

Review Articles

Evaluation of Pericardial Effusion in Dogs and Successful Treatment Using a Hemodialysis Fistula Needle: A Retrospective Study



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The aim of this retrospective study was to assess epidemiology and echocardiographic findings of pericardial effusion in canine patients and to determine the clinical usefulness and safety of a new pericardiocentesis technique, using a “fistula needle” for hemodialysis. A database of 5304 dogs of different breeds, age, gender, type, and severity of the cardiac disease, referred for a specialist cardiology and echocardiographic examination from 2009–2016, was reviewed. All the dogs were subjected to echocardiography; when possible and required, an echo-guided pericardiocentesis was performed by mean of a 17 G “fistula needle” commonly used for hemodialysis. Complete echocardiography was repeated at the end of each pericardiocentesis. Pericardial effusion was identified by echocardiography in 91 dogs (1.71%), 20 were female (21.98%) and 71 were male (78.02%). PE caused cardiac tamponade in 38/91 cases (41.76%). A clear evidence of a neoplasm was found in 33 cases (36.26%). In 32 cases (35.16%) severe degenerative mitral and tricuspid valve disease was detected as the cause of the pericardial effusion. Echo-guided pericardiocentesis was performed in 28 cases (30.77%) with cardiac tamponade. No adverse effects were found in any of the patients during the 48 hours of follow up after pericardiocentesis. This study showed the high incidence of pericardial effusion due to severe bilateral degenerative valve disease in adult to elderly dogs of different breeds. Moreover, the use of a “fistula needle” for pericardiocentesis in dogs showed no adverse effects.

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Introduction

Pericardial effusion is an abnormal accumulation of fluid within the pericardial space and represents the most common disease of the pericardium in dogs. Prevalence in dogs has been reported to be .43% and it was found in approximately 7% of dogs presented with clinical signs of cardiac disease.¹ Most commonly, the etiology of pericardial effusion in dogs is neoplastic or idiopathic in origin. The most common neoplastic causes of PE in dogs include hemangiosarcoma, heart base tumors (chemodectoma), or mesothelioma.^{2,3} Idiopathic pericardial effusion refers to a sterile hemorrhagic effusion with no known etiology. Prognosis of dogs with PE is strongly related to the cause of the effusion. Neoplastic PE is associated with short-survival times, whereas idiopathic pericardial effusion usually has a good long-term prognosis.^{2,4}

The accumulation of fluid of any type in the pericardial space reduces diastolic cardiac filling and may lead to right heart failure; when the intrapericardial pressure increases to a level higher than or equal to that of the right ventricle, cardiac tamponade occurs.⁵ However, patients with mild PE may not show clinical signs. Echocardiography is the gold standard to confirm the diagnosis of PE and to distinguish between neoplastic and nonneoplastic etiologies, as well as to define the specific causes and location of neoplasms.¹ Several echocardiographic views of the heart, such as right parasternal short-axis and long-axis views, left apical view and left cranial parasternal long-axis view, have to be performed to obtain a complete image of the

heart to detect any masses, specially ones localized in the right atrium.¹

Cardiac tamponade is diagnosed when diastolic collapse of the right atrium, right ventricle, or both is found together with pericardial effusion. In a study of 107 dogs with pericardial effusion, echocardiography showed a sensitivity and specificity of 82% and 100%, respectively for the diagnosis of a cardiac mass. Moreover, it showed a high sensitivity and specificity from differentiating the specific type of cardiac mass.¹ Pericardiocentesis is required for the relief of cardiac tamponade and clinical signs in emergency conditions and to carry out cytologic examinations of the fluid for diagnostic evaluation. Pericardiocentesis is performed with the dog in left lateral or sternal recumbency from the right hemithorax.⁶ Echocardiography is helpful in finding the best intercostal space, but if it is not available, pericardiocentesis should be performed starting from the fifth to the seventh intercostal space. Several types of over- or through-the-needle catheters may be used to perform pericardiocentesis.^{6,7} The most common adverse events reported during or following pericardiocentesis are cardiac puncture, arrhythmias, laceration of tumor or coronary artery leading to intrapericardial hemorrhage or cardiopulmonary arrest, with a rate of occurrence of 15% in dogs.⁵

The aim of this retrospective study was to evaluate the signalment, echocardiographic findings and epidemiology of PE in canine patients. Secondary objectives included defining the specific causes of PE and locations of neoplasm within the heart, and determining the clinical usefulness and safety of a new pericardiocentesis technique, using a “fistula needle” for hemodialysis.

Materials and Methods

Case Selection Criteria

A database of 5304 dogs referred for specialist cardiology and echocardiographic examination from 2009–2016 was reviewed. The examinations were carried out in a high standard veterinary referral clinic on client-owned dogs, after the informed consent had been provided by the owners.

Dogs were of different breeds, age, gender, type, and severity of the cardiac disease. Pericardial effusion was found in 91/5304 dogs (1.71%). Among these, 20 were female (21.98%) and 71 were male (78.02%). The mean age at presentation was 10.63 ± 2.90 years (range: 1–19 years). Breed, gender, and age of the 91 dogs with PE included in the study are reported in Table 1.

Animal husbandry and clinical procedures were in compliance with the standards recommended by the *Guide for the Care and Use of Laboratory Animals* and Directive 2010/63/EU on the protection of animals used for scientific purposes.

Diagnostic Tests

All the dogs were subjected to a general physical examination, radiographs of the thorax in dorsoventral and right lateral recumbency and echocardiography in right parasternal short-axis and long-axis views, left apical view, and left cranial parasternal long-axis view. All the echocardiographic examinations were performed by the same specialized operator (B.C.) by mean of an ultrasound machine¹ with a multifrequency probe of 2.5–3.5 MHz with sterile cover.

Pericardiocentesis

When possible and required, an echo-guided pericardiocentesis was performed. The right lateral thorax was shaved and aseptically prepared between the second and the eighth intercostal spaces. Patients were placed in right lateral recumbency, on a echocardiography table with a suitable hole for performing diagnostics and procedures. Pericardiocentesis was performed between the fourth and the fifth intercostal space by mean of a 17 G “fistula needle,”² commonly used for hemodialysis, with a catheter of 2.5 cm provided with a lateral hole and 2 wings, connected to a flexible tube 30 cm long. A large 50 mL syringe and a 3-way stop cock were attached to it.

Following the echo-guided insertion of the needle into the intercostal space and perforation of the pericardium, aspiration of the effusion was performed. A sample of the effusion was kept for physical-chemical and cytological examinations in heparinized³ and K₃EDTA⁴ blood tubes, respectively, stored under refrigeration until examinations were performed. During the pericardiocentesis procedure, continuous electrocardiogram monitoring was performed. Complete echocardiography was repeated at the end of each pericardiocentesis, to detect any mass or abnormality that may have been hidden by the effusion.

Descriptive statistics were applied for age among the breeds of the dogs enrolled in the study. Data were analyzed using a commercially available statistical software program⁵.

Table 1

Number of Animal, Gender, and Descriptive Statistic of Ages (Mean, Standard Deviation, Minimum, and Maximum Values) among the Breeds of Dogs With PE Enrolled in the Study

Breed	N	Gender		Age			
		F (n)	M (n)	Mean	SD	Min	Max
Mongrel dog	38	7	31	11.74	2.45	6	19
German shepherd	5	0	5	9.8	.84	9	11
Beagle	5	0	5	9.75	1.89	7	11
Labrador retriever	4	0	4	7.25	3.86	2	11
Miniature Poodle	4	0	4	12	1.63	10	14
Italian mastiff	4	1	3	8.5	3.11	5	12
Yorkshire terrier	3	1	2	11.33	1.53	10	13
Pit bull	3	2	1	11	3.46	9	15
English setter	3	2	1	9.33	4.72	4	13
Pug	2	0	2	8.5	.71	8	9
Golden retriever	2	0	2	10	0	10	10
CKCS ^a	2	1	1	8.5	.71	8	9
Siberian husky	2	1	1	11.5	.71	11	12
Irish setter	1	1	/	/	/	10	/
Pekingese	1	/	1	/	/	15	/
Rottweiler	1	/	1	/	/	8	/
German pinscher	1	1	/	/	/	12	/
Dogue de Bordeaux	1	1	/	/	/	1	/
Bull mastiff	1	1	/	/	/	8	/
Shar pei	1	1	/	/	/	9	/
Maltese	1	/	1	/	/	8	/
Etna Cirneco	1	/	1	/	/	15	/
Dachshund	1	/	1	/	/	6	/
Chihuahua	1	/	1	/	/	12	/
Italian hound	1	/	1	/	/	10	/
Shih Tzu	1	/	1	/	/	15	/
Newfoundland	1	/	1	/	/	8	/

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Results

Pericardial effusion caused cardiac tamponade, with signs of obstructive shock, in 37/91 cases (40.66%) and all the patients considered in the study showed various degrees of ascites. Radiographs of the thorax showed cardiomegaly with a globular cardiac silhouette in all the 91 dogs. On echocardiographic examination, clear evidence of a neoplasm was found in 33/91 cases (36.26%). Among these, 15 were on the right atrium (45.45%), 9 were heart base masses (27.27%), 5 were on the left atrium (15.15%) and 4 were in the thorax (12.12%).

In 32 cases (35.16%) severe mitral regurgitation, together with tricuspid regurgitation was detected as the cause of the PE; among these pulmonary hypertension was found in 22 cases (68.75%). In only 1 case (1.10%) the PE was due to a foreign body (a lead bullet) stuck in the interventricular septum. In the remaining 25 cases (27.47%) a clear etiology was not found (Table 2).

No cardiac tamponade was found in any of the patients with PE due to severe mitral regurgitation.

Echo-guided pericardiocentesis was performed in 28 cases (30.77% of dogs with PE) with cardiac tamponade (73.68% of patients with cardiac tamponade). In all animals before and after the execution of pericardiocentesis, a complete echocardiographic examination was performed. No patient required sedation or general anesthesia.

Pericardiocentesis was performed until the complete disappearance of the echocardiographic signs of cardiac tamponade (normal distension of the cardiac chambers) and, at least, until almost complete aspiration of the effusion. The procedure lasted in all cases no more than 15 minutes.

In all patients that underwent pericardiocentesis, no adverse effects or complications occurred, except for occasional

¹ Esaote MyLab 30 Gold, Genova, Italy.

² Fresenius Medical Care, Bad Homburg, Germany.

³ BD Vacutainer Heparin Tube, Oakville, ON, USA.

⁴ BD Vacutainer K₃EDTA Tube, Oakville, ON, USA.

⁵ STATISTICA 7, Stat Soft Inc, USA, 2003.

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