



# Is Hypocalcemia Responsible for Epilepsy in Canines? A Case Study of Twelve Dogs from Veterinary Clinical Complex, Anand, Gujarat, India

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## ABSTRACT

**Background:** Dogs with epilepsy are among the most frequently seen neurological patients in veterinary practice. Phenobarbital is commonly used for therapeutic management. Calcium is one of the factors responsible for epileptic signs in canines. The current study was conducted to establish the correlation of calcium with epileptic signs in dogs.

**Methods:** A total of twelve dogs that failed to respond to traditional management of epilepsy were included in the study. Hemato-biochemical estimation was carried out on the day of presentation from twelve dogs showing epilepsy signs. Calcium and nerve supplements were advised to the owner for a month. A re-examination was done after thirty days of treatment. Statistical analysis was done using the t-test method.

**Result:** A significant difference was observed in serum calcium levels after treatment in all canines. No significant difference was detected in other parameters, which indicates nervous signs were due to low levels of calcium only. The study concluded that calcium can be considered for the treatment of epilepsy in canines.

**Key words:** Albumin, Canine, Creatinine, Epilepsy, Hypocalcemia.

## INTRODUCTION

The canine population is increasing day by day and is preferred more as a companion animal (Smith *et al.*, 2019). Since epilepsy is a neurological condition that affects both people and domestic dogs, dogs are a perfect translational model for epilepsy. Epilepsy is a complicated brain disorder that affects both species and is defined by a persistent propensity to experience recurrent, spontaneous epileptic seizures (Loscher, 2022). Epilepsy is not one single disease process but can be provoked by multiple causes and can be classified as genetic, structural and of unknown origin (Thomas, 2000). The true prevalence of epilepsy in canines is unknown but has been estimated to be 0.6-0.75% in the general dog population (Heske *et al.*, 2014). Several causes have been documented for epilepsy. However, calcium as one of the causative agents has not been demonstrated yet in the veterinary field in this region. In dogs, hypocalcemia may cause muscle tremors, facial rubbing, muscle cramping, stiff gait, seizures, restlessness, aggression, hypersensitivity and disorientation (Coady *et al.*, 2019). This study was undertaken to check whether or not the low level of calcium is responsible for epilepsy. This is the first study which shows that hypocalcemia can be accountable for the induction of epilepsy in dogs.

## MATERIALS AND METHODS

The present study was conducted from November 2023 to March 2024 at the Veterinary Clinical Complex, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Anand, Gujarat, India. No ethical approval is

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necessary as the owner came to veterinary clinic for diagnosis. A total of twelve dogs were included in the study, having epilepsy as a major complaint. Dogs with epilepsy were evaluated, which were already treated with phenobarbital and still having epilepsy. The details of the canines are shown in the Table 1. Four ml of blood was collected and divided into EDTA vials and clot activator vials for hemato-biochemical parameters. Red blood cells ( $10^6/\mu\text{L}$ ), white blood cells ( $10^3/\mu\text{L}$ ), hemoglobin (g/dl), packed cell volume (%) and platelets ( $10^3/\mu\text{L}$ ) were estimated from blood. Calcium (mg/dl), creatinine (mg/dl) and albumin (g/dl) were measured from serum. All parameters were recorded at the time of the case presented at the referral hospital and after 30 days. The statistical analysis was achieved using a t-test in GraphPad Prism software (9.0) and tabulated in a Table 2.

## RESULTS AND DISCUSSION

Breeds like Saint Bernard, Labrador, German Shepherd, Siberian Husky, Great Dane and Pomeranian were included in the study. Six male and six female dogs were targeted for unbiased result outcomes. Two dogs were aged under one year, six dogs were under five years of age and four dogs aged more than five years. The duration of epilepsy was nearly one month in six dogs, one month to 1 year in four dogs and more than a year in two dogs. All the dogs received phenobarbital and still, epilepsy was present.

Haematological examination revealed non-significant ( $p>0.05$ ) alterations in the level of hemoglobin, red blood cells, white blood cells and packed cell volume. A non-significant ( $p>0.05$ ) difference was also observed in albumin and creatinine levels in all twelve dogs. Albumin and creatinine values remained within range on the day of treatment and after 30 days. The serum calcium level was under the normal range ( $4.76\pm0.14$ ) at the time of presentation. A significant ( $p<0.001$ ) increase in the level of calcium ( $7.41\pm0.17$ ) was observed after 30 days of treatment. Improvement in epilepsy was observed after one month of treatment, with a decrease in episodes and severity.

Epilepsy is a complicated brain disease where sudden and irregular activity in neuronal networks causes the projecting clinical sign of seizures characterised by motor, autonomic and behavioural features (Berendt *et al.*, 2015).

All dog breeds are prone to epilepsy and Hulsmeyer *et al.* (2015) documented breed predisposition for different disease conditions.

Breeds like Beagles, British Alsations, Keeshonds, Labrador retrievers, Golden retrievers, Boxers, Shetland sheepdogs, Vizslas, English Springer Spaniels, Irish wolfhounds and Standard Poodles are supposed to develop epilepsy (Bielfelt *et al.*, 1971; Jaggy *et al.*, 1998; Patterson *et al.*, 2003; Plonek *et al.*, 2022). Heynold *et al.* (1997) reported different aspects of epilepsy in Labrador retrievers, which supports the findings of the present study, in which 33.33% (4/12) of dogs were Labrador retrievers. Siberian husky and German shepherd breeds of dogs are more prone to epilepsy, as per reports of Hulsmeyer *et al.* (2015) and Czerwik *et al.* (2018). In contrast to these studies, Monteiro *et al.* (2012) documented that German shepherds and boxers were significantly ( $P=0.04$  and  $0.01$ , respectively) more likely to suffer from epilepsy compared to Labrador retrievers.

In a study of 99 client-owned dogs, Ghormley *et al.* (2015) discovered that 2 out of 7 dogs older than 14 years old and 7 out of 30 dogs (23%) and 8 out of 29 (45%) and 10 out of 33 dogs (39%) had primary epilepsy. The findings are contrary to the results of the present study, which showed the highest occurrence of epilepsy in dogs aged between 1 and 5 years. According to De Risio *et al.* (2015), the chances

**Table 1:** Details of canines included in the study (n=12).

Breed	Age	Sex	Duration
Saint Bernard	11 Months	Male	3 Week
Labrador	4 Years	Male	1 Year
Pomeranian	8 Years	Male	3 Month
Labrador	12 Years	Female	1 Week
Labrador	2.5 Years	Female	6 Month
GSD	3 years	Female	18 Month
Siberian husky	7 Months	Male	1 Month
Great dane	7 Years	Male	5 Years
Siberian husky	7 Years	Female	1 Month
German shepherd	3 Years	Female	1 Month
German shepherd	3 Years	Female	1 Month
Labrador	5 Years	Male	2 Month

**Table 2:** Hemato-biochemical alteration in canines with epileptic signs (Mean $\pm$ SE).

Variables	Day 0	Day 30	Normal range	Significance
Hemoglobin (g/dl)	12.93 $\pm$ 0.80	12.94 $\pm$ 0.78	11.9-18.9	Ns
RBC ( $10^6/\mu\text{L}$ )	5.51 $\pm$ 0.19	5.52 $\pm$ 0.18	4.95-7.87	Ns
WBC ( $10^3/\mu\text{L}$ )	12.30 $\pm$ 1.84	10.90 $\pm$ 0.78	5.0-14.1	Ns
Platelets ( $10^3/\mu\text{L}$ )	239.17 $\pm$ 12.38	258.17 $\pm$ 8.72	211-621	Ns
PCV (%)	37.19 $\pm$ 2.48	37.89 $\pm$ 1.77	35-57	Ns
Calcium (mg/dl)	4.76 $\pm$ 0.14	7.41 $\pm$ 0.17	9.1-11.7	****
Albumin (g/dl)	2.83 $\pm$ 0.07	2.86 $\pm$ 0.07	2.3-3.1	Ns
Creatinine (mg/dl)	1.07 $\pm$ 0.07	1.03 $\pm$ 0.08	0.5-1.7	Ns

ns= Non-significant; \*\*\*\*= Significant.

of epilepsy are 2.65 times higher in dogs aged between 6 months and six years. The findings are in accordance with the results of the present study. Epilepsy can occur in male and female dogs. Sex predisposition has been reported in male dogs, but no explanation for this alteration in prevalence between sexes has been provided (Van Meervenne *et al.*, 2014).

Calcium is an essential element required for various physiological activities. Low levels of calcium result in muscle fasciculation, tremors, epilepsy and behavioural changes (Holowaychuk, 2013). Brauer *et al.* (2011) reported that calcium is the second-highest cause of epilepsy in canines after intoxication. Ionized calcium is commonly used to diagnose and establish a correlation with the disease condition (Whitehead *et al.*, 2015). Ionized calcium was not estimated due to the unavailability of facilities for the same. Results clearly agree on the role of calcium in epilepsy development in dogs.

## CONCLUSION

The result presented here allows us to conclude that calcium has a good correlation with epilepsy development and can be considered and estimated to rule out the causes of epilepsy. The evaluation of ionized calcium's role can be studied further to understand and manage the condition better.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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