

***Staphylococcus pseudintermedius*-induced Aortic and Tricuspid Bacterial Endocarditis in a Dog**

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Abstract : A 14-year-old spayed female, Shihtzu dog, presented with anorexia, depression and respiratory distress. She had a history of mastectomy for mammary gland tumor before 2 weeks. Severe gingivitis, dental plaque, and calculus were confirmed on physical examination. On auscultation, the dog had a diastolic and systolic murmur at the left heart base and right heart apex respectively. The dog had valvular vegetation including tricuspid and aortic valves with regurgitation on echocardiography. Blood culture was performed to confirm bacterial endocarditis and identify pathogens of bacterial endocarditis. Before the result of blood culture was confirmed, antibiotic (cefalexin, 30 mg/kg, PO, q12hr) with furosemide (2 mg/kg, PO, q12hr) and benazepril (0.25 mg/kg, PO, q12hr) were administered empirically and the patient was well controlled. *Staphylococcus pseudintermedius* was confirmed later. One week later, however, the patient died of acute respiratory distress caused by fulminant pulmonary edema. The owners denied necropsy of the patient.

Key words : bacterial endocarditis, *staphylococcus pseudintermedius*, tricuspid valve, aortic valve.

Introduction

Bacterial endocarditis causing potentially lethal disease that is mostly occurring in middle-aged (i.e., ≥ 4 years old), medium-sized, or large-breed dogs is defined as inflammation of the endocardial surface of the heart that is predominated in mitral valve region by infectious agents (1,3,4,11-13,17,19, 20,22). The most commonly cultured organisms from blood culture and tissue samples after necropsy were *Streptococcus* spp., *Enterococcus* spp., *Staphylococcus* spp., *Enterobacter* spp., and *Escherichia coli* (16). On hematologic examination, absolute white blood cell (WBC) and neutrophil counts were significantly higher in bacterial endocarditis dogs than others (16). Most cases of bacterial endocarditis in small animals affect apparently normal valves (17). Mitral and aortic valves are mainly affected lesions by bacterial endocarditis (15). Prognosis of dogs with bacterial endocarditis is poor to grave because of some causes including difficulty in valve sterilization, significant valvular regurgitation, and volume overload (1,11-13,22). To authors' knowledge, this is the first case report of canine bacterial endocarditis involved both tricuspid and aortic valve in Korea.

Case

A 14-year-old, spayed female Shihtzu dog weighing 4.04

kg was presented due to a three day history of anorexia, depression, and respiratory distress. The dog had performed mastectomy for mammary gland tumor 2 weeks ago before presented to Animal Medical Center of Chonbuk National University. The owners reported that she had no signs associated with respiratory distress until recently.

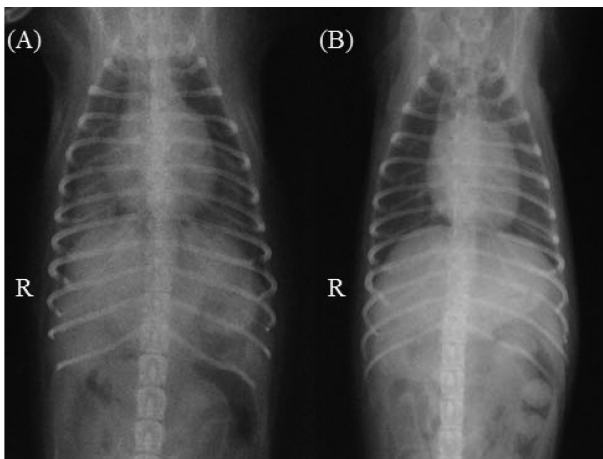
Upon presentation, the dog was thin, depressed and hypothermia (37.5°C). The respiratory rate was increased (132 breaths per minute). On physical examination, the dog had severe gingivitis, dental plaque, and calculus. Auscultation of the heart revealed heart murmur with the regular rhythm at aortic valve region on left 4th intercostal space and tricuspid valve region on right 4th intercostal space. A grade IV out of VI, diastolic and systolic heart murmur were detected at aortic and tricuspid valve region respectively. And auscultation of the lung revealed crackle sound at general portion. According to a referring veterinarian, heart murmur was previously undetected. A complete blood count showed mild leukocytosis with a neutrophilic leukocytosis (Table 1). The results of a serum biochemical analyses demonstrated mild increase of blood urea nitrogen (48 mg/dl; reference range, 7~25 mg/dl), hyperphosphatemia (9.9 mg/dl; reference range, 2.9~6.6 mg/dl), and mild hyperglycemia (121 mg/dl; reference range, 60~110 mg/dl). Thoracic radiographs revealed mild cardiomegaly (Vertebral heart scale: 10) and severe pulmonary edema with interstitial pattern at left and right caudal lung lobe (Fig 1). After confirmation of severe pulmonary edema by auscultation and thoracic radiographs, no more examinations including electrocardiographic and echocardiographic examination

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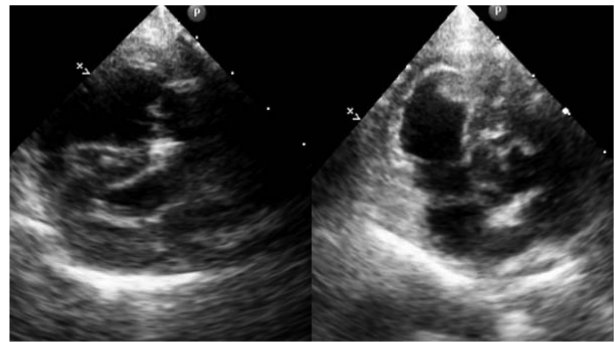
Table 1. Hematologic outcome for the patient at initial presentation. The dog showed mild neutrophilic leukocytosis

Hematology	Values	Reference range
WBC(10^3 /ul)	21.7	6.0-17.0
RBC(10^6 /ul)	6.72	5.40-7.80
HGB(g/dl)	17.0	13.0-19.0
HCT(%)	49.1	37.0-54.0
PLT(10^3 /ul)	270	160-430
MCV(μm^3)	73	60-74
MCH(pg)	25.3	20.0-25.0
MCHC(g/dl)	34.6	32.0-36.0
RDW(%)	14.7	14.0-17.0
MPV(μm^3)	9.0	6.7-11.1

WBC: white blood cell; RBC: red blood cell; HGB: hemoglobin; HCT: hematocrit; PLT: platelet; MCV: mean cell volume; MCH: mean cell hemoglobin; MCHC: mean cell hemoglobin concentration; RDW: red blood cell distribution width; MPV: mean platelet volume

**Fig 1.** Ventrodorsal projection of thoracic radiographs at initial presentation (A) and 1 week later from treatment (B). The dog showed a interstitial pattern at right and left caudal lung lobe and mild cardiomegaly (A) and improved pulmonary edema after treatment (B).

were performed until the patient became stable. Pulmonary edema was well controlled using furosemide (FURIX, Il Yang Pharm, Korea, 2 mg/kg, IV) and oxygen therapy. After the patient was improved in respiratory condition and pulmonary edema, an electrocardiographic and an echocardiographic examination were performed. On electrocardiographic examination, sinus tachycardia with low amplitude of QRS complexes was observed. Echocardiographic findings revealed irregular vegetation of tricuspid and aortic valves (Fig 2). Significantly decreased left ventricular internal distance during systolic and diastolic phases was presented. Especially, tricuspid valve regurgitation was severe (pressure gradient: 37.7 mmHg). Aortic and pulmonic valve regurgitations were

**Fig 2.** Tricuspid (arrowhead) and aortic valve (arrow) vegetation was confirmed by echocardiography on right parasternal long-axis four chamber view (A) and left apical five chamber view (B) respectively. RV = right ventricle; RA = right atrium; LV = left ventricle; LA = left atrium; Ao = aorta.

irregular and intermittent regurgitated blood flow was observed. Blood samples (3 ml for each venipuncture) for culture (Trypticase Soy Broth, ASAN pharmaceutical, Korea) were obtained from three different venipuncture sites 1 hour apart aseptically. At the same time, cefalexin (FALEXIN, Dong Wha Pharm, Korea, 30 mg/kg, PO, q12hr) was administered for empiric antibiotic therapy. The results of blood cultures approved the growth of *Staphylococcus pseudintermedius*. After the patient had well controlled with antibiotics, furosemide, and benazepril for 1 week (Fig 1), the patient had acute respiratory distress with fulminant pulmonary edema. Eventually the patient died of respiratory distress by fulminant pulmonary edema.

Discussion

Normal endothelium has a function of inhibiting bacterial adherence and colonization. Because of this normal function of endothelium, damage to the vascular endothelium including trauma secondary to turbulent or high-velocity blood flow plays an important role for proceeding to bacterial endocarditis (1,5,13). Mitral and aortic valves are mainly affected lesions by bacterial endocarditis. But the tricuspid valve and the pulmonic valve are rarely affected. Among these two rarely affected lesions, the pulmonic valve is almost never affected (1,3,4,11-13,19,20,22). In this case, however, the patient has both tricuspid and aortic valves insufficiency even though the evidence of bacterial endocarditis-induced tricuspid and aortic valve insufficiency is not enough. In this patient, blood cultures were performed and *Staphylococcus pseudintermedius* was confirmed. To distinguish aerobic and anaerobic microorganisms, aerobic and anaerobic cultures have been recommended respectively, but there are a small number of cases caused by anaerobic microorganisms. Thus aerobic cultures alone may be sufficient for diagnosis of bacterial endocarditis (11,12,22). Necropsy is required to diagnosis of bacterial endocarditis. However we could not perform necropsy. Because only a few etiologies in dogs are known to

cause aortic insufficiency including bounding peripheral pulses, auscultation of a diastolic murmur is helpful in the diagnosis of bacterial endocarditis (11,12). On auscultation, new heart murmurs (diastolic murmur at left heart base and systolic murmur at right heart apex) were detected at initial presentation. In addition, because small vegetative lesions composed of fibrin, platelets, microorganisms and inflammatory cells may not be detected on echocardiography, lack of vegetative lesions on echocardiography does not exclude endocarditis (10,12). In some reports, the prolapse of aortic valve in ventricular septal defect and membranous ventricular septal aneurysm may cause aortic endocarditis by increased the susceptibility of aortic valve to infection (17,21,23). In human studies, the factors of causing bacterial endocarditis include endothelial integrity, hemostatic function, intrinsic microorganisms, host immune function that include immunosuppression from previous disease or corticosteroid therapy and peripheral bacteremia (1,3,4,11-13,20,22). This patient had performed mastectomy for mammary gland tumor 2 weeks ago before presentation and had severe gingivitis, dental plaque, and calculus. Some reports in human showed association between dental procedures and bacteremia caused by periodontal disease and bacterial endocarditis. But it is still unclear (2,6-8,14,16,18). In one report, however, there is no association in dogs between bacterial endocarditis and either dental or oral surgical treatment that was required general anesthesia or oral infection. But detection of new heart murmur or change in intensity of an existing heart murmur caused by valvular involvement and nonoral surgical treatment in the previous 3 months were significantly associated with bacterial endocarditis (16). Even though there is no obvious evidence of association between bacterial endocarditis and periodontal disease, severe gingivitis, dental plaque, calculus and previous surgical procedure including mastectomy for mammary gland tumor may affect bacterial endocarditis in this patient. Most cases of bacterial endocarditis are febrile different from this patient. In one report, however, rectal temperature in 56% dogs with bacterial endocarditis was afebrile and this result indicate that the lack of fever was not a good indicator for rule out the list of potential differential diagnosis of bacterial endocarditis (16). This case was diagnosed according to the modified Duke criteria for diagnosis of infective endocarditis. Modified Duke criteria include some major and minor criteria. Major criteria involve positive echocardiogram, new valvular insufficiency and positive blood culture. Minor criteria involve fever, medium to large dog (> 15 kg), subaortic stenosis, thromboembolic disease and immune-mediated disease. Two major criteria were corresponded to this case (vegetative lesion and aortic insufficiency without subaortic stenosis or annuloaortic etasia) (9).

Conclusion

This patient had a three day history of anorexia, depression, and respiratory distress. The dog had a severe gingivitis,

dental plaque, and calculus. Tricuspid and aortic valves insufficiency was confirmed by echocardiography. *Staphylococcus pseudintermedius* was confirmed by blood culture and the diagnosis of the dog was bacterial endocarditis caused by *Staphylococcus pseudintermedius*. Cephalixin was administered for empiric antibiotic therapy before the pathogen was confirmed. The patient was well controlled using antibiotics, furosemide, and benazepril. One week later, however, the patient died because of acute respiratory distress by fulminant pulmonary edema.

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개에서 *Staphylococcus pseudintermedius*에 의해 발생한 심내막염 증례

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요 약 : 14년령의 중성화한 암컷 시츄가 식욕부진, 침울, 호흡곤란으로 전북대학교 수의과대학 동물병원에 내원하였다. 2주전 유선종양 제거 수술을 받았으며 내원 당시 신체검사상 구강 내 심한 치은염, 치태 및 치석을 관찰하였다. 청진상 좌측 심기저부에서 이완기 잡음이 들렸으며 우측 심첨부에서는 수축기성 잡음이 들렸다. 심혈관 초음파 검사 결과 삼첨판과 대동맥 판막의 변성과 함께 혈액의 역류를 관찰 할 수 있었다. 세균성 심내막염을 진단하고 그 원인체를 알기 위해 혈액배양을 실시 하였다. 혈액배양 검사 결과가 나오기 전에 항생제를 포함하여 이노제와 베타제프릴을 사용하였으며 환자는 잘 관리 되었다. 혈액배양 검사 결과 *staphylococcus pseudintermedius*가 배양 되었다. 하지만 1주일 후 환자는 급성으로 발생한 폐수종에 의해 사망하였다.

주요어 : 세균성 심내막염, *staphylococcus pseudintermedius*, 삼첨판, 대동맥 판막