PREVALENCE STUDIES OF CANINE ENDOCARDITIS

Commented [ПW1]: We recommend changing the name A STUDY ON THE PREVALENCE OF CANINE ENDOCARDITIS ACROSS VARIOUS REGIONS OF INDIA

ABSTRACT

Commented [ПW2]: Please correct the text

Background :- Canine cardiac ailments are disease conditions that are associated with the cardiovascular system of dogs. Congenital and acquired heart diseases are the two main categories of cardiac ailments. Congenital cardiovascular lesions in descending order of frequency of occurrence are Patent Ductus Arteriosus (PDA), Pulmonary Stenosis, Aortic Stenosis, Persistent Right Aortic Arch, Ventricular Septal Defect (VSD), Tetralogy of Fallot (ToF), Atrial Septal Defect (ASD), Persistent Left Cranial Vena Cava and Mitral Insufficiency. Congenital heart diseases account for only 5% of all canine heart diseases and are generally diagnosed in puppies. Congenital heart disease has not been studied widely **(Tilley *et al.*, 2008)**. The acquired diseases of the heart are those which a dog picks naturally during its lifetime usually as a result of infection, injury, or normal wear and tear it includes Cardiac arrhythmias, Hypertension disease, Heartworm disease, Congestive heart failure, Dilated cardiomyopathy, Pericarditis, Myocarditis, Pulmonary, and Endocarditis. Endocarditis commonly involving involves the heart valves, but also affecting affects the inner lining of cardiac chambers or the endocardium elsewhere **(Radostits *et al.*, 2007)**.

Commented [ПW3]: associated with dogs' cardiovascular system

Methods :- The present work on "Prevalence studies of canine endocarditis " was conducted carried out in the Department of Veterinary Medicine and Teaching Veterinary Clinical Complex, C.V. A. Sc, GBPUAT, Pantnagar from July 2020 to July 2021. In addition, a prevalence study of Canine Cardiac ailments was carried out by conducting the Retrospective study and Routine Heart Health screening at different Veterinary polyclinics, of Dehradun, Haldwani and Rudrapur of Uttarakhand & nearby Veterinary Institutions (NDVSU, Jabalpur, and DUVASU, Mathura).

Results :- The prevalence study comprised 51655 cases of the total canine population. 3056 (5.91%) of the canine population had clinical evidence of cardiac problems and 57 (0.11%) cases of cardiac diseases were determined to be positive for endocarditis. Maximum prevalence of endocarditis was found in Mathura (0.137%) followed by Rudrapur (0.126%), Dehradun (0.121%), Pantnagar (0.102%), Haldwani (0.094%), and Jabalpur (0.070%). Out of 57 cases of endocarditis of in different regions, the males were more affected as compare compared to the females. The prevalence of endocarditis was uppermost in the 7-9 Year age group (33.33%) followed by > 9 year age group (24.56%), 4-7 year age group (19.29%), 2-4 year age group (15.78%). The breed-wise prevalence of endocarditis of breeds like Labrador, German shepherd, Pomeranian, Non Discript, Doberman, Beagle, and Dalmantian was 29.82%, 22.80%, 14.03%, 12.28%, 10.52%, 7.01% and, 3.50%, respectively.

Keywords :- Cardiac disorders, Prevalence, Endocarditis, Dilated cardiomyopathy, Cardiology.

INTRODUCTION

Commented [ПW4]: Please check the links and grammar

The bonding of dogs and humans is known as the human-canine relationship. The foundation of the relationship had developed 15000 years ago and in today's framework, at least in areas populated by humans, dogs are the planet's most abundant tellurian carnivore **(Lescureux and Linnell J. D., 2014)**. Dogs are an essential part of human lives for centuries and their advantageous effects have been found for at least 200 years **(Edney, 1992)**. The global dog population is estimated to 700 million and rising **(Smith *et al.*, 2019)**. Canine cardiac ailments are disease conditions that are associated with the cardiovascular system of dogs. The cardiovascular disease of dogs is a common, complex, and devastating disorder **(Parker *et al.*, 2006)**.

Congenital and acquired heart diseases are the two main categories of cardiac ailments. Congenital cardiovascular lesions in descending order of frequency of occurrence are Patent Ductus Arteriosus (PDA), Pulmonary Stenosis, Aortic Stenosis, Persistent Right Aortic Arch, Ventricular Septal Defect (VSD), Tetralogy of Fallot (ToF), Atrial Septal Defect (ASD), Persistent Left Cranial Vena Cava and Mitral Insufficiency. Congenital heart diseases account for only 5% of all canine heart diseases and are generally diagnosed in puppies. Congenital heart disease has not been studied widely **(Tilley *et al.*, 2008)**.

The acquired diseases of the heart are those which a dog picks naturally during its lifetime usually as a result of infection, injury, or normal wear and tear it includes Cardiac arrhythmias, Hypertension disease, Heartworm disease, Congestive heart failure, Dilated cardiomyopathy, Pericarditis, Myocarditis, Pulmonary, and Endocarditis. Endocarditis commonly involving the heart valves, but also affecting the inner lining of cardiac chambers or the endocardium elsewhere **(Radostits *et al.*, 2007)**. Bacteria are the main pathogens isolated from lesions in Valvular and Mural endocardial tissue. The two terms Bacterial and Vegetative Endocarditis are in use to describe the disease. Sometimes the term infectious endocarditis is also used, it's an infection of valvular and mural endocardium with the microbe, which may have cardiac and extracardiac sequelae **(Valeire, 2004)**.

Endocarditis is rare in cats and uncustomary in dogs but it can result in fatal outcomes. Common microbial etiological agents of the disease include *Bartonella* spp., *Escherichia coli*, *Streptococcus* spp., and *Staphylococcus* spp. It also can be a fungal infection origin *Candida albicans*, *Histoplasma capsulatum*, and *Aspergillus* are the fungi which demonstrated to cause Endocarditis **(Lamas and Eykyn, 2003)**. The epidemiology of endocarditis in companion animals has not been studied substantially, difficulty in diagnosis and under-reporting of

cardiac ailments plays a key role in the reported low prevalence rate of Endocarditis. Otherwise, Endocarditis is one of the most common endocardial alterations which occurs in Middle-aged, Large breeds, Male dogs. Pure-bred dogs are more affected **(Kittleson, 2013)**. The most obvious signs of endocarditis are usually nonspecific early in the onset of the disease and after the spread of pathogens throughout the body, dogs may develop signs such as arthritis and lameness. The affected dogs often show respiratory abnormalities (Cough, Dyspnea, Tachypnea). Diagnosis of cardiac ailments and endocarditis is difficult because of its complex nature but it can be made by proper examination of Clinical Signs, Auscultation of animal, Hematology and biochemical profile of blood also plays a key role in diagnosing heart disease, Electrocardiography and Echocardiography are advanced diagnosing facilities which are used for the confirmatory diagnosis of the disease. Because of the importance of canine endocarditis, the present study was conducted in the Department of Veterinary Medicine and Teaching Veterinary Clinical Complex, C.V. A. Sc, GBPUAT, Pantnagar from July 2020 to June 2021.

MATERIALS AND METHODS

The present work on "Prevalence studies of canine endocarditis" was carried out in the Department of Veterinary Medicine and Teaching Veterinary Clinical Complex, C.V. A. Sc, GBPUAT, Pantnagar from July 2020 to July 2021. In addition, a prevalence study of Canine Cardiac ailments was carried out by conducting the Retrospective study and Routine Heart Health screening at Sadar Veterinary Hospital Dehradun and other organizations and hospitals of Dehradun, Government Veterinary Polyclinics and Hospitals Rudrapur and Haldwani of Uttarakhand state, Teaching Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, NDVSU Jabalpur (M.P.), and Veterinary Clinical complex (Kothari hospital), DUVASU, Mathura, U. P. An initial health check-up and general clinical assessment were performed on all of the canines. The owner's history, cardiac auscultation, and a general clinical examination are all part of the cardiac exam. Dogs exhibiting evidence of heart illness underwent a clinical examination that included a full history from the owner as well as a physical examination that included detailed auscultation of the heart and lungs, as well as electrocardiographic, echocardiographic, and radiographic findings.

Commented [ПW5]: This section needs detailed additions and serious revisions
Please indicate the breeds of animals, their number, age groups, whether special diagnostic tools (ECG, echocardiography, X-ray), laboratory diagnostic methods were used. Specify the device name, model, country of manufacture.
Specify the ethical principles of conducting research. Official permits for conducting experiments.
Indicate the permission of the owners to conduct experiments

RESULTS AND DISCUSSION

As very little evidence has been reported in India, about canine endocarditis as well as other canine cardiac disorders so the current study was aimed to conduct the retrospective study and heart health screening at Department of Veterinary medicine and TVCC, CVASc, Pantnagar, Veterinary polyclinics, Private pet clinics of registered Veterinary Practitioners in different cities of Uttarakhand & nearby Veterinary Institutions recognized by Veterinary Council of India, to carry out the prevalence of cardiac problems in dogs in Uttarakhand and nearby states. As a consequence of the retrospective investigation, the prevalence study comprises 51655 cases of the total canine population. The 3056 (5.91%) of them had clinical evidence of cardiac problems and 57 (0.11%) cases of cardiac diseases were determined to be positive for endocarditis. **Kristin *et al.* (2004)** reported that the prevalence of endocarditis in dogs was ranges between 0.05% to 6.6%. similar results was documented by **Macdonald (2010); kittleson (2013)**, in their studies and they said that, the prevalence of endocarditis in dogs was 0.06% to 9%**. Omobowale *et al.* (2017)** said the prevalence of canine endocarditis is low as compare to other cardiac ailments. The prevalence study of endocarditis in companion animals has not been studied extensively in the world **(Bruce, 2002)** so the reported data is very less about this disease. Under-reporting of the disease due to struggle in judgement is one of the chief factor contributes in the low prevalence of disease **(Larry and John, 2001).**

Area wise prevalence of endocarditis

Maximum prevalence of endocarditis was found in Mathura (0.137%) followed by Rudrapur (0.126%), Dehradun (0.121%), Pantnagar (0.102%), Haldwani (0.094%) and, Jabalpur (0.070%). Area wise prevalence is depicted in table no. 1.

Commented [ПW6]:

Sex wise prevalence of endocarditis

The sex wise prevalence of endocarditis in dogs is depicted in the figure 1. Out of 57 cases of Endocarditis of different regions, the males were more affected as compare to the females. There were 34 male Dogs and 23 Female Dogs who were suffering from the disease. The prevalence of males was 59.64% and Females was 40.35%. Endocarditis in canines affects

male dogs more as compare to female dogs, so the prevalence of endocarditis is greater in males. **Miller and Sission 1999** supported the data they said that male dogs are more prone for the canine endocarditis as the male female ratio of ailment reported is 2:1 for endocarditis. Overall prevalence of other cardiac ailments is more in males as compare to females. According to **Hunt *et al.* (1990)**, large breed male dogs were the most usually suffered by tachycardia. The reason for men's and male dogs' increased vulnerability to cardiac failure is unidentified, though a genetic foundation is occasionally alleged in humans because familial cardiac failure has been described in studies by **Brugada *et al.* (1997)** and **Chugh *et al.* (2001)**.

Age wise prevalence of endocarditis

To rule out the age-wise prevalence of Endocarditis the dogs were categorized into different age groups like 0-2 year age group, 2-4 year age group, 4-7 year age group, 7-9 year age group, and age group of > 9 years. Out of 57 dogs studied for endocarditis, 4 were in the age group 0-2 years age group, 9 was in 2-4 year age group, 11 were in 4-7 year age group, 19 were in 7-9 year age group and 14 were found in > 9 year age group. After observing and analyzing the data the result was that, the prevalence of Endocarditis was higher in the age group of 7-9 years followed by age group of > 9 year age group, 4-6 year age group, 2-4 years age group, 0-2 year age group. The prevalence recorded for the age groups of 0-2 years, 2-4 years, 4-7 years, 7-9 years, and >9 years is 7.01%, 15.78%, 19.23%, 33.33%, and 24.56% respectively. The prevalence of Endocarditis was uppermost in the 7-9 Year age group (33.33%) followed by > 9 year age group (24.56%), 4-7 year age group (19.29%), 2-4 year age group (15.78%). Results are alsodepicyed in the table no. 2. The results of present investigation are supported by the findings of **Lombard *et al.* (1983)** and **Anderson *et al.* (1984)** they observed that most of the clinical cases of endocarditis was belongs to middle aged group (i.e., >5 years).

The above findings are also consistent with **Miller *et al.* (1989)**, who said that about 25% of cardiac ailments in dogs arises between the ages of nine and twelve years, and 33% in dogs over the age of thirteen years.

Breed wise prevalence of endocarditis

The breed wise prevalence of Endocarditis is depicted in table no. 3. Out of 57 cases of Canine Endocarditis screened in different breeds, the highest number was found in Labrador (17) followed by German shepherd (13), Pomeranian (8), Beagle (7), Non descript (6), Doberman (4), Dalmantian (2). The breed wise prevalence of endocarditis of breeds like Labrador,

German sepherd, Pomeranian, Non Discript, Doberman, Beagle, and Dalmantian was 29.82%, 22.80%, 14.03%, 12.28%, 10.52%, 7.01% and, 3.50% respectively. The results of present study were in close association with the findings of **Kittleson (1998), Calvert *et al.* (2002)** and **Sykes *et al.* (2006)** who documented the breeds who over presented endocarditis includes German shepherd, Boxer, Golden retriever and Labrador reteriver. While other findings **Staaden (1981)** found a higher prevalence in Cocker spaniels.

CONCLUSION

It was concluded that cardiac disorders (5.91%) in dogs is a noteworthy ailment object as a cause of illness; it must be consequently taken into consideration during daily examination of a dog patient. Canine endocarditis is a relatively uncommon finding (0.11%) but it should not be ignored due to its fatal effects. Maximum prevalence of endocarditis was found in Mathura (0.137%) followed by Rudrapur (0.126%), Dehradun (0.121%), Pantnagar (0.102%), Haldwani (0.094%) and, Jabalpur (0.070%). Out of 57 cases of Endocarditis of different regions, the males were more affected as compare to the females. The prevalence of Endocarditis was uppermost in the 7-9 Year age group (33.33%) followed by > 9 year age group (24.56%), 4-7 year age group (19.29%), 2-4 year age group (15.78%). The breed wise prevalence of Endocarditis of breeds like Labrador, German sepherd, Pomeranian, Non Discript, Doberman, Beagle, and Dalmantian was 29.82%, 22.80%, 14.03%, 12.28%, 10.52%, 7.01% and, 3.50%, respectively.

It is a very exhaustive process to rule out the confirmatory diagnosis of endocarditis because it requires cumulative use of all modern as well as ancient methods of diagnosis. As inadequate diagnostic facilities are present in India for field veterinarians, as well as veterinary institutions and lack of awareness in owners in regards to cardiac disorders are key contributory factors of the low prevalence of the disease.

Commented [ПW7]: Please make clear and concise conclusions. Emphasize the relevance and prospects of further research. It is not necessary to show statistical data in the conclusions. It is better to focus attention on the seriousness of the problem and the result of research

REFERENCES

Commented [ПW8]:

Anderson CA, Dubielzig RR (1984). Vegetative endocarditis in dogs. J. Am. Anim. Hosp. Assoc., 20: 149–152.

Bruce W.Keene (2002).The 26th Annual WALTHAM diets/OSU symposium. Small animal cardiology, Ohio state university. Waltham USA.

Brugada, R.; Tapscott, T.; Czernuszewicz, G.Z.; Marian, A.J.; Iglesias, A.; Mont, L.; Brugada, J.; Girona, J.; Domingo, A.; Bachinski, L.L. and Roberts, R. (1997). Identification of a genetic locus for familial atrial fibrillation. N. Engl. J. Med., 336: 905-911.

Calvert, C.A. (2002). Diagnosis and therapy of occult cardiomyopathy, in Proceedings. World vet. Congr., 27-29.

Chugh, S.S., Blackshear, J.L, Shen, W.K., Hammill, S.C, Gersh, B.J. (2001). Epidemiology and natural history of atrial fibrillation: clinical implications. J. Am. Coll. Cardiol., 37: 371-378.

Edney, A, T, B. (1992). Companion animals and human health. Vet. Rec., 130: 285- 287.

Hunt, G.B.; Malik, R. and Church, D.B. (1990). Ventricular tachycardia in the dog: a review of 28 consecutive cases. Aust. Vet. Practitioner, 20: 122-127.

Kittleson, M.D. and Kienle, R.D. (1998). Small Animal Cardiovascular Medicine. Mosby, Inc.

Kittleson. (2013). Infective Endocarditis: Text from "Small Animal Cardiovascular Medicine" available at www.vmth.ucdavis.edu.

Kittleson. (2013). Infective Endocarditis: Text from "Small Animal Cardiovascular Medicine" available at www.vmth.ucdavis.edu.

Kristin, Macdonald., Chomel BB, Kittleson M, (2004). A prospective study of canine IE in northern California (1999-2001): emergence of Bartonella as a prevalent etiologic agent. J. Vet. Intern. Med., 18:56–64.

Lamas, C, C. and Eykyn, S, J. (2003). Blood culture negative endocarditis: analysis of 63 cases presenting over 25 years. Heart, 89(3): 258–262.

Larry, P, T. and John-K, G. (2001). Editors: Manual of canine and feline cardiology, Third Ed. W.B Sounders Company. ISBN 0-7216-7721-5; pg 129136.

Larry, P, T. and John-K, G. (2001). Editors: Manual of canine and feline cardiology, Third Ed. W.B Sounders Company. ISBN 0-7216-7721-5; pg 129136.

Lescureux, N., and Linnell, J. D. (2014). Warring brothers: The complex interactions between wolves (Canis lupus) and dogs (Canis familiaris) in a conservation context. Biol. Conserv, 171: 232-245.

Lombard, C. W. and Buergelt, C. D. (1983). Vegetative bacterial Endocarditis in dogs; Echocardiographic diagnosis and clinical signs. J. Small Anim. Pract., 24,325-339.

Mcdonald. (2010). Infective endocarditis in dogs; Diagnosis and Therapy. Vet. Clin. North Am. Small Anim. Pract. Vet. Clin. N. Am.Small, 40:665-684.

Miller, M, W. and Sisson, D. (1999). Infectious Endocarditis. Textbook of Canine and Feline Cardiology. 2nded. Philadelphia: WB Saunders. 26:567-580.

Miller, M.S.; Tilley, L.P. and Smith, F.W.K. (1989). Cardiopulmonary disease in the geriatric dog and cat. Vet. Clin. North Am. Small Anim. Pract., 19: 87-102.

Omobowale, T, O., Otuh, P, I., Ogunro, B, N., Adejumobi, O, A. and Ogunleye A, O. (2017). Infective Endocarditis in dogs : A review. EJPMR, 4(8), 103-109.

Parker, H, G., Meurs, K, M. and Ostrander, E, A. (2006). Finding cardiovascular disease genes in the dog. J. Vet. Cardiol., 8:115-27.

Radostits, O, M., Gay, C, C., Hinchcliff, K, W., Constable, P, D. (2007). Veterinary Medicine A textbook of the diseases of cattle, horses, sheep, pigs and goats. 10th edition saunders elsevier Philadelphia.

Smith, M, Lauren., Hartmann, Sabine., Munteanu, M, Alexandru., Villa, Dalla, Paolo, Quinnell, J, Rupert. And Collins, M, Lissa. (2019). The Effectiveness of Dog Population Management. Animals, 9: 1020.

Staaden, R.V. (1981). Cardiomyopathy of English Cocker Spaniels. J. Am. Vet. Assoc., 178:1289–1292.

Sykes, Jane, E., Mark, D, Kittleson., Patricia, A, Pesavento., Barbara, A, Byrne., Kristin, A, MacDonald., Bruno, B, Chomel. (2006). Evaluation of the relationship between causative organisms and clinical characteristics of infective endocarditis in dogs: 71 cases (1992–2005). J. Am. Vet. Med. Assoc, Vol 228, No. 11, June 1, 2006.

Tilley, L, P., Smith, Jr, F, W, K., Oyama, M, A. and Sleeper, M. (2008). Manual of canine and feline cardiology. 4th edn., Saunders (Elsevier), St. Louis, Missouri.

Valerie, Brown, A. (2004). Aortic valvular endocarditis in a dog. Can. Vet. J.,45: 682-684.

Table No. 1. Area wise Prevalence (N=51655)

Commented [ПW9]: We recommend putting two characters after the period

S.No.	Place	Total Canine cases	Affected with Endocarditis	Prevalence of Endocarditis
1	Dehradun	**15590**	**19**	**0.121%**
2	Mathura	**5832**	**8**	**0.137%**
3	Jabalpur	**8571**	**6**	**0.070%**
4	Rudrapur	**10245**	**13**	**0.126%**
5	Haldwani	**9564**	**9**	**0.094%**
6	Pantnagar	**1853**	**2**	**0.107%**

Figure No. 1. Sex wise Prevalence of endocarditis

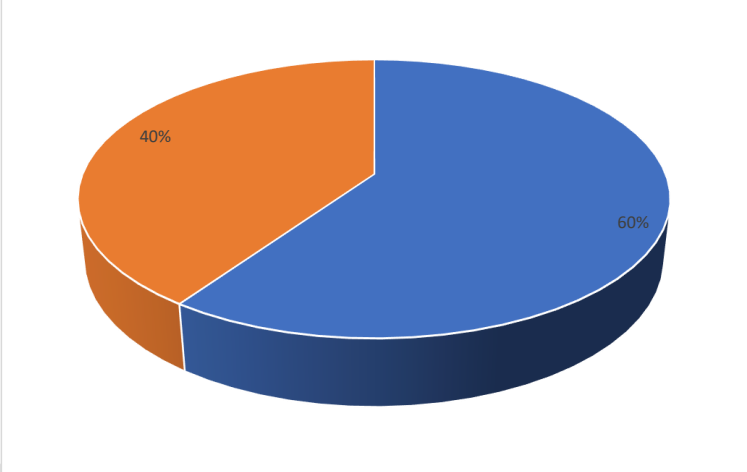

Table. No. 2 Age Wise Prevalence (n=57)

S.No	Age Group	No. of affected Cases	Prevalence

Commented [ПW10]: We recommend putting two characters after the period

Commented [ПW11]: Please supplement the list with new sources for the last 3-5 years
Please add DOI

1	**0-2 Year age group**	**4**	**7.01%**
2	**2-4 Year age group**	**9**	**15.78%**
3	**4-7 Year age group**	**11**	**19.29%**
4	**7-9 Year age group**	**19**	**33.33%**
5	**>9 Year age group**	**14**	**24.56%**

Table. No. 3 Prevalence of Endocarditis (Breed wise)

S.No.	Breed	No. of Affected	Percentage (%)
1	**Labrador**	**17**	**29.82**
2	**German Shepherd**	**13**	**22.80**
3	**Pomenearian**	**8**	**14.03**
4	**Non-Discript**	**6**	**10.52**
5	**Doberman**	**4**	**7.01**
6	**Beagle**	**7**	**12.28**
7	**Dalmatian**	**2**	**3.50**