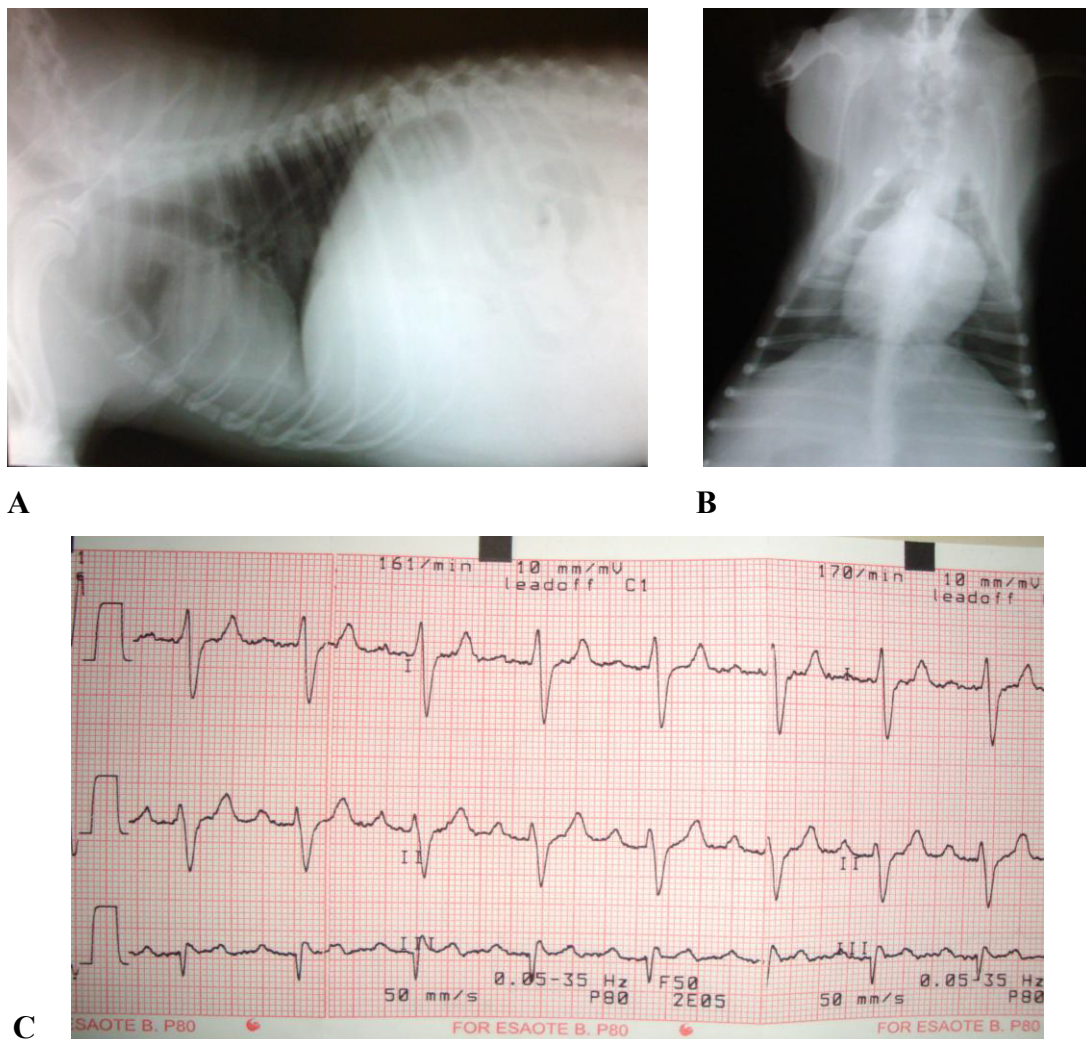


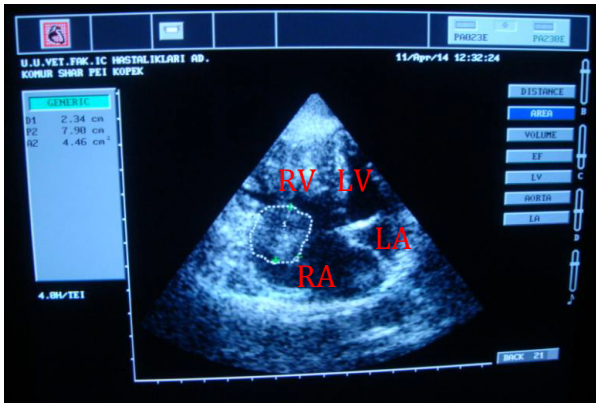
Figure 1. Thoracic radiography and electrocardiography of the dog with myxosarcoma. A and B: Right-sided cardiomegaly (right atrial enlargement, D-shaped and increased sternal attachment of right ventricle) and pulmonary edema. C: Constant deep S waves, right bundle branch block, right axis deviation, and prolonged “rS” appearance of QRS complexes.

over the posterior leaflet of the TV (Figures 2A and 2B). Aortic, mitral, and tricuspid inflows were evaluated by continuous and pulse-wave (PW) Doppler. Pulmonary artery systolic pressure (PASP) was calculated using the modified Bernoulli equation (1). To evaluate TV function, tricuspid annular plane systolic excursion (TAPSE) was measured from an M-mode recording the lateral aspect of the TV annulus in a left parasternal apical 4-chamber view (7).

The dog was treated symptomatically for 2 weeks with furosemide (Lasix 40 mg/tablet, 2 × 1 tablets, per os), enalapril plus hydrochlorothiazide (Konveril Plus 20 mg/tablet, 2 × 1 tablet, per os), and methylprednisolone (Prednol 16 mg/tablet, 2 × 3 tablet, per os) (1). For the differential diagnosis, and a radical approach of the

mass, the dog underwent surgery. General anesthesia was induced by the combination of ketamine, HCl, and diazepam. After intubation, anesthesia was maintained with 2% isoflurane. The dog was monitored by pulse oximetry, capnography, peripheral capillary oxygen saturation (SpO₂), electrocardiography (ECG), central venous pressure, blood gas and coagulation analysis, and noninvasive blood tension. Respiration was assisted by mechanical ventilation. Heparin solution and an antibiotic agent were given to prevent thrombus formation in the vascular system and secondary infections, respectively. Cardioplegia was not applied the dog, in order to resuscitate the heart easily after surgery. The heart was easily exposed by intercostal right thoracotomy and pericardiectomy. After cannulation of the vascular structures (aorta, caudal,

A



B

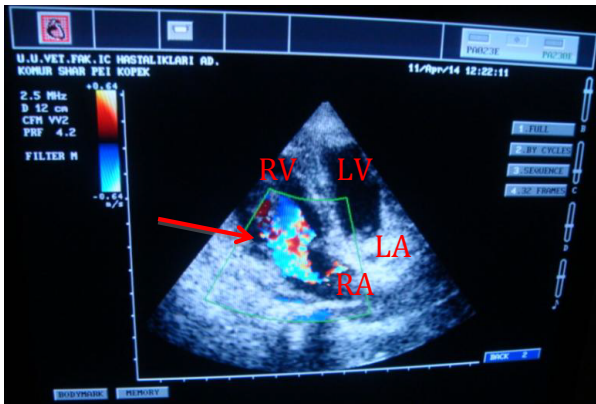


Figure 2. Two-dimensional echocardiography on left apical 4-chamber view in a dog with tricuspid valve myxosarcoma. A: A mass arising from the posterior leaflet of the TV, and right atrial enlargement. B: Severe TV regurgitation (arrow). LA: Left atrium; LV: left ventricle; RA: right atrium; RV: right ventricle.

and cranial vena cava), cardiopulmonary bypass was provided with a pump machine (Sarns 8000 3M, Heart Pump, USA). The tricuspid mass was removed following the incision of the right atrium (RA) (Figure 3). After suturing of the RA, residual air was aspirated and the blood supply was integrated with the assistance of the pump machine. Ventricular functions were supported by a cardiac pacemaker temporarily before thoracotomy closure. The mass was stained with hematoxylin and eosin for histopathological evaluation (Figures 4A and 4B).

3. Results and discussion

In this case, abdominal distension was selected as the main clinical problem during the diagnostic work-up. Thus, the differential diagnosis included organomegaly (hepatomegaly, splenomegaly, etc.), intraabdominal mass, hepatorenal failure, hypoalbuminemia, lymph obstruction, peritonitis, abdominal urea, bleeding

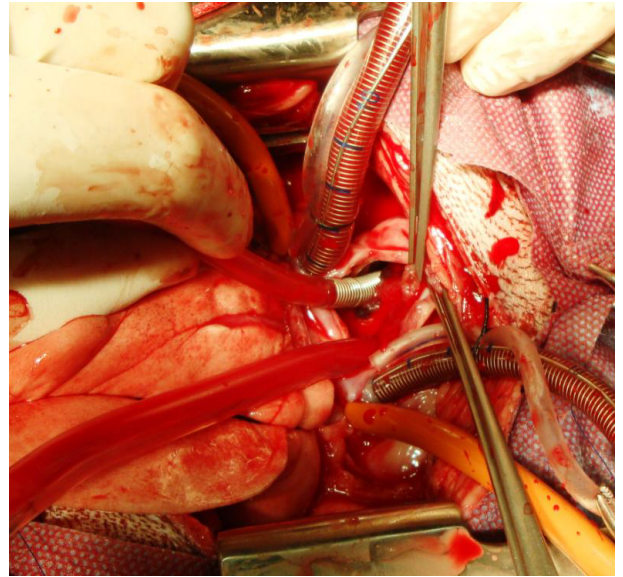


Figure 3. Intraoperative view points out the removing of the mass (arrow) over the TV.

disorders, hyperadrenocorticism, and congestive heart failure (1). Since complete blood counts (white blood cells: $14.1 \times 10^3/\mu\text{L}$, hematocrit: 37.5%, platelets: $422 \times 10^6/\mu\text{L}$) and serum biochemistry values (alanine aminotransferase: 65 IU, aspartate aminotransferase: 32 IU, alkaline phosphatase: 48 IU, blood urea nitrogen: 18 mg/dL) were within the reference ranges, hematological and metabolic diseases were excluded from the differential diagnosis list. The dog was also negative for common vector-borne pathogens. In this dog, congestive heart failure was suspected based on clinical observations such as pale mucous membranes, pulse deficit, tachycardia, jugular distension, and high-grade systolic murmur over the TV, in addition to initial imaging findings for ascites and right-sided cardiomegaly (Figures 1A and 1B). Ascitic fluid was characterized as modified transudate based on the following findings: white-transparent physical appearance, pH 7.2, specific gravity 1.022, protein content 4.9 g/dL, and rare cell content (1). In addition, ECG findings such as right bundle branch block (RBBB) and the 'rs' appearance of QRS complexes (Figure 1C) highly suggested the presence of right heart failure (1).

M-mode measurements were compatible with RA and right ventricular dilations, as well as impaired left ventricular function and geometry (Table) (1). Echocardiography revealed a large mass (2.3 cm \times 7.9 cm, 4.46 cm²), which was attached on the posterior leaflet of the TV (Figure 2A), leading to TV dysfunction, severe TV regurgitation, and RA enlargement (Figure 2B). A TAPSE value of 0.92 cm in this dog (reference: ≥ 1.3 cm) (7) indicated RV systolic dysfunction and right heart

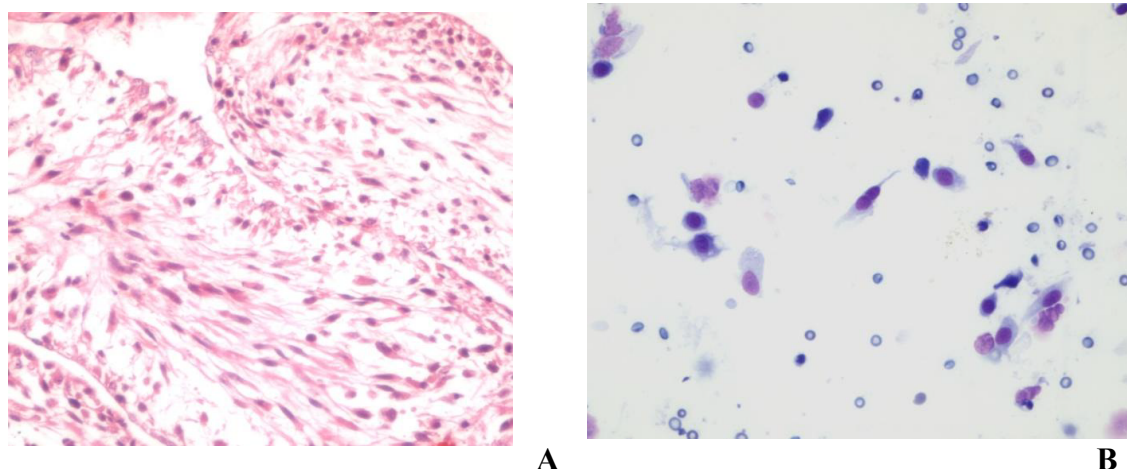


Figure 4. Neoplastic masses have myxomatous stroma with a sparse number of spindle cells scattered throughout the sections. In some areas stellate mesenchymal cells were noticed (A, B). Cellularity was low and an occasional number of mitotic figures were observed. Nuclear pleomorphism was evident in some areas (B).

remodeling (1). PW Doppler examination revealed a high tricuspid regurgitant jet velocity (v : 2.8 m/s), indicating moderate pulmonary hypertension (PH) ($4v^2 + 15$ mmHg: 47 mm/Hg) (1). Doppler measurements of TV inflow were in the reference range (data not shown).

The dog was treated by a diuretic, ACE inhibitor, and methylprednisolone to decrease RA volume overload and

Table. M-mode measurements on right parasternal long-short axis view in a dog with TV myxosarcoma.

Parameters	Patient	Reference range
RVDd (cm)	1.44	1.35 ± 0.08
IVSd (cm)	0.96	0.62–1.27
IVSs (cm)	0.82	0.92–1.69
LVDd (cm)	2.02	3.23–4.71
LVDs (cm)	1.63	1.93–3.43
LVPWd (cm)	0.86	0.61–1.25
LVPWs (cm)	0.86	0.97–1.76
FS (%)	19	39 ± 6
Ao (cm)	1.7	1.86–2.84
Left atrium (cm)	2.0	1.77–2.90
Mitral E/A ratio	3.2	>1.0
Tricuspid E/A ratio	0.9	>1.0

RVDd = Right ventricular end-diastolic diameter; IVSd = interventricular septal end diastole; IVSs = interventricular septal end systole; LVDd = left ventricular end-diastolic diameter; LVDs = left ventricular end-systolic diameter; LVPWd = left ventricular posterior wall end diastole; LVPWs = left ventricular posterior wall end systole; FS = fractional shortening; Ao = aorta.

remove the ascites, as suggested (1). Our observation of the failure of medical treatment was in good accordance with the result of a previous case study of Briggs et al. (3), who reported that although a dog with RA myxosarcoma was treated medically for 10 days by antibiotic, diuretic, and digoxin, the dog deteriorated and was euthanized due to the grave prognosis. In the case presented here, 2 weeks after initiating the medical therapy, clinical and imaging findings did not improve as expected, probably due to fact that the mass size was large and gave rise to severe TV regurgitation and PH, which is not controlled with a standard medical approach (1). The prognosis of cardiac tumors depends on the structural and functional changes associated with their size and location. Unfortunately, in this case, the neoplastic mass was over the leaflets of the TV, thereby resulting in geometric and functional abnormalities such as cardiomegaly and PH.

In this case, the dog underwent surgery due to an unsatisfactory response in medical treatment, as reported earlier (3,6). After RA incision, a mass over the TV was removed without disturbing the TV leaflets (Figure 3). During this manipulation, severe pulmonary artery dilation was observed as a result of PH. However, separating the patient from the heart-lung machine was unsuccessful, due to a cardiac cycle failure. This probably resulted from PH and reexpansion of pulmonary edema (8). As reported in human medicine, dogs need medical support such as nitric oxide inhalation and sildenafil to decrease PH during surgery (1). The presence of ECG abnormalities such RBBB might have played a role in impairing the cardiac cycle when the dog was separated from the heart-lung machine, as well (1).

Necropsy could not be carried out due to the owner's objection and thus possible metastases were not clarified.

Previously, myxosarcoma has been reported in the left atrium (2), mitral valve (5), RA (3), left ventricle (6), eye and brain (9), and thorax (1) in dogs. In this study, based on histopathological findings, the mass, which was diagnosed as myxosarcoma, had a myxomatous stroma with a sparse number of spindle cells scattered throughout the sections (Figure 3).

This case presentation suggests that echocardiographic examination is crucial for accurate diagnosis in patients with an atrioventricular valvular mass. TV myxosarcoma should also be considered in the diagnostic work-up and in the differential diagnosis in dogs suffering from abdominal distension (ascites). Veterinarians should keep

in mind that PH may cause unfavorable conditions during open-heart surgery. Owners should also be informed that the prognosis is poor despite medical therapy and/or surgical approaches in dogs with myxosarcoma.

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