

Echocardiographic Diagnosis of Intracardiac Masses in Yorkshire Terrier Dogs : 2 Cases

Donghyun Han, Hyunji Kim and Changbaig Hyun¹

Section of Small Animal Internal Medicine, School of Veterinary Medicine,
Kangwon National University, Chuncheon 201-100, Korea

(Accepted: December 14, 2012)

Abstract : Primary and metastatic tumors involving the heart are relatively uncommon in dogs. In this study, we provide the echocardiographic diagnosis of intracardiac masses in 2 Yorkshire terrier dogs. In the first case, the mass was attached between ascending aorta and pulmonary artery and caused moderate aortic regurgitation and moderate left ventricular dilation. The case was graded into ISACHC II heart failure. The dog was treated with common cardiac medications (i.e. furosemide, enalapril, pimobendan) and oral chemotherapeutic agent (i.e. lomustine). In the second case, the mass was occupied 2/3 of the left atrium and caused marked dilation of left atrium and severe mitral regurgitation (~5 m/s), but not severe congestive heart failure (ISACHC Ib). Although the nature of progression of the mass was likely to cardiac myxoma, the biopsy was not performed due to the owner's refusal. The dog was currently treated with cardiac medications (i.e. ramipril, clopidogrel) and bronchodilator (i.e. aminophylline). Those two dogs are still survived and are currently regularly checked.

Key words : intracardiac mass, aortic body, left atrium, myxoma, echocardiography.

Introduction

Primary and metastatic tumors involving the heart are relatively uncommon in dogs (1,9). The overall prevalence rate in canine heart tumors has been estimated at 0.19% (9). Increased risk of developing a cardiac tumor has been also reported in castrated male and spayed female dogs (9). One canine data base survey study found 84% of heart tumors were identified as primary to the heart (9). Hemangiosarcoma (HAS) arising in the right atrium is the most common primary cardiac tumor in dogs, while several cardiac tumors of mesenchymal origin including rhabdomyosarcoma, leiomyosarcoma, fibrosarcoma and malignant mixed mesenchymal tumor have also been reported (4,7,9). Even though cardiac metastasis is rarely occurred in dogs, cardiac metastases of mammary and pulmonary carcinoma, lymphoma, and malignant melanoma have often reported in veterinary literature (9).

Cardiac tumors can cause variable effects to the body, based on the tumor location and the severity of hemodynamic interference (9). Cardiac tamponade resulting from pericardial effusion and restriction of ventricular filling process is the common consequence from the extra-cardiac compression by external cardiac tumors such as HAS and aortic body tumors. In contrast, intracardiac tumors can cause heart failure by obstructing blood flow and/or by inducing arrhythmias. Furthermore, the location and the size of tumor can

significantly affect the functional derangement of heart.

Echocardiography can provide non-invasive and sensitive detection of intracardiac neoplasia, as well as pericardial effusion, although other diagnostic studies can be helpful for detecting intracardiac neoplasia (8). Using the echocardiography, we can identify the location and extent of mass lesions and also assess hemodynamic effect occurred from the intracardiac mass lesion. Furthermore, secondary changes in chamber size, wall thickness and valve motion can be also evaluated by the echocardiography. Based on the Doppler estimation of blood flow abnormalities, we can estimate the severity of disease from mechanical disturbance from intracardiac tumors, although we can't estimate the malignancy of these tumors. This case study was designed to provide the echocardiographical diagnosis of intracardiac masses in dogs.

Cases

Case 1

An 11-year-old, neutered male Yorkshire terrier weighing 5.2 kg was referred with tachypnea, crackle sound in bilateral lung field and left basal pansystolic murmur in chest auscultation. The systolic blood pressure was 130 mmHg (Doppler measurement, Parks 811B, Parks Medical, USA) whereas the heart rate was ~130bpm on the physical examination. There were mild elevation of hematocrit (57%, reference range: 37.0-55.0%), hemoglobin (18.2 g/dL, reference range: 12.0-18.0 g/dL) and BUN (46 mg/dL, reference range 7-25 mg/dL) on the laboratory exams. Furthermore there were no

¹Corresponding author.
E-mail : hyun5188@kangwon.ac.kr

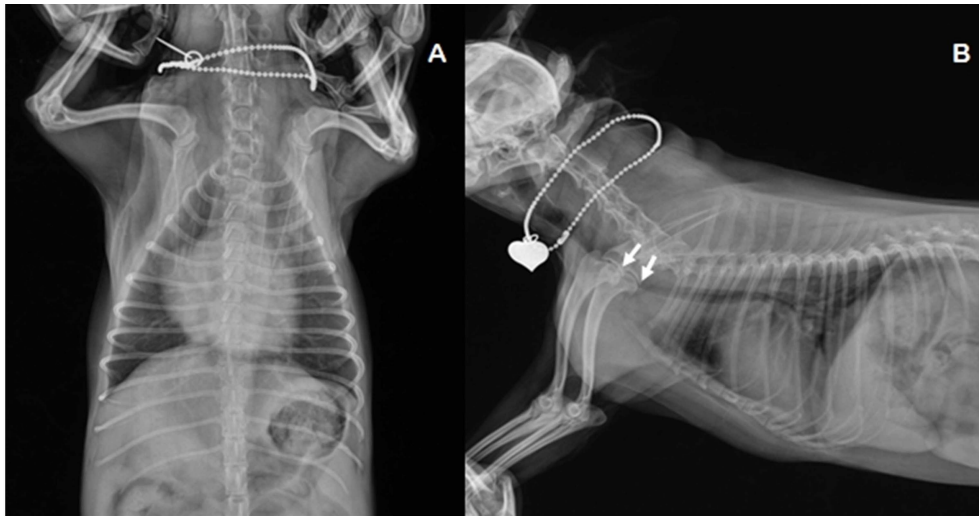


Fig 1. Thoracic radiography of the case 1. A: Ventrodorsal projection of radiography showed mild cardiomegaly especially with right chamber. B: Right lateral projection of radiography showed loss of cranial waist, dilation of aortic root, cardiac enlargement, dorsal displacement of trachea and moderate collapse of thoracic trachea (white arrows).

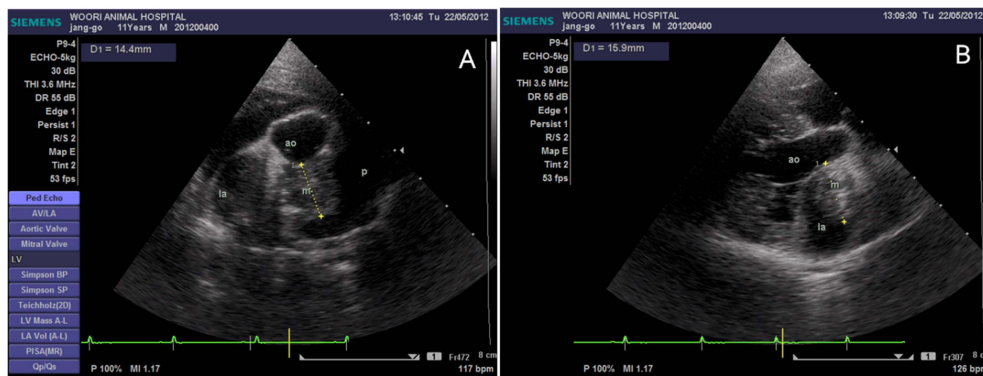


Fig 2. Echocardiogram images obtained from the case 1. The right parasternal short axis (aortic level; A) and long axis (5 chamber view; B) of 2 D echocardiography showed 14-16 mm mass grown among ascending aorta, pulmonary artery and left atrium.

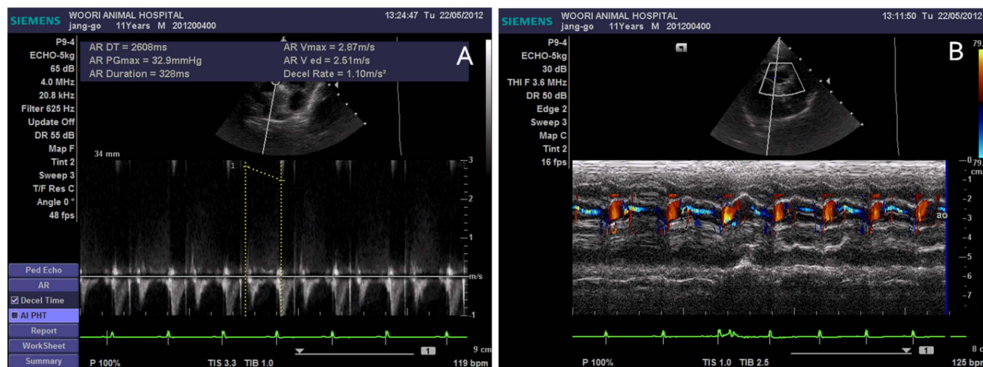


Fig 3. Echocardiogram images obtained from the case 1. The continuous (A) and color M-mode (B) Doppler study revealed moderate aortic regurgitation due to the intracardiac mass.

remarkable abnormalities on the electrocardiogram.

Ventrodorsal projection of thoracic radiography showed mild cardiomegaly especially with right chamber (Fig. 1 A). Right lateral projection of thoracic radiography showed loss

of cranial waist, dilation of aortic root, cardiac enlargement, dorsal displacement of trachea and moderate collapse of thoracic trachea (Fig. 1B). The 2D-echocardiography revealed hyperechogenic mass (14-16 mm diameter) grown among

ascending aorta, pulmonary artery and left atrium (Fig. 2). The continuous (A) and color M-mode (B) Doppler study also revealed moderate aortic regurgitation (peak velocity of 2.87 m/s; Fig. 3) and moderate mitral regurgitation (peak velocity of 5.33 m/s; Fig. 4) due to the intracardiac mass. However, left ventricular (LV) systolic and diastolic function were well preserved, although there were mild increase in ejection fraction (77.43%, reference range: 55-75%) and fractional shortening (44.97%, reference range: 27-48%). Based on these findings, the case was tentatively diagnosed as aortic body tumor. Further diagnostic study found the cardiac mass found to be primary and found no metastasis in other organs. Although we requested cardiac biopsy for histopathological exam, the owner refused, so that further investigation was not possible to conduct, unfortunately.

Chemotherapy (Iomustine 60 mg/m², every 3 weeks, PO), cardiac medication (based on ISACHC II heart failure, furosemide 1 mg/kg, q12h, PO; enalapril 0.5 mg/kg, q12h, PO; pimobendan 0.25 mg/kg, q12h, PO) and aminophylline (for tracheal collapse 10 mg/kg, q12h, PO) were initiated. Follow-up study (6 weeks after treatment) found no further worsening of clinical signs and proliferation of the mass in this dog. The dog did not show particular side-effects from chemotherapy, to date. The dog is still alive and regularly checked-up.

Case 2

A 9-year-old, neutered male Yorkshire terrier weighing 2.5 kg was referred with coughing and cyanosis. Physical examination found typical goose-honking coughs possibly due to tracheal collapse and mild (III/VI) systolic left apical murmur. Despite abnormalities in physical examination, no significant abnormalities were found in laboratory tests, blood pressure measurement (130-140 mmHg, Doppler measurement) and electrocardiogram.

Thoracic radiographs showed moderate cardiomegaly with left ventricular and atrial dilation on the ventrodorsal projection (Fig. 5A). Right lateral projection of radiography showed severe left atrial dilation and dorsal displacement of trachea with bronchial compression (Fig. 5B). The dog also had severe thoracic tracheal collapse. The 2-D echocardiograms

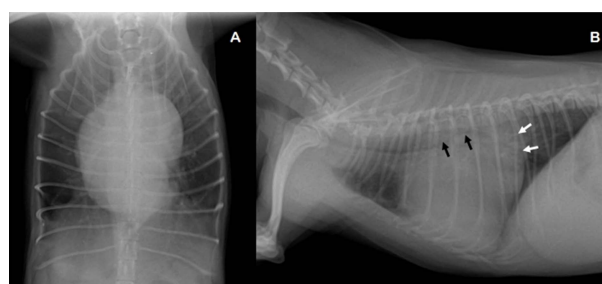


Fig 5. Thoracic radiography of the case 2. A: Ventrodorsal projection of radiography showed moderate cardiomegaly with left ventricular and atrial dilation. B: Right lateral projection of radiography showed severe left atrial dilation (white arrows) and dorsal displacement of trachea with bronchial compression (black arrows). The dog also had severe thoracic tracheal collapse.

showed marked left atrial dilation and hyperechoic mass occupying over 60% of left atrium (Fig. 6A and B). The left atrium to aorta ratio was ~2.8:1. Color and continuous Doppler study revealed mitral regurgitant jet (~5.15 m/s) to the left atrium (Fig. 6C and D). However, left ventricular (LV) systolic and diastolic function were well preserved, although there were mild increase in ejection fraction (88.03%, reference range: 55-75%) and fractional shortening (55.86%, reference range: 27-48%). Furthermore, there were measured mitral valve E peak was decreased (0.60 m/s, reference range 0.8-1.0 m/s), mitral valve A peak velocity was increased (0.8 m/s, reference range: 0.5-0.7 m/s) and E/A ratio was 0.75, suggesting restrictive filling of left ventricle. Based on these findings, the case was tentatively diagnosed as left atrial myxoma. Further diagnostic study found no mass in other organs so that the cardiac mass seemed to be primary. Unfortunately, the owner refused to further histopathological examination.

The treatment was directed to reduce cardiac workload (ramipril 0.125 mg/kg, q24h, PO), to prevention of accidental embolism from myxoma (clopidogrel 5 mg/kg, q24h, PO) and to lessen clinical signs from tracheal collapse aminophylline (10 mg/kg, q12h, PO). Further follow-up study found no worsening of clinical signs. Fortunately the mass was still the same size after 3 months of the first presentation. The dog is

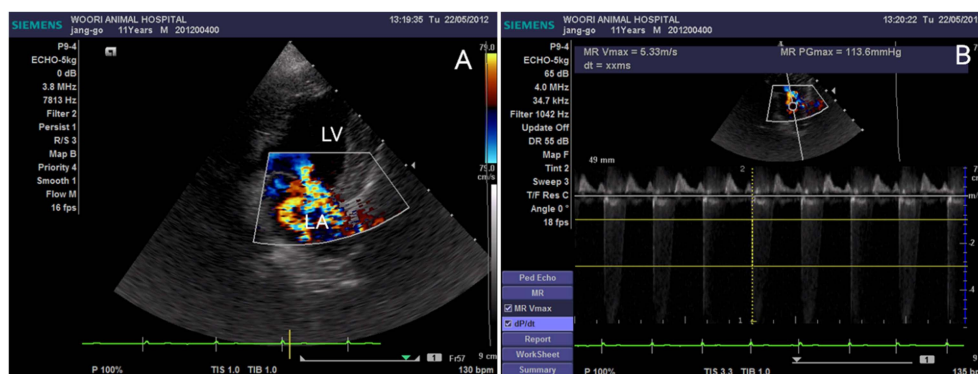


Fig 4. Echocardiogram images obtained from the case 1. The continuous (A) and color M-mode (B) Doppler study revealed moderate mitral regurgitation due to the intracardiac mass.

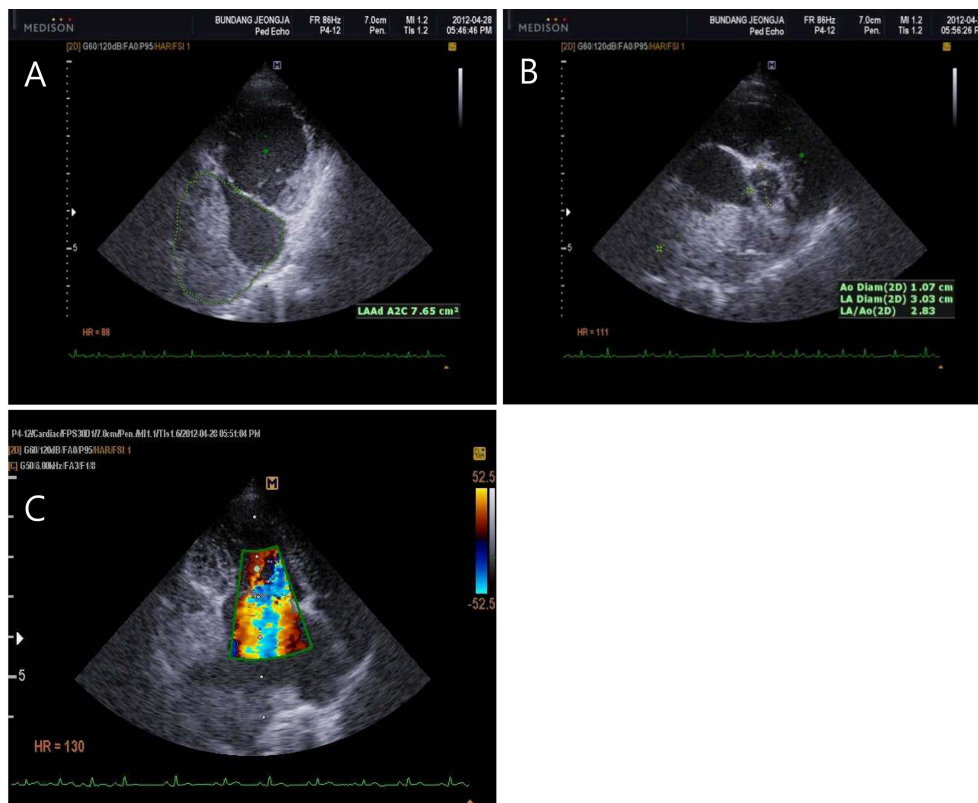


Fig 6. Echocardiogram images obtained from the case 2. A, B: The left apical long axis (2 chamber view) showed marked left atrial dilation and hyperechoic mass occupying over 60% of left atrium. The left atrium to aorta ratio was $\sim 2.8:1$. C, D. Color and continuous Doppler study revealed mitral regurgitant jet (~ 5.15 m/s) to the left atrium.

currently checked-up as scheduled.

Discussion

Heart tumors are relatively rare in both animals and humans (7). However, development of angiocardiology, echocardiography, and other imaging modalities has markedly increased the detection of cardiac tumors in animals and humans (1). In this study, the echocardiography found to be very sensitive and accurate modality to detect heart tumors in dog, although the nature of heart mass still has to be investigated histopathologically. However the invasiveness and progression of the heart tumor were easily assessed by serial echocardiography.

Most human primary cardiac tumors are benign ($\sim 75\%$) and nearly 50% of these are myxomas usually involving the left atrium (1,6). Malignant primary cardiac tumors in human takes up to 25%, and these usually are sarcomas (eg, angiosarcoma, rhabdomyosarcoma, brosarcoma), while malignant hemangiosarcoma (HSA) is reported to be the most common cardiac tumor in dogs (4,10). Almost all primary canine cardiac tumors in dogs occurred in the right side of the heart, especially the right atrium (4,10). Aortic body tumors (ABT), tumors of chemoreceptor tissue located at the aortic root or heart base, are the second most common tumor in dogs (3,8).

Unlike human, only sporadic cases of cardiac myxoma have been reported in dogs (2,5).

The first case of dog had the mass arisen from aortic root and expanded to the pulmonary artery and left atrium (LA), suggesting aortic body tumor. Since the location of mass the movement of aortic valve was significantly affected and resulted in aortic regurgitation (AR). The aortic regurgitation might cause the dilation of left ventricle and caused physiological mitral regurgitation (MR) along with the mass expansion to the left atrium. Because the mass was not still relative large enough to cause severe heart failure, the clinical signs from this dog was more influenced from tracheal collapse than heart failure from the heart tumor dog. Aortic body tumors are originated from chemoreceptor cells involving in the regulation of respiration and heart rate. Those cells are usually found near the aortic root (aortic bodies), carotid bifurcations (carotid bodies), and elsewhere (glomus pulmonale, glomus jugulare) (3). Although these tumors usually are locally invasive and sometimes metastasize, they may be only an incidental finding, if symptomatic pericardial effusion or dysfunction of surrounding structures has not been occurred.

The second case of dog had the mass occupying almost 60% of left atrium. The location and shape of mass inside of LA was similar to myxoma rather than thromboembolism. Similar to case 1, the dog also had MR and AR. However, in

case 2, the MR firstly occurred due to space occupying mass in the LA, due to marked dilation of LA. Severe MR might cause the eccentric dilation of left ventricle (LV). The AR might result from the LV dilation with the expansion of LA tumor to aortic root. The LV dilation was not severe than the LA dilation and thus the heart failure of the case 2 was not severe (ISCHCH Ib). Similar to case 1, the clinical signs from this dog were also more influenced from tracheal collapse. The cardiac myxoma is a benign tumor primarily occurred in the LA (6). It is commonly irregular and whose consistency is jellylike but leads to systemic embolism (2) causing myocardial infarction and possibly mitral valve dysfunctions in human such as mitral valve stenosis or regurgitation. These mitral valve dysfunctions can lead to left-sided heart failure with indisposition of breath, paroxysmal nocturnal dyspnea, pulmonary edema, fatigue and cough (2).

Even if the cardiac mass is extensive, or has begun to metastasize to other parts of body, surgical resection is still the recommended option of therapy for most heart tumors. Although the surgery will not cure the condition, it will help to the length of survival. If the tumor is benign, surgical resection may be curative. Chemotherapy can be administered in the case of malignant heart tumors, but unfortunately, in many cases patients will die in spite of treatment. In our case, the location of tumor was not possibly approached by surgical method. Although we did chemotherapy for one dog, the remarkable remission of tumor has not been found, to date (2 months of therapy).

In summary, these case studies were described two intrac-

ardiac masses occurred in Yorksire terriers, which were diagnosed by the echocardiography.

Reference

1. Colucci WS, Braunwald E. Primary tumors of the heart. In: Braunwald E, ed. Heart Disease: A Textbook of Cardiovascular Medicine, 4th ed. Philadelphia, PA: WB Saunders; 1992: 1451-1464.
2. Darke PG, Gordon LR. Cardiac myxoma in a dog. Vet Rec 1974; 95: 565-567.
3. Hayes HM. A hypothesis for the aetiology of canine chemoreceptor system neoplasms, based upon an epidemiological study of 73 cases among hospital patients. J Small Anim Pract 1975; 16: 337-343.
4. Kleine LJ, Zook BC, Munson TO. Primary cardiac hemangiosarcoma in dogs. J Am Vet Med Assoc 1970; 157: 326-337.
5. Kustos G, Bohenszky G, Torok B. Multiple myxoma of the heart valves in dogs. Magy Allatorv Lapja 1964; 19: 205-206.
6. Reynen K. Cardiac myxomas. N Engl J Med 1995; 333: 1610-1617.
7. Luginbuhl H, Detweiler DK. Cardiovascular lesions in dogs. Ann NY Acad Sci 1968; 127: 517-540.
8. Thomas WP, Sisson D, Bauer TG. Detection of cardiac masses in dogs by two-dimensional echocardiography. Vet Radiol 1984; 25: 65-72.
9. Ware WA, Hopper DL. Cardiac tumors in dogs: 1982-1995. J Vet Intern Med, 1999; 13: 95-103.
10. Zook BC. Some spontaneous cardiovascular lesions in dogs and cats. Adv Cardiol 1974; 13: 148-168.

요크셔테리어 개에서 심장초음파를 이용하여 진단된 심장내 종괴 2 증례

한동현 · 김현지 · 현창백¹

강원대학교 수의(학부)대학 소동물 내과교실

요 약 : 심장에 발생하는 원발성 그리고 전이성 종양은 개에서는 흔치 않다. 우리는 본 연구에서 심장초음파적 진단을 이용하여 요크셔테리어 2마리에서 발생한 심장내 종괴를 확인하였다. 첫째 증례에서의 종괴는 상행 대동맥과 폐동맥 사이에 위치하고 있었으며, 중증도의 대동맥 역류와 좌심실의 확장을 유발하고 있었다. 이 증례의 환자등급은 ISACHC II 등급의 심부전으로 분류되었다. 환자에 대한 심장치방으로는 furosemide, enalapril, pimobendan 그리고 경구적인 화학요법으로는 lomustine가 처방되었다. 둘째 증례에서의 종괴는 좌심방의 2/3를 차지하고 있었으며, 좌심방의 확연한 확장과 심각한 이첨판 역류 (~5 m/s) 를 유발하고 있었으나, 환자의 심부전 등급은 ISACHC Ib 등급으로 심각한 울혈성 심부전은 나타나지 않았다. 종괴의 성상은 cardiac myxoma로 추정되었으나, 조직생검검사는 보호자의 거절로 인하여 수행되지 않았다. 환자에 대한 심장치방으로는 ramipril, clopidogrel 그리고 기관지 확장제는 aminophylline이 처방되었다. 본 증례의 두 환자들은 여전히 생존해 있으며, 정기적인 검진을 받고 있다.

주요어 : 심장내 종괴, 대동맥 소척, 좌심방, 점액종, 심장초음파