Case report

A Dog with Right Auricular Aneurysm Diagnosed with Computed Tomography Angiography

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Abstract. A 7-year-old Golden Retriever with mild exercise intolerance and presence of an arrhythmia was referred to Nihon University. Electrocardiographic findings included wide QRS complexes, irregular R–R intervals, small irregular baseline undulations and no P waves. Thoracic radiography revealed a large mass of soft tissue opacity obliterating the cranial cardiac silhouette and the dilation of the pulmonary artery silhouette. Transthoracic echocardiography showed a type III pulmonary artery flow pattern, but it did not reveal the presence of a mass in the cranial mediastinum. Computed tomography angiography identified an enlarged right auricle that was consistent with a right auricular aneurysm in the region of the suspected mass. This case was therefore diagnosed with a right auricular aneurysm. These findings suggest that computed tomography angiography may be a useful diagnostic tool in the diagnosis of the right auricular aneurysm.

Key words: dog, right auricular aneurysm, computed tomography, atrial fibrillation, exercise intolerance

Introduction

Aneurysmal dilation of the right auricle, otherwise referred to as right auricular aneurysm, is a rare cardiac disease in dogs.¹ In humans, these aneurysms are usually diagnosed by transthoracic or transesophageal echocardiography.²–⁹ However, previous reports in dogs have reported difficulties in identifying abnormal right auricles by echocardiography alone.⁵,⁶ Therefore, the diagnosis of a right auricular aneurysm in dogs requires additional diagnostic procedures, including nonselective angiography.
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raphy or computed tomography (CT).
In this report, we describe a dog with diagnosed with a right auricular aneurysm that necessitated CT angiography after failed attempts with transthoracic echocardiography.

Case

A 7-year-old, male castrated, Golden Retriever weighing 29.1 kg was referred to the Nihon University Animal Medical Center Veterinary Cardiovascular Medicine and Surgery Unit following the detection of an arrhythmia and the presence of mild exercise intolerance. There was no history of trauma. On clinical examination, the dog was alert and in good body condition. The heart rate was 136 beats/min with an irregular rhythm. No cardiac murmur was auscultated. The remainder of the physical examination was unremarkable. The hematology and chemistry panels were normal, but the levels of plasma atrial natriuretic peptide (131 pg/mL; normal <25 pg/mL) and N-terminal pro-B-type natriuretic peptide (2,407 pmol/L; normal <900 pmol/L) were above the reference range. Electrocardiography (a6000 AX-D, Fukuda M-E Kogyo Co., Ltd., Tokyo) showed wide QRS complexes (0.09 s), irregular R–R intervals, small irregular baseline undulations, and no P waves (Fig. 1). Systolic blood pressure, which was measured by the oscillometric method (BP-100D, Fukuda M-E Kogyo Co., Ltd.), was 147 mmHg. Thoracic radiography revealed a large soft tissue opacity that obliterated the cranial aspect of the cardiac silhouette. The diameter of the pulmonary artery silhouette that crossed the 9th rib was 1.3 times the diameter of the 9th rib in the ventrodorsal view. Thus, the pulmonary artery silhouette was mildly enlarged (Fig. 2). Transthoracic echocardiographic findings (Aprio SSA-700A, Toshiba Medical Sys-

![Fig. 1. Electrocardiography: wide QRS complexes, irregular R–R intervals, small irregular baseline undulations, and no P waves were found. The heart rate was 101 beats/min during the examination. Paper-speed was 50 mm/s.](image)
Fig. 2. Right lateral (A) and ventrodorsal (B) thoracic radiographs
A large soft tissue mass opacity (red arrows) in the cranial mediastinal and the dilation of the pulmonary artery (red lines) in the ventrodorsal view at the 9th rib was shown.

Fig. 3. Pulsed-wave Doppler examination of the pulmonary flow
The pulmonary flow was recorded from the right parasternal short-axis view at the level of the pulmonary artery, with the gate placed distally to the pulmonary valve (A). The pulmonary blood flow was a type III, which is characterized by a rapid rise that is followed by a delayed deceleration and notching (red arrows) during mid-systole (B). Ao = Aorta, PA = Pulmonary artery, RA = Right atrium, RV = Right ventricle.

tems Co., Ltd., Tochigi) revealed mild tricuspid regurgitation and a type III pulmonary artery flow pattern9–10 (Fig. 3). However, the velocity of the tricuspid regurgitation could not be measured exactly. Other echocardiographic findings were within normal limits, and enlargement of the right atrium and ventricle was not found. In addition, echocardiography did not reveal the presence of a mass in the cranial mediastinum.

To confirm the presence of a soft tissue mass in the cranial mediastinum, CT angiog-
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Fig. 4. Contrast computed tomography (CT) image at a sagittal section (A) and a three-dimensional reconstruction of a contrast CT image (B) of the thorax. A large right auricular aneurysm (RAA) is visible. CaVC = Caudal vena cava, CrVC = Cranial vena cava, LA = Left atrium, LV = Left ventricle, RA = Right atrium, RV = Right ventricle.

Angiography (Aquilion 16, Toshiba Medical Systems Co., Ltd., Tochigi) was performed while the dog was under general anesthesia. CT angiography revealed an enlarged right auricle that was connected to the right atrium (Fig. 4). On the basis of CT findings, a diagnosis of a right auricular aneurysm was made.

The case’s heart rate was not fast despite the arrhythmia, and the clinical symptoms were mild in this dog. Thus, no treatment was prescribed for the condition.

Discussion

In this case, an aneurysmal right auricle was not identified with echocardiography because of the region of examination, which resulted in significant artifact due to the presence of the lung lobes. The right parasternal long-axis and short-axis views were the standardized views that were used to assess the right atrium. However, visualization of the dilated right auricle that protruded far into the cranial mediastinum was difficult because of the well-aerated lung lobes. Therefore, a suspected right auricular aneurysm should not be ruled out in dogs on the basis of echocardiographic findings alone. As illustrated by the dog in our report, the contrast CT clearly delineated the dilated right auricle. Therefore, CT angiography may be a useful diagnostic tool in the diagnosis of this disease. We recommend the use of CT angiography to differentiate the cause of the soft tissue mass that is detected with thoracic radiography in the cranial mediastinum.

There are various causes of atrial auricular aneurysms in dogs. These include herniation of the right auricle through a defect of the pericardial sac, myocarditis that is accompa-
nied by polymyositis,\textsuperscript{12} and congenital abnormalities.\textsuperscript{6} Partial defects of the parietal pericardium occur in dogs in association with trauma.\textsuperscript{5} In humans, atrial septal defects or tricuspid regurgitation resulting in elevated right atrial pressure have also been shown to cause an atrial auricular aneurysm.\textsuperscript{2} In our case, the velocity of the tricuspid regurgitation was not known. However, the pulmonary blood flow was shown by the Pulsed-wave Doppler examination to have a type III profile, which is characterized by a rapid rise followed by a delayed deceleration and notching during mid-systole. This finding indicated the elevation of systolic pulmonary artery pressure.\textsuperscript{9,10} In addition, our case showed mild dilation of the pulmonary artery silhouette by thoracic radiography in the ventrodorsal view. These findings indicated that this dog might have increased pulmonary artery pressure. In addition, our case showed increased levels of the plasma atrial natriuretic peptide and N-terminal pro-B-type natriuretic peptide. Plasma atrial natriuretic peptide and N-terminal pro-B-type natriuretic peptide levels are increased in dogs with pulmonary hypertension.\textsuperscript{13} Thus, the increased levels of these plasma natriuretic peptides indicated the increasing pulmonary artery pressure due to the absence of findings of left heart dysfunction. However, our case did not show findings that indicated right ventricular dysfunction and increased right atrial pressure. Thus, the relationship between the right auricular aneurysm and increased pulmonary artery pressure in our case was unknown.

Previous reports have indicated the development of supraventricular tachyarrhythmias in dogs with right auricular aneurysms.\textsuperscript{5,6,12} The relationships between right atrial aneurysms and supraventricular tachyarrhythmia have not been fully discussed. However, Zeebregts et al. have suggested that the atrial tissue itself might be responsible for the arrhythmias in human with this disease.\textsuperscript{9} In our case, the electrocardiographic findings included the wide QRS complexes, irregular R–R intervals, small irregular baseline undulations, and no P waves. These electrocardiographic findings and previous reports suggested that the present case might be affected with atrial fibrillation with a complete left bundle branch block. However, further diagnostics to identify the cause of the arrhythmia were not performed.

The prognoses of dogs with right auricular aneurysms were variable,\textsuperscript{5,6,12} but they may have an increased risk for thromboembolism due to the congestion of blood flow in the right atrium.\textsuperscript{9} Therefore, close follow up was performed to identify any signs of the development of thromboembolism.

In conclusion, our case was diagnosed with the right auricular aneurysm with CT angiography. A suspected right auricular aneurysm should not be ruled out in dogs on the basis of echocardiographic findings alone because of the difficulty of the visualization of the dilated right auricle, and CT angiography is a useful diagnostic tool to differentiate the cause of the soft tissue masses that are detected with thoracic radiography in the cranial mediastinum.
References


