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Research Article

A CLINICAL STUDY ON HYPERTENSION IN CLIENT-OWNED DOGS OF HYDERABAD, TELANGANA STATE

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ABSTRACT

The primary objective of the current study was to document the incidence of hypertension in dogs. A total of 6856 adult dogs were presented during the study period and when subjected to blood pressure measurement using the Vet Doppler BP machine, 87 dogs were diagnosed to have hypertension (>150 mm Hg). The incidence of hypertension in the present study was found to be 1.27 % with secondary hypertension accounting for 90.8 % and idiopathic for 9.2 %. Recurrent epistaxis, secondary glaucoma, acute onset of blindness, seizures, acute onset of head tilt, and circling were some of the clinical signs noticed in various hypertensive dogs. However, the dogs with secondary hypertension also exhibited the clinical signs of underlying diseases like kidney disease (vomiting, hematuria, hematemesis, polyuria, polydipsia, weight loss, anemia, oliguria, emaciation, oral ulcers, dental tartar, stranguria and dribbling of urine), diabetes mellitus (polyuria, polydipsia, polyphagia and emaciation), chronic hepatitis (icterus, ascites and edema) and hypothyroidism (obesity, bilateral alopecia, delayed wound healing and rat-tailed appearance). There was a high incidence of hypertension in dogs of 6-8 years age group followed by dogs of 12 years and above. Males (56.32 %) were affected more than females (43.68%). The Spitz was the most affected (33.30 %) breed and the lowest incidence was noticed in the Pug (1.15%). Echocardiographic changes observed in hypertensive dogs were thickened left ventricular free wall and interventricular septum, hyperechoic/ thickened, and flail MV leaflets, dilatation of aortic root, increased LA/AO and dilated ventricles. Elevated R wave, elevated T wave along with ST segment slurring were the common ECG findings of the present study.

Keywords: Hypertension, incidence, dog

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Hypertension refers to persistent pathologic elevation in systemic arterial blood pressure, especially constant elevations in systolic blood pressure (Chalhoub and Palma, 2017). Blood pressure measurement is not a widely conducted test in veterinary practice in India. The uncertain prevalence of hypertension in dogs and cats can be attributed to the absence of standardized measurement techniques, varying inclusion criteria, and inconsistent thresholds used for diagnosing hypertension in the field of veterinary medicine. These factors contribute to the challenge of interpreting prevalence data accurately (Acierno et al., 2018). Studies conducted on apparently healthy dogs have revealed a hypertension prevalence rate of 0.5% among a group of 400 dogs (McCubbin and Corcoran, 1953), 0.9% of 1000 young dogs (Katz *et al.*, 1957), 2% of 215 dogs (Hamilton *et al.*, 1939), 10% of 102 dogs (Remillard *et al.*, 1991) and 13% of healthy Shetland Sheepdogs (Scansen *et al.*, 2014). Primary/essential hypertension is unusual in dogs as hypertension in veterinary practice is most often associated with an underlying disease or condition (Brown and Henik, 1998).

MATERIALS AND METHODS

The current study was conducted in client-owned dogs aged over 6 years that were presented to the Veterinary Clinical Complex, CVSc., Rajendranagar, Hyderabad during the period from January 2022 to August 2022. After a thorough clinical examination, all these dogs were subjected to blood pressure measurement using a Vet Doppler BP machine following the standardized protocol proposed by the ACVIM guidelines (Acierno *et al.*, 2018).

BP measurement:

Blood pressure measurements were taken after a 5-10 minute period of acclimatization in a quiet room to reduce anxiety or excitement-induced situational hypertension. All measurements were taken using cuffs that most nearly matched 30%-40% of the forelimb's circumference. The hair was trimmed near the palmar metacarpal pad specifically at the superficial palmar arterial arch in order to take measurements of the forelimb. An occluding cuff was placed proximal to the point of flow detection (mid-radius in the forelimb). Measurements were taken while the cuff was situated at heart level. Ultrasonic coupling gel was applied on the concave surface of the Doppler transducer, and the transducer was either held steady during measurements or secured in place using adhesive tape. An audible pulse signal was acquired, and the cuff was pumped up using a bulb attached to a pressure gauge. The cuff was inflated to a pressure that was at least 40 mm Hg higher than the audible cut-off point of the signal. The cuff was then gradually released, and the pressure at which the Doppler signal was audible again

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was noted as the systolic pressure. The diastolic pressure was then recorded at the point at which the audible signal abruptly changed in pitch or became muffled. The first measurement was discarded, and an average of 5-7 successive stable indirect measurements were noted and the arithmetic mean was calculated (Stepien, 2017). Blood pressure measurement is depicted in Fig. 1.

The categorisation of hypertension is based on the guidelines set forth by ACVIM consensus statement which characterizes hypertension as SBP ranging from 160 to 179 mmHg and defines SBP≥180 mmHg as severe hypertension (Acierno *et al.*, 2018). Hypertensive dogs were further classified into primary and secondary depending on whether they were associated with an underlying disease/condition or not. All the hypertensive dogs were subjected to hemato-biochemical analysis, radiography, ultrasonography, 2d-echocardiography and electrocardiography for the diagnosis of associated underlying disease if any. Echocardiography was performed using a Mindray Diagnostic Ultrasound machine with a cardiac probe of 3.5 MHz to obtain B and M-mode images of the heart. Electrocardiography was recorded using a BPL cardiart 9108-D, 12 lead ECG machine, in accordance with the standard protocol outlined by Tilley (1992). Lead II was used to interpret electrocardiogram variables.

RESULTS AND DISCUSSION

During the study period (January 2022 to August 2022), a total of 6856 dogs that were >6 years old were presented to the VCC, College of Veterinary Science, Rajendranagar, Hyderabad, Telangana. When all these dogs were subjected to blood pressure measurement, 87 dogs of various breeds and genders were diagnosed with hypertension (>150 mm Hg) forming an incidence of 1.27 percent. These findings are in agreement with McCubbin and Corcoran (1953), Katz *et al.* (1957), Michell and Bodey (1994) and Priyanka (2010). Among hypertensive dogs, 44.83 percent (39/87) were in the hypertensive stage and 55.17 percent (48/87) were in the severely hypertensive stage. This concurred with Littman *et al.* (1988), Priyanka (2010) and Cole *et al.* (2020) who observed the majority of hypertensive dogs were in the high-risk group. In contrary, Singla (2015) in his study reported that there were no dogs in the high-risk group. In the present study, secondary hypertension (90.80 percent) occurred more commonly than idiopathic hypertension (9.20 percent). These findings are in agreement with Bennardo (2005), Priyanka (2010) and Acierno *et al.* (2018). Priyanka (2010) in her study observed 89.63 percent prevalence of secondary hypertension and 10.37

Fig. 1. Measurement of blood pressure in a hypertensive dog

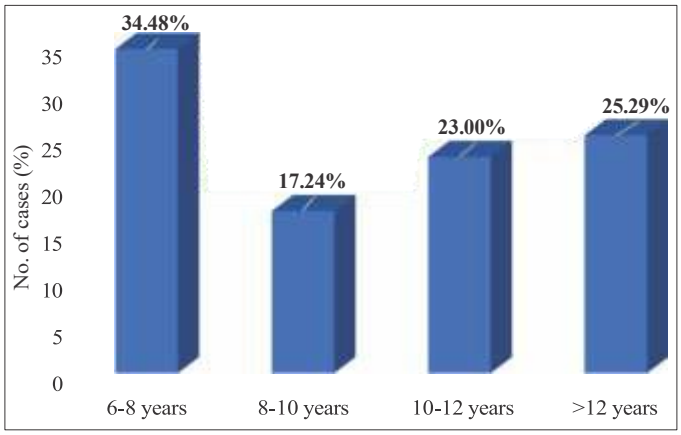

Fig. 2. Age-wise incidence of hypertension

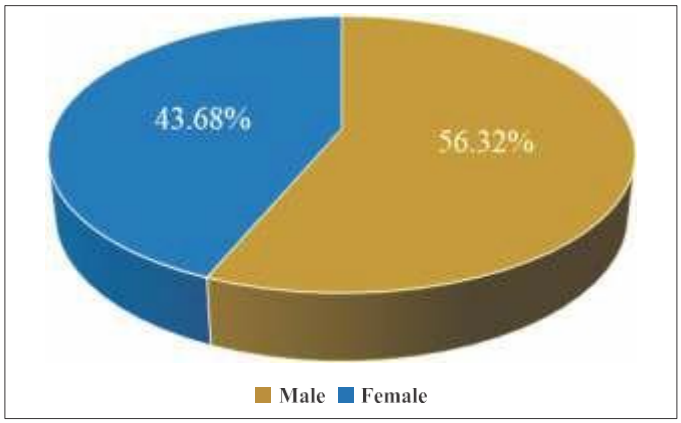

Fig. 3. Gender-wise incidence of hypertension

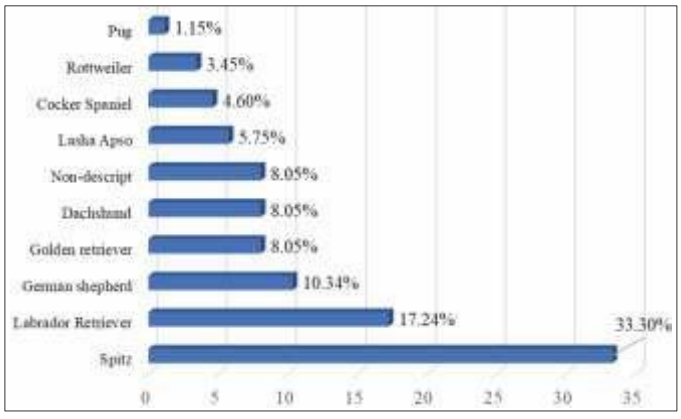

Fig. 4. Breed-wise incidence of hypertension in dogs

Fig. 5. 2d-echocardiogram m-mode image showing severe thick inter-ventricular septum-suggestive of hypertrophic cardiomyopathy. Also note increased ejection indices.

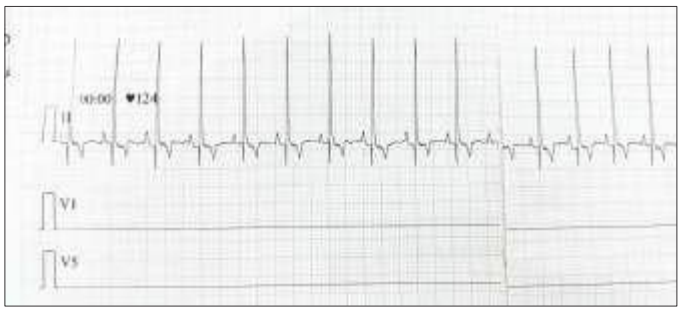

Fig. 6. Elevated R wave amplitude (3.0 mv) along with electrical alternans from a Cocker Spaniel with hypertension.

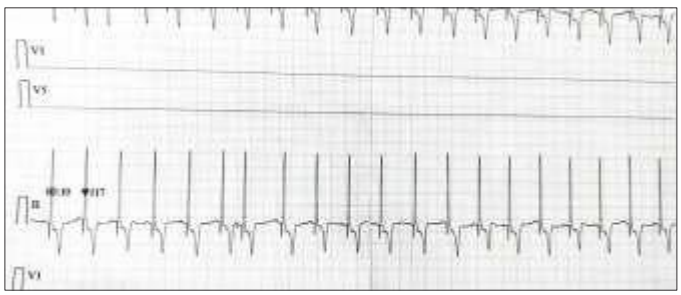

Fig. 7. ST segment depression or coving along with moderate increase in R wave amplitude in a Spitz with hypertension.

percent of idiopathic hypertension.

Clinical signs suggestive of hypertension that were recorded in the dogs of the present study include recurrent epistaxis, systolic murmur, secondary glaucoma, acute onset of blindness, seizures and acute onset of head tilt and circling. In addition to signs of hypertension, dogs with secondary hypertension also exhibited the clinical signs of certain underlying diseases. Recorded clinical signs that were related to kidney disease were vomiting, hematuria, hematemesis, polyuria, polydipsia, weight loss, anemia, oliguria, emaciation, oral ulcers, dental tartar, stranguria, dribbling of urine; related to diabetes mellitus were polyuria, polydipsia, polyphagia, and emaciation. Few

Table 1. Age-wise incidence of hypertension in dogs (n=87)

Age	Number	Percentage (%)
6-8 years	30	34.48
8-10 years	15	17.24
10-12 years	20	23.00
>12 years	22	25.29
Total	87	100

Table 2. Gender-wise incidence of hypertension in dogs (n=87)

Sex	Number	Percentage (%)
Male	49	56.32
Female	38	43.68
Total	87	100

Table 3. Breed-wise incidence of hypertension in dogs (n=87)

Breed	Number	Percentage (%)
Spitz	29	33.30
Labrador Retriever	15	17.24
German shepherd	9	10.34
Golden retriever	7	8.05
Dachshund	7	8.05
Non-descript	7	8.05
Lasha Apso	5	5.75
Cocker Spaniel	4	4.60
Rottweiler	3	3.45
Pug	1	1.15
Total	87	100

were also presented with icterus, ascites and edema and obesity, bilateral alopecia, delayed wound healing and rat-tailed appearance suggesting chronic hepatitis and hypothyroidism. Clinical signs noticed in the present study might be due to the underlying disease and end-organ damage. Several authors stated that animals with secondary hypertension had varied clinical signs caused by the underlying diseases and the end organ damage (Brown *et al.*, 2007; Mylonakis *et al*., 2008 and Grauer, 2009).

Dogs of different age groups i.e., 6-8 years, 8-10 years, 10-12 years, and above 12 years showed an incidence of 34.48 percent (30/87), 17.24 percent (15/87), 23.00 percent (20/87), 25.29 percent (22/87), respectively (Table 1 and Fig. 2). The current study found a high incidence of hypertension in dogs of 6-8 years age group followed by dogs of 12 years and above. The increased prevalence of hypertension in geriatric dogs might be due to age-related loss of arterial compliance and increased occurrence of the diseases associated with secondary hypertension in this group of dogs (Mosier, 1989). A higher incidence of hypertension in 6-8 years dogs could

also be due to the overrepresentation of this age group in the study area. The incidence of hypertension among males and females was 56.32 percent (49/87) and 43.68 percent (38/87) (Table 2 and Fig. 3). The higher blood pressure values recorded in male dogs when compared to female dogs of the present study could be attributed to larger body mass, larger heart size, and more cardiac output (Valtonen and Oksanen, 1972) or might be due to the increased ratio of males in the pet population. On the contrary, Meenu (2020) reported a higher incidence of hypertension in female obese dogs as compared to males. However, Perez-Sanchez *et al.* (2015) opined that there was no correlation between gender and elevated or reduced BP. Breed-wise incidence of hypertension was found to be higher among Spitz (33.30 percent), followed by Labrador Retriever (17.24 percent). Other breeds affected were German Shepherd (10.34 percent), Golden retriever, Dachshund and Non-descript (8.05 percent) each, Lasha Apso (5.75 percent), Cocker Spaniel (4.60 percent), Rottweiler (3.45 percent) and lowest among Pug (1.15 percent) (Table 3 and Fig. 4). The breed-wise incidence of the present hypertensive dogs was found to be highest among Spitz (33.30 percent) and lowest among Pug (1.15 percent).

As chronic kidney disease and Cushing's disease have the greatest association with the development of hypertension in dogs, breeds susceptible to CKD and Cushing's disease were commonly affected with hypertension. Karunanithy *et al.* (2021) reported the Spitz breed exhibited the highest incidence rate of kidney diseases while the Pug had the lowest. Priyanka (2010) reported the highest incidence of hypertension in the Spitz breed. Major echocardiographic changes observed in hypertensive dogs were thickened left ventricular free wall and interventricular septum (Fig. 5) in 14.94 percent (13/87), hyperechoic / thick and flail mitral valve leaflets resulting in mitral valve insufficiency and regurgitation in 12.64 percent (11/87), dilatation of aortic root in 9.20 percent (8/87), increased LA/AO in 4.60 percent (4/87), dilated ventricle in 3.45 percent (3/87). These findings are in accordance with the earlier reports of Nicolle *et al.* (2005), Lee and Hyun (2009) and Misbach *et al.* (2011). Functional/adaptive changes like ventricular hypertrophy in hypertensive dogs might be due to an increase in after-load (Grauer, 2009). Hypertrophy occurs in an effort to normalize wall stress and preserve left ventricular (LV) chamber function (Chalhoub and Palma, 2017), enlargement of the proximal aorta in patients with systemic hypertension is due to elevated intra-aortic distending pressure (Palmieri *et al.*, 2001). The degree of thickening of the LV free wall and interventricular septum suggested the chronic process of cardiac remodelling (Lee and Hyun, 2009).

The electrocardiographic changes indicating left ventricular enlargement such as increased R wave amplitude was noticed in 29.89% of hypertensive dogs of the present study (Fig. 6). This is in accordance with Thiruselvame (2002) and Priyanka (2010) who reported an elevated amplitude of R wave in hypertensive dogs. Left ventricular hypertrophy occurs as a reaction of the heart to the increased afterload resulting from abnormally elevated arterial pressure (Snyder *et al.*, 2001). Myocardial hypoxic changes like ST slurring and ST elevation are observed in 16.09 percent and 9.20 percent, respectively (Fig. 7). This finding is in agreement with Lee and Hyun (2009) and Priyanka (2010). Chetboul *et al.* (2003) stated that increased afterload in hypertensive patients poses stress on cardiac muscles which results in hypoxic or ischemic changes in the myocardium. ECG abnormalities associated with electrolyte imbalance like tall T wave was another abnormality recorded in 21.84 percent of present hypertensive dogs, which might be due to hyperkalemia associated with kidney disease.

CONCLUSION

According to the findings of the current study, the overall incidence of hypertension was 1.27% with the highest incidence of secondary hypertension (90.80%). A higher incidence of hypertension was found in dogs of the 6-8 years age group followed by > 12 years and with males predominating over females, it showed an increased risk of hypertension among geriatric dogs. Hence, it may be concluded that geriatric dogs are more prone for degenerative diseases that may be presented with specific signs but hypertension, a silent killer may also be seriously considered for differential diagnosis.

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