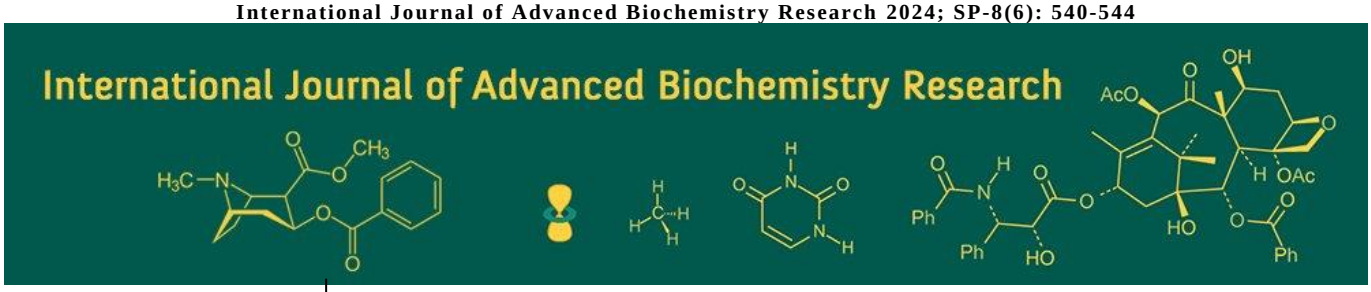

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Diagnosis of pericardial effusion in dogs: A short study

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Abstract
Pericardial effusion in dogs is relatively uncommon diseases in dogs but its presence is very serious and life threatening in nature. So its early diagnosis is essential. Out of total 2582 cases reported at Veterinary Medicine section of VCC, LUVAS, Hisar during a period of 8 months (August 2019 to March 2020), 4 cases were diagnosed to be affected with pericardial effusion based on diagnostic aids i.e. electrocardiography, radiography and echocardiography. Out of 4 affected dogs, 3 belonged to age group 4-9 year and 1 dog was less than 4 year. Characteristic clinical examination findings were muffled heart sound and weak femoral pulse. Haematological analysis revealed low haemoglobin, haematocrit values with relative neutrophilia. Biochemical analysis depicted elevated SGOT, SGPT and LDH levels. On electrocardiography, characteristic low voltage QRS complex and electrical alterans found. Lateral radiograph depicted characteristic globoid cardiac silhouette. Echocardiography revealed characteristic anechoic- hypoechoic space/fluid between epicardium and pericardial sac along with swinging motion of heart within pericardial sac. Based on findings, it can be concluded that electrocardiography, radiography and echocardiography provide definitive diagnosis of pericardial effusion.

Keywords: ECG, pericardial effusion, echocardiography

Introduction
Pericardial effusion is the most common pericardial abnormality in dogs and cats (Mac Donald, 2017) [12] and defined as the abnormal accumulation of fluid inside the pericardial cavity which further increase the intrapericardial pressure over right atrium and ventricle leading to functional impairment by collapse of right ventricle (Vishnurahav *et al*., 2019) [18]. The challenge in canine cardiovascular medicine revolves around the diagnosis of cardiac diseases. Auscultation, radiography, electrocardiography, echocardiography and biochemical tests are most useful diagnostic procedures employed in recognizing the cardiac diseases in dogs **(**Hoque *et al*., 2019) [9]. So keeping above facts under consideration present study was planned with the objective to diagnose pericardial effusion reported in referral hospital setups of India with the help of different diagnostic aids.

Materials and Methods
The present study was conducted over a period of eight months in a referral veterinary hospital of northern part of this country. Out of total 2582dogs registered 47 dogs were suspected for cardiac affections based on preliminary screening and were used in the study. Six healthy dogs were included as control group.

A. Anamnesis: Complete history of the suspected cases was recorded via self- designed questionnaire.

B. Clinical examination: All the vital clinical parameters were recorded. Different clinical parameters noted were rectal temperature (F°), examination of mucous membrane, calculation of Capillary refill time (sec), jugular veins were checked for pulsation and distension, femoral artery was checked for the rate and quality of pulse, cardiac auscultation was done to check heart rate (beats per minute), intensity of heart sounds, murmurs and abnormal heart sounds and abnormal fluid accumulation in abdomen was checked by palpation and ballottement of the abdomen.

C. Haemato-biochemical analysis: The blood samples collected in tubes coated with K_3EDTA were analysed in automated hematology cell counter (MS4s, Melet Schlosing Lab.) and serum samples were analysed using automated random access clinical chemistry analyzer.

D. Radiographic measurements: Thoracic radiography was performed with an X-ray unit (Siemens X- Ray machine) and images processed through Computed radiography system (Konica Minolta PVT, LTD). All animals were positioned in lateral position without giving any kind of sedation. The heart size in the lateral view was evaluated by using vertebral heart scale (VHS) (Buchanan and Bucheler, 1995) [4].

E. Electrocardiography: Electrocardiogram was recorded in all dogs as described by Tilley and Smith (2008) [17] by using ECG 300G-Vet Contec Electrocardiograph machine. The electrocardiogram was recorded in an area with least distraction and disturbances. The patient was placed in right lateral recumbency by placing alligator clips.

F. Echocardiography: Echocardiographic examination was carried out in a quiet room having dim light with dogs loosely restrained by their parent. The Siemens Acuson S2000 ultrasound machine (Siemens Healthcare Pvt. Ltd.) with multifrequency (4-9MHz) cardiac phased array probe was used for the present study. All the dogs were clipped on the right and left thoracic wall from 2nd to 7th intercostal spaces as described by Boon (2011a) [3] and placed in lateral recumbency on a specially designed table having "V"-shaped cut on the table top.

Results and Discussion

1. Occurrence of pericardial effusion

A total of four cases were found affected with pericardial effusion. Of the 4 dogs with pericardial effusion, 3 were Rottweiler (75%) and 1 was Mongrel (25%). Tappin (2010) [16] also reported large breed predisposition to PE. The occurence of pericardial effusion in 0-4 year age group was 25% and in 4-9 years age group occurrence was 75%. The mean age of dogs affected with pericardial effusion was 5.75±0.97 years. In dogs with pericardial effusion 75% (3/4) were female and 25% (1/4) were male. Celona *et al.* (2017) [5] on an epidemiological based study on pericardial effusion found male predominance (78.02%) and suggested that male predominance in pericardial effusion might be due to the fact that the incidence of DVD which was one of the most common neoplastic causes of pericardial effusion was higher among male dogs. In the present study higher incidence in male dogs may also be because of preference of pet owners for keeping male dogs in comparison to female dogs in this part of country.

2. Clinical profile in dogs suffering from pericardial effusion

Abdominal distension and lethargy (100% each), exercise intolerance, cachexia, inappetence, vomiting and dyspnoea (75% each) and tachypnoea (25%) were observed in dogs with pericardial effusion. Abdominal distension, lethargy and exercise intolerance in pericardial effusion as seen in the present study were the most common signs and may be because of increased pressure within the pericardial space causing difficulty in chamber-filling in diastole. This affects the right side of the heart more than the left, with the right atrium being most compromised. As a result, clinical sigs of right-sided heart failure usually predominated with ascites, lethargy and coughing (Tappin, 2010) [16]. Coughing in pericardial effusions could be due to greatly distended pericardial sac pressing on the airways. Vomiting associated with pericardial effusion as seen in the present study may be because of direct irritation to the phrenic nerve by PE distending the pericardial sac causing stimulation of the nucleus tractus solitarius resulting in central pattern for the generation of vomiting (Fahey *et al.*, 2017) [6].

3. Clinical examination findings in dogs suffering from pericardial effusion

The prominent clinical examination findings in dogs with pericardial effusion were ascites and muffled heart sounds (100% each), pale mucous membrane and prolonged CRT (75% each), weak femoral pulse (50%) and tachycardia (25%). Ascites in PE occurs mainly because of progressive rise in intra pericardial pressure, increases diastolic right atrial and right ventricular pressures and systemic capillary leakage. Muffled heart sounds as noted in this study results from dampening of sounds in the fluid between heart and thoracic wall. Similar findings were reported by Shaw and Rush (2007) [6]. An impairment of ventricular filling as a consequence of increased intrapericardial pressure caused by fluid accumulation within the pericardial cavity lead to reduction in the amount of blood pumped around the body i.e. decreased cardiac output and decreased preload leading to clinical signs of pale mucous membrane and prolonged CRT (Gugjoo *et al.*, 2014) [7].

4. Electrocardiographic findings in dogs suffering from pericardial effusion: In pericardial effusion affected dogs, prominent electrocardiographic findings observed were low voltage QRS complex and electrical alterans 75 %each (3/4) followed by sinus tachycardia and right atrial enlargement 25% (1/4) each (Figure1). The reason for the electrical alterans was alternating configuration of the ventricular action potential or alternating changes in intra ventricular conduction or due to exaggerated anatomical or swinging motion of the heart within the distended pericardial sac (Bodh *et al.*, 2016) [2].

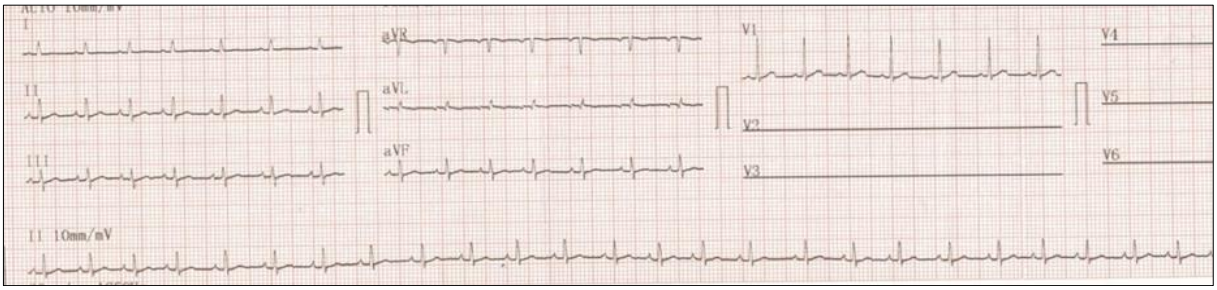

Fig 1: Low voltage QRS complex in PE affected dog

Reason behind low voltage QRS complex was internal short circuiting of the electrical currents by the accumulated fluid within the pericardial space causing change in heart position or due to electrical impedance provided by pericardial effusion (Wray, 2014) Wray. The low amplitude of the ventricular complex was frequently associated with normal amplitude of the P-wave in the limb leads. This was explained by the absence of effusion over the posterior surface of atria (Badiger *et al.*, 2012) [1].

5. Radiographic findings in dogs suffering from pericardial effusion

In pericardial effusion affected dogs, most commonly observed radiographic findings were cardiomegaly and ascites 100% each (4/4) followed by tracheal elevation, globoid cardiac silhouette and increased sternal contact 75% each (3/4). Pathophysiologic mechanisms found to be responsible for the enlarged cardiac silhouette and high VHS measured in dogs with severe PE, where large amounts of fluid within the pericardial sac was present. Wray (2014) [19] found that thoracic radiography of pericardial effusion typically shows a globoid enlargement to the cardiac silhouette with loss of any clear demarcation between cardiac chambers (Figure 2). The distension of pericardial sac with fluid caused cardiac silhouette to be enlarged and globoid (Kang *et al.*, 2019) [10].

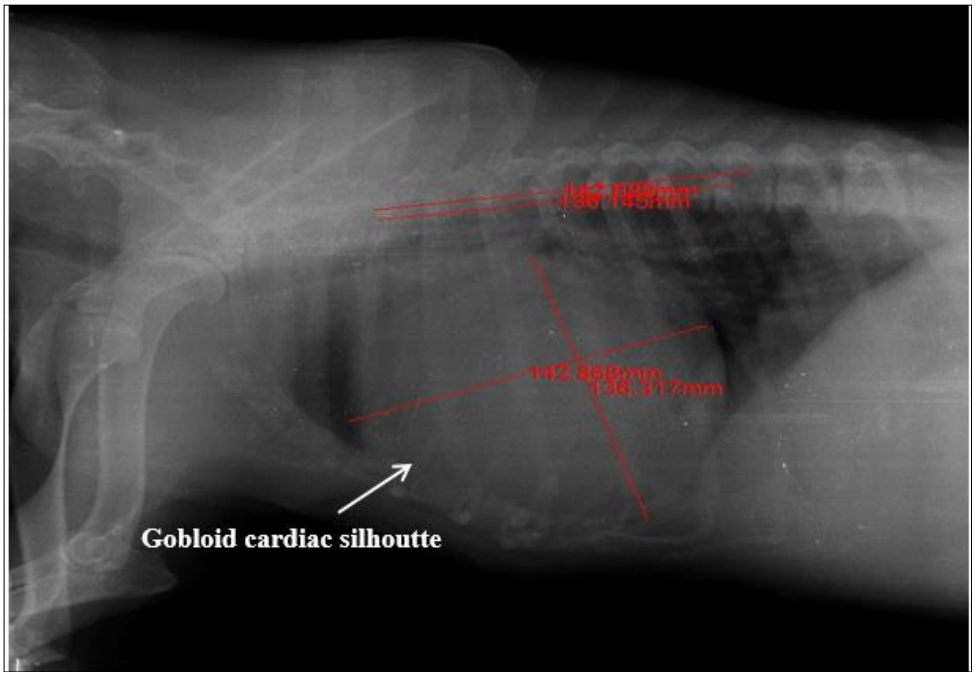

Fig 2: Lateral view of PE affected dog showing gobloid cardiac silhoutte

4. Haemato-biochemical profile of dogs suffering from pericardial effusion

In the pericardial effusion affected dogs, Mean ± SEM of Hb and PCV were non-significantly low and significant elevation of neutrophil count was observed. It was presumed to be because of anemia in chronic diseases (Ojeda *et al.*, 2015) [13]. Significant neutrophilia attributed to the inflammatory nature of the disease as seen in the present study. Significant ($P<0.05$) increase in mean values of SGOT, SGPT and LDH was observed. Macdonald *et al.* (2009) [12] also detected increase liver enzymes activities and mild azotemia in 23.3% of dogs affected with pericardial effusions. Increased liver enzyme activities in present study were because of systemic venous congestion secondary to right ventricle collapse in PE. Our findings also concur with the findings of Kang *et al.* (2019) [10].

6. Echocardiographic findings of dogs suffering from pericardial effusion

On B-mode at right parasternal long axis four chamber view, presence of hypoechoic to anechoic free space between epicardium and pericardial sac was seen along with swinging motion of heart in the fluid (Figure 3). The epicardium appeared bright simply because of the difference in acoustic impedance between epicardium and fluid. All the chambers of heart were compressed and appeared small in size and the walls showed thickening due to large amount of pericardial effusion and due to impaired cardiac filling (Figure 4). There was non-significant increase in mean values of IVSs, IVSd while non-significant decrease in LVIDs and LVIDd was observed. The increased thickness of interventricular septum in systole and diastole could be due to pseudo-hypertrophy caused by external compression of pericardial fluid (Boon, 2011) [3]. The right ventricular diastolic collapse was observed on M mode images as the downward motion of right ventricular wall during diastole. The FS% and EF% mean values were increased that could be due to hyper contractibility of left ventricle (Saini, 2014). There was non-significant change in EPSS, LVIDs, LVIDd, LVPWs, LVPWd, LA/AO, EDV and ESV values (Table 1).

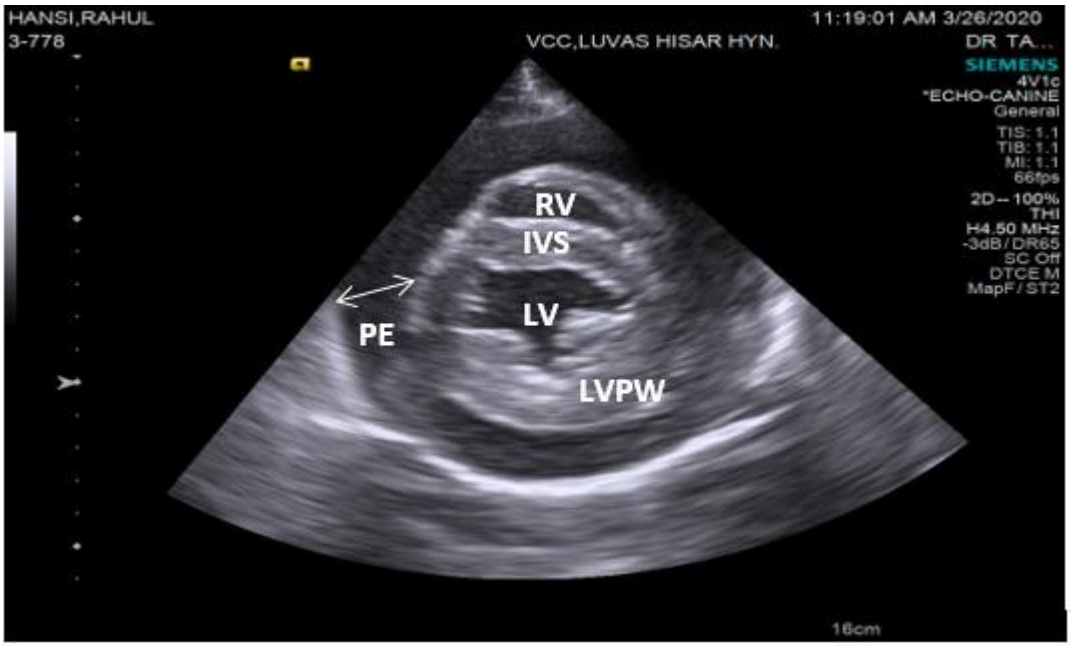

Fig 3: The two-dimensional B-mode right parasternal short axis left ventricle with papillary muscle view in PE affected dog showing pericardial effusion and swinging motion of heart. RV= right ventricle, LV= left ventricle, IVS= interventricular septum, PE= pericardial effusion, LVPW= left ventricle posterior wall.

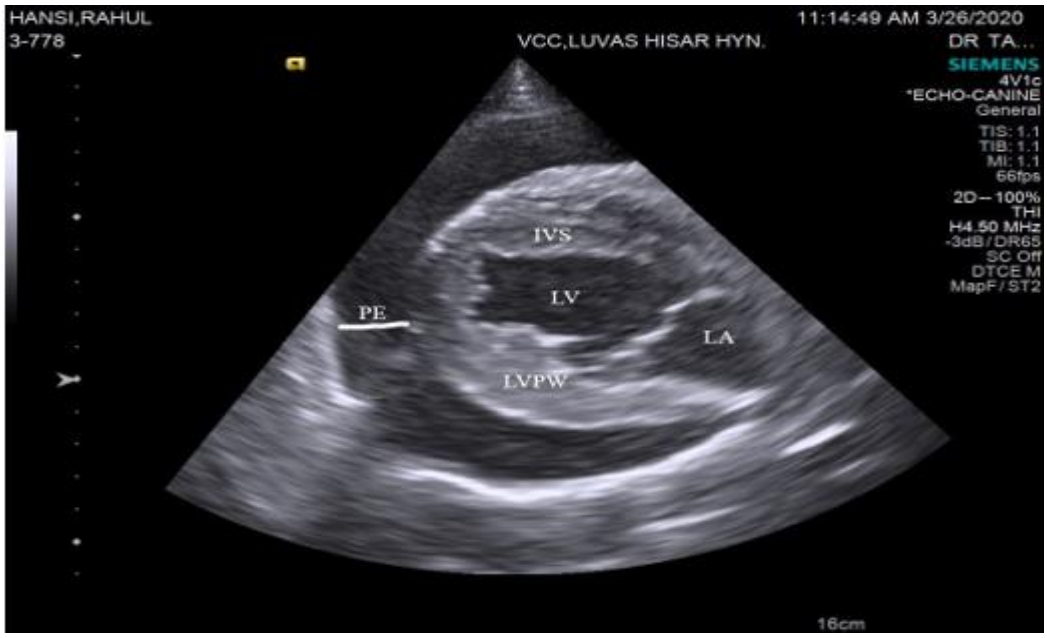

Fig 4: The two-dimensional B-mode right parasternal long axis four chamber view during systole of PE affected dog showing pericardial effusion and decreased lumen of heart chambers. PE- pericardial effusion, LV- left ventricle, LA- left atrium, IVS- interventricular septum, LVPW= left ventricle posterior wall

Table 1: Mean ± SE of M mode echocardiographic parameters in dogs suffered with pericardial effusion as compared to normal healthy dogs

Parameters	Rottweiler (25-30 kg bwt)	Mongrel (25-30 kg bwt)	Rottweiler (50-60 kg bwt)	Pericardial effusion (n=4)
LVIDd (mm)	9-17	9-17	11-20	28.88±2.84[a]
LVIDs (mm)	6.3-12.8	6.3-12.8	7.5-15.3	18.00±3.76[a]
LVPWd (mm)	20-35	20-35	24-43	14.18±1.28[b]
LVPWs (mm)	33-48	33-48	40-58	18.63±2.04[c]
IVSd (mm)	10-18	10-18	11-21	14.23±0.31[b]
IVSs (mm)	6-13	6-13	7-15	24.50±2.50[b]
LA/AO	0.95-1	0.95-1	0.98-1	1.00±0.08[a]
EPSS (mm)	<6	<6	<6	6.03±0.34[a]
FS (%)	25-40	25-40	25-40	38.84±9.50[b]
EF (%)	45-50	45-50	45-50	60.18±7.07[b]
EDV (ml)	-	-	-	29.13±4.86[a]
ESV (ml)	-	-	-	11.58±1.74[a]

Conclusion

It can be inferred from the present study on pericardial effusion in dogs that electrocardiography, radiography and echocardiography provide definitive diagnosis of pericardial effusion

References

1. Badiger S, Prema T, Akkasaligar PT, Biradar MS. Electrocardiography–Pericarditis, Pericardial Effusion and Cardiac Tamponade. Int J Intern Med. 2012;1(4):37-41.
2. Bodh D, Hoque M, Saxena AC, Kumar V, Gugjoo MB, Bist D. Diagnosis of dilated cardiomyopathy and pericardial effusion in two dogs. Ind J Vet Surg. 2016;37(1):48-50.
3. Boon JA. Evaluation of size, function and hemodynamics. Veterinary Echocardiography. 2nd ed. Ames: Wiley-Blackwell; c2011. p. 153-266.
4. Buchanan JW, Bucheler J. Vertebral scale system to measure canine heart size in radiographs. J Am Vet Med Assoc. 1995;206(2):194-199.
5. Celona B, Crinò C, Giudice E, Di Pietro S. Evaluation of Pericardial Effusion in Dogs and successful treatment using a Haemodialysis Fistula Needle: A Retrospective Study. Topics in Compan Anim Med. 2017;32:72-75.
6. Fahey R, Rozanski E, Paul A, Rush JE. Prevalence of vomiting in dogs with pericardial effusion. J Vet Emerg Crit Care. 2017;1-3.
7. Gugjoo MB, Saxena AC, Hoque M, Mahendran M, Zama MMS. Pericardial effusion in a Labrador retriever dog. Asian J Anim Sci. 2014;8(1):34-37.
8. Guglielmini C, Diana A, Santarelli G, Torbidone A, Di Tommaso M, Toaldo MB, *et al*. Accuracy of radiographic vertebral heart score and sphericity index in the detection of pericardial effusion in dogs. J Am Vet Med Assoc. 2012;241:1048-1055.
9. Hoque M, Saxena AC, Reetu, Gugjoo MB, Bodh D. Cardiac diseases in dogs. Ind J Anim Health. 2019;58(1):01-20.
10. Kang MH, Sur JH, Park HM. Pericardial effusion in a dog concurrent with carcinoma of unknown primary origin. Iran J Vet Res. 2019;20(3):225-228.
11. MacDonald KA, Cagney O, Magne ML. Echocardiographic and clinicopathologic characterization of pericardial effusion in dogs: 107 cases (1985-2006). J Am Vet Med Assoc. 2009;235:1456-1461.
12. MacDonald K. Pericardial diseases. Textbook of Veterinary Internal Medicine. 8th ed. Philadelphia: W.B. Saunders, Elsevier; c2017. p. 1305-1316.
13. Ojeda J, Mieres M, Dunner C, Sagredo N, Bustamante H. Pericardial effusion and cardiac tamponade in a dog with hypothyroidism. Arch Med Vet. 2015;47:391-394.
14. Saini N. Diagnosis and therapeutic management of myocardial and valvular diseases in dogs [doctoral dissertation]. Punjab: Gadvasu; 2014.
15. Shaw PS, Rush JE. Canine pericardial effusion: pathophysiology and cause. Compend Contin Educ Pract Vet. 2007;29:405-411.
16. Tappin S. Idiopathic pericardial effusion in a seven-year-old Labrador Retriever. Small Anim Cardiol. 2010;15:22-27.
17. Tilley LP, Smith FWK. Electrocardiography. Manual of Canine and Feline Cardiology. 2nd ed. Philadelphia: W.B. Saunders; c2008. p. 49-77.
18. Vishnurahav RB, Ajithkumar S, Pillai UN, Madhvan Unny N. Diagnosis and management of cardiac tamponade due to pericardial effusion secondary to aortic body tumor in a Spitz. Pharm Innov J. 2019;8(1):82-85.
19. Wray J. Pericardial effusion in dogs: an aetiological mystery. Companion Animal. 2014;19(1):34-39.