



Original Research

Evaluation of Prognostic Indicator Based on the Electrical Conductivity of the Heart in Canine Parvovirus Enteritis

M. Areshkumar*, P. Vijayalakshmi and D. Selvi

Department of Veterinary Medicine, Rajiv Gandhi Institute of Veterinary Education and Research Teaching Veterinary Clinical Campus, Mettupalayam, Puducherry, INDIA

*Corresponding author: areshvet@gmail.com

Rec. Date:	Jun 27, 2018 08:32
Accept Date:	Aug 19, 2018 07:15
DOI	10.5455/ijlr.20180627083211

Abstract

Canine parvovirus infection is one of the most common infectious diseases of dogs and the most prevalent viral cause of diarrhea in dogs. Fifty two dogs affected with canine parvovirus was subjected to electrocardiography and the results were recorded. Electrocardiography of non-survivor dogs showed significant decrease in R wave amplitude and the shortening of QT interval when compare to survivors and healthy control. Decreased R amplitude (<0.5 mV) and decreased QT interval (<0.16 sec) in ECG of dogs with canine parvoviral enteritis had a poor outcome.

Key words: CPE, Electrocardiography, Prognosis

How to cite: Areshkumar, M., Vijayalakshmi, P. & Selvi, D. (2018). Evaluation of Prognostic Indicator Based on the Electrical Conductivity of the Heart in Canine Parvovirus Enteritis. International Journal of Livestock Research, 8(12), 41-46. doi: 10.5455/ijlr.20180627083211

Introduction

Canine parvovirus infection is one of the most common infectious diseases of dogs and the most prevalent viral cause of diarrhea in dogs. It is postulated to have arisen either from feline pan leucopenia or a wild carnivore parvovirus (Murphy *et al.*, 1999). In 1980, the original strain of CPV-2 was reported into type 2a (CPV-2a) and in 1984, another variant designated type 2b (CPV-2b) appeared. In the year 2000, yet another strain (CPV-2c) was originally isolated in dogs in Italy (Decaro *et al.*, 2010). It is essential to predict the outcome of the disease based on proper interpretation of laboratory tests on the day of presentation and subsequent days during supportive treatment. Effective prognostication would be beneficial in the therapeutic management of this disease. Soave (1959) reported that in prolonged vomiting and diarrhea, the serum electrolyte balance is disturbed due to loss of chlorides and resultant loss of potassium, resulting in an increase in the heart rate and shortening of the QT time. In more severe cases ventricular changes appear in the form of widening of the QRS complex and widening of the T wave. Hilwig and Hahn (1976) reported



that all intervals are shortened by increased heart rate, thus wide range values have been published. Robinson *et al.* (1979) reported that viral myocarditis suspected puppies had small R waves (0.4 mv in lead II) S-T segment elevation, QRS notching and paroxysmal ventricular tachycardia. Carpenter *et al.* (1980) opined that only very young cardiac muscle fiber (in puppies less than 8 weeks of age) was susceptible to fatal parvoviral infection. Lenghaus and Studdert (1980) reported that the multiple foci of irritations giving rise to extra systoles and edema interfering with conduction are the important factors contributing to the death from heart failure that occurs in puppies with parvovirus – myocarditis. Viral myocarditis was associated with parvovirus and it affected pups of four to eight weeks of age.

Further it was reported that the parvovirus infections involved the changes in R waves, S-T segment elevation, QRS notching and poor prognosis in small R waves (Wood, 1983). Michell (1983) reported that dehydration caused by diarrhea is likely to be accompanied by metabolic acidosis and in severe diarrhea by hyperkalemia. An early rapid and reasonably reliable screening test for identifying life-threatening hyperkalemia is an electrocardiogram. Typical early electrocardiographic changes include tall, peaked T waves, loss of P waves and wide QRS complexes. (Tilley and Lawrence, 1992).

Materials and Methods

This study was conducted at the Small Animal Medicine Unit of Teaching Veterinary Clinical Complex, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry. Ten apparently healthy dogs with normal vital signs and normal haematobiochemical values were taken as control group. Dogs irrespective of breed, age, sex with history and clinical manifestations of CPE, after confirmed by PCR analysis. Electrocardiographic recordings were made with standard electrocardiographic lead systems as described by Tilley and Lawrence (1992) using ECG 300 G, concept bio medicals. Lead II was used to interpret electrocardiogram variables and compared to the standard dog ECG and analyzed.

Results

P wave Amplitude

Electrocardiography of the CPE affected dogs was recorded. The mean \pm SE of P wave amplitude of the control group was 0.18 ± 0.01 mV whereas the dogs which died of CPE was 0.23 ± 0.02 mV and the survivors was 0.20 ± 0.01 mV. There was no significant difference observed between the control group, dogs that recovered from CPE and puppies that died of CPV infection (Table 1) (Plate 1).

P wave Duration

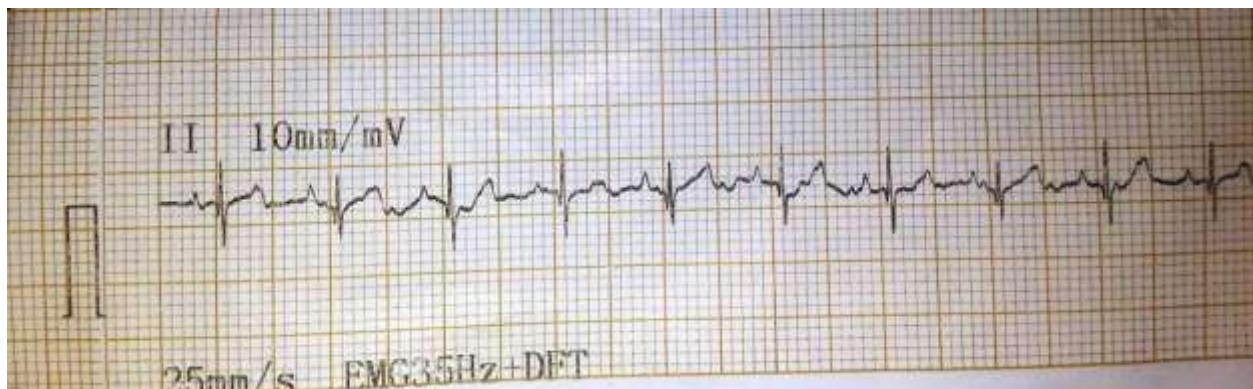
The mean \pm SE of the P wave duration of the control dogs was 0.04 sec, whereas the survivors and non-survivors had a duration of 0.03 ± 0.001 sec and 0.03 ± 0.001 seconds respectively (Table 1). There was no

significant difference observed between the control group, dogs that recovered from CPE and puppies that died of CPV infection.

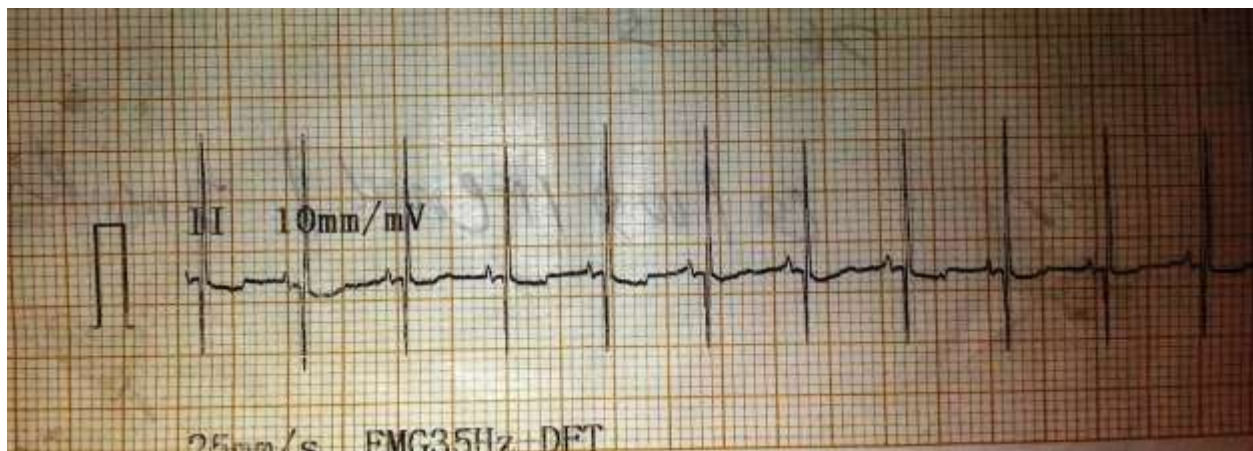
Table 1: Comparison of ECG of control, survivors and non-survivors of CPE in dogs on the day of presentation

Parameter	Control (N=10)	Survivors (N=42)	Non-survivors (N=10)
P wave amplitude (mV)	0.18 ± 0.01	0.20 ± 0.01	0.23 ± 0.02
P wave duration (sec)	0.04 ± 0	0.03 ± 0.001	0.03 ± 0.001
QRS wave amplitude (mV)	1.56 ± 0.13	1.81 ± 0.08 ^c	1.32 ± 0.15 ^c
QRS wave duration (sec)	0.04 ± 0	0.03 ± 0.001	0.03 ± 0.002
PR interval (sec)	0.11 ± 0.008	0.10 ± 0.003	0.09 ± 0.006
QT interval (sec)	0.20 ± 0.006 ^b	0.16 ± 0.007	0.13 ± 0.005 ^b
T wave Amplitude (mV)	0.35 ± 0.03	0.33 ± 0.03	0.26 ± 0.03

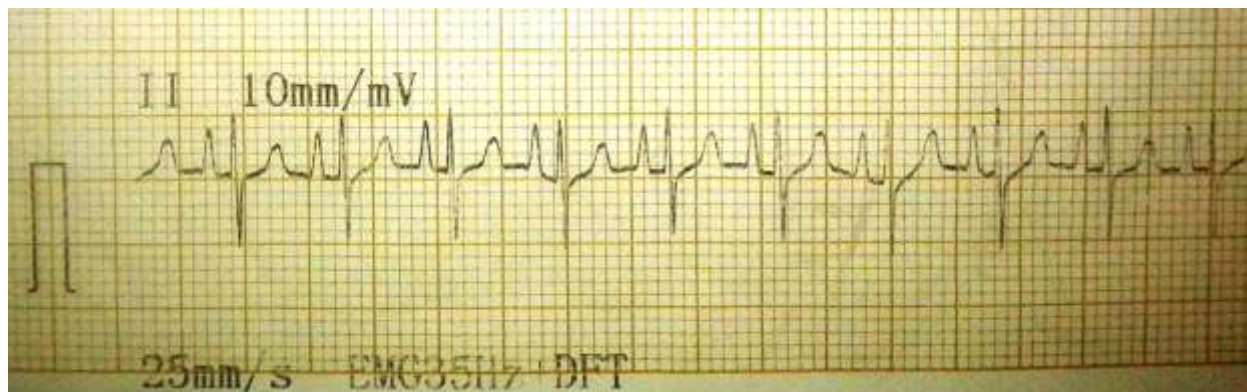
Same superscript with in a row differ significantly ($p < 0.05$)



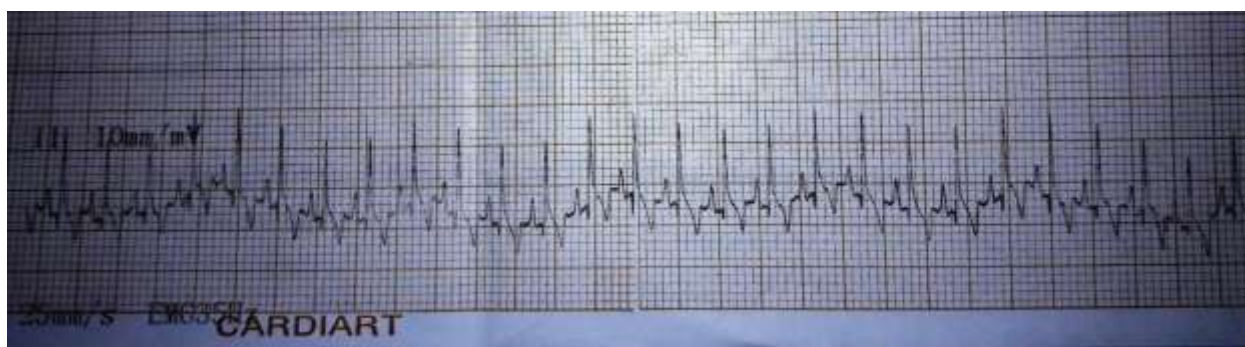
1a: Low R amplitude with deep S wave indicating low ventricular conduction in a 3 months, Labrador pup



1b: Tall R amplitude with deep Q wave indicating right ventricular enlargement in a 2 months old non-descript pup



1c: Tall P indicates right atrial enlargement with deep S wave and peaked T wave



1d: Tachycardia with tall P wave with ST coving indicates endomyocardial ischemia and Potassium imbalance in a 4 month old non-descript pup

Plate 1: Electrocardiography of CPE affected dogs

QRS Amplitude

The mean \pm SE of the R amplitude of the control dogs were 1.56 ± 0.13 mV, whereas R amplitude was 1.32 ± 0.15 mV (non-survivors) and was 1.81 ± 0.08 mV for survivors of CPE. A high significant decrease was observed in non-survivors when compared to survivor ($p=0.0256$). No significant difference was observed between control group and survivors, control group and non-survivors.

QRS Duration

No significant difference was observed between the mean \pm SE of QRS duration of control (0.04 sec), recovered (0.03 ± 0.001 sec) and non-survivors (0.03 ± 0.002 sec) dogs respectively (Table 1).

PR Interval

The mean \pm SE of the PR interval of control dogs was 0.11 ± 0.008 seconds whereas the CPE affected survivor dogs was 0.10 ± 0.003 sec and non-survivor dogs was 0.09 ± 0.006 sec. There was no significant difference observed between the control group, dogs that recovered from CPE and puppies that died of CPV infection.

QT Interval

The mean \pm SE of QT interval of the control dogs was 0.20 ± 0.006 sec. QT interval of dogs which survived from the disease was 0.16 ± 0.007 sec and the non-survivor dogs was 0.13 ± 0.005 sec. A significant decrease was observed in puppies that died of CPV infection when compared to the control mean. No significant difference was observed between the control group and the dogs that recovered from CPE, survivors and non-survivors.

T Wave Amplitude

There was no significant difference in the mean \pm SE of T wave between control dogs (0.35 ± 0.03 mV), survivors (0.33 ± 0.03 mV) and non-survivors (0.26 ± 0.03 mV). The T wave was positive in 45 cases, biphasic (flattened T wave) in 3 cases and negative in 5 cases.

Discussion

The P wave amplitude and duration was found to have no significant difference with the control mean. The mean \pm SE of the R amplitude of control dogs were 1.56 ± 0.13 mV, whereas R amplitude was 1.32 ± 0.15 mV (non-survivors) and was 1.81 ± 0.08 mV for survivors of CPE. A high significant decrease was observed in non-survivors when compared to survivors ($p = 0.0256$). No significant difference was observed between control group and survivors, control group and non-survivors. Wood (1983) reported that the viral myocarditis was associated with parvovirus in affected pups of four to eight weeks of age. Further, he reported that the parvovirus infections involved the changes in R waves, S-T segment elevation and QRS notching and poor prognosis in dogs with low amplitude QRS complex. The present findings are in accordance with Robinson *et al.* (1979) who reported that the viral myocarditis suspected puppies had smaller R waves, ST segment elevation, QRS notching and paroxysmal ventricular tachycardia. In the present study also the dog died of CPV myocarditis had smaller R wave, ST segment elevation and QRS notching. Q wave deepening indicates right ventricular hypertrophy in dogs infected with canine parvovirus, which is in agreement with Bolton (1975) who reported that Q wave deeper than 0.5 mV (5 boxes) in lead II were suggestive of right ventricular hypertrophy.

The PR interval is normal in this study whereas dogs that died of CPV showed QT interval of 0.13 ± 0.005 sec. The present findings is in agreement with (Tilley and Lawrence, 1992) who reported shortening of QT interval, may be due to hyperkalaemia, hypercalcaemia digitalis, atropine, beta-blockers and calcium channel antagonists resulting in an increase in the heart rate and shortening of QT interval. Hence, shortening of QT interval may act as a prognostic indicator and it indicates loss of chloride and potassium ions due to prolonged vomiting and diarrhea. Similar findings reported by Hilwig and Hahn (1976) also reported that decrease QT interval increases the heart rate.

In this study, T wave showed normal values, which is of no use in predicting the prognosis for the CPV infected dogs. Whereas, Tilley and Lawrence (1992) reported a rapid and reasonably reliable screening test for identifying life-threatening hyperkalemia early is an electrocardiogram. Typical early electrocardiographic changes included tall, peaked T waves, absent P wave, and wide QRS complexes.

Conclusion

Electrocardiography showed significant decrease in R wave amplitude and the shortening of QT interval when compare to survivors and healthy control. Decreased R amplitude (<0.5 mV) and decreased QT interval (<0.16 sec) in ECG of dogs with CPE had a poor outcome.

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