

ELECTROCARDIOGRAPHIC CHANGES OF LABRADOR DOGS WITH AGE

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ABSTRACT

A study of electrocardiographic changes of Labrador dogs with age was performed which showed that the P amplitude of older dogs was significantly higher than P amplitude of younger dogs. The Q wave amplitude was found to be decreasing with the advancement of age. QRS complex and R-R were significantly higher in group 2 dogs than group 1 dogs. Highest heart rate was recorded in group 1 dogs. Pulse rate of group 2 dogs was significantly higher as compared to group 1,3, and 4 dogs.

INTRODUCTION

Electrocardiography is an important diagnostic tool for detecting cardiac abnormalities in dogs (Tilley, 1985). There are numerous reports regarding use of electrocardiography in dogs. The amplitude of QRS complex was recorded to be higher in older dogs as compared to younger ones (Bernal *et al.*, 1995). ECG values among Doberman Pinschers, Spitz, Labrador Retriever, Mongrels and German Shepherd, had been reported by Dhanapalan *et al.* (1997). However, there is no report on electrocardiographic change with advancing age in Labrador Retriever, a popular breed of dog. Therefore, the present study was conducted to assess the alterations in electrocardiographic parameters with different stages of life i.e. birth to senility.

MATERIALS AND METHODS

Twenty privately owned apparently healthy Labrador Retriever dogs were categorized into four age groups (group 1: dogs above 6 months and below 1 year, group 2: dogs above 1 year and below 3 years, group 3: dogs above 3 years and below 5 years and group 4: above 5 years with equal number of dogs in each group and the Lead II ECG was recorded with a 12-lead standard ECG recorder, (Cardiart 108 T- MK VII- BPL). The electrocardiograph was set with a paper speed of 25 mm/sec and sensitivity of 1 (1 cm= 1mv) with the 50 Hz filter turned 'on'. The ECG was recorded with the dog in standard body position (Tilley, 1985) restrained in right lateral recumbency with the legs positioned parallel to each other and perpendicular to the long axis of the body and keeping the head and neck flat on the wooden table. The right forelimb (RA) and left forelimb (LA) electrodes were placed proximal to the olecranon on the caudal aspect of the respective forelimbs and the right hind limb (RF) and left hind limb (LF) electrodes were placed over the patellar ligament on the anterior aspect of the respective hind limbs.

RESULTS AND DISCUSSION

The results of the current study is presented in table 1. It was observed that the amplitude of P-wave ranged from 0.2 to 0.25 mV in older dogs (groups 3 and 4) and was significantly higher than the P wave amplitude of younger dogs (group 1 and 2) which ranged between 0.1 to 0.2 mV.; These findings are in corroboration with Changkija, (2007). The increase in the amplitude of P-wave with age may be attributed to the increase in weight of the heart (Kirk *et al.*, 1975). However, the duration

of P-wave of Labrador belonging to group 1, group 2, group 3 and group 4 had no significant difference ($P > 0.05$) although apparently higher values were recorded in older age groups (group 2, 3 and 4) where the readings hovered around 0.04 and 0.08 sec as compared to lower age group (group 1) in which the P wave duration ranged from 0.02 to 0.06 sec.

The Labradors belonging to group 1 and group 2 had the amplitude of Q- wave (range 0.1 to 0.4 mV) significantly higher ($P < 0.05$) than those belonging to group 3 and group 4 (range 0.05 to 0.1 mV). Thus, the Q-wave amplitude was found to be decreasing with the advancement of age.

Nonetheless, the amplitudes of QRS complex ranged between 1.3 to 2.3 mV in group 2 and were significantly higher than group 1 where the amplitudes recorded between 0.9 to 1.3 mV. The development of left ventricle of growing dogs with an increasing age might be the reason behind higher amplitudes in comparatively older dogs. Right ventricle predominates at birth and is followed by the predominance of left ventricle at the end of first week of age due to greater increase in left ventricular mass in the first two weeks (Kirk *et al.*, 1975). Previous study also recorded higher amplitude of QRS complex in older dogs as compared to younger ones (Bernal *et al.*, 1995). However, the amplitude of QRS complex decreased in group 3 and 4 as compared to group 2. Conversely, significant increase in the duration of QRS complex was recorded in the dogs belonging to groups 3 and 4 (range 0.04 to 0.06 sec) as compared to the dogs belonging to groups 1 and 2 (range 0.02 to 0.04 sec). This finding is in agreement with earlier report (Shimizu *et al.*, 1986). The relationship between QRS complex and age appears to corroborate the increase in heart size with age (Edwards, 1987).

The amplitude of S-wave of Labradors belonging to group 1, group 3 and group 4 ranged from 0.05 to 0.1 mV and have no significant difference ($P > 0.05$) amongst them. However, all these groups differed significantly ($P < 0.05$) from the dogs belonging to group 2 in which the S-waves were absent and the findings are in agreement with Sonia *et al.* (2014), who also recorded variable S waves in lead II electrocardiogram of Labrador dogs.

There is no significant difference ($P > 0.05$) between group 1, group 2, group 3 and group 4 as far as T-wave amplitude is concerned. However, the measurements of T wave amplitude hovered around 0.2 and 0.3 mV. Similarly, the duration of T-wave (ranging from 0.06 to 0.08 sec) also remained invariably the same without any significant difference in all experimental groups of dogs.

All the electrocardiograms showed a significant increase in the P-R interval in the dogs of higher age groups (3 and 4) where values between 0.12 and 0.16 sec were recorded as compared to the dogs belonging to lower age groups (1 and 2), which is in agreement with the findings of other workers (Shimizu *et al.*, 1986 and Bernal *et al.*, 1995).

As far as the Q-T interval is concerned, a wide range of Q-T interval is considered normal (Pouchelon *et al.*, 1973 and Rezakhani *et al.*, 1990). The Q-T interval in the dogs belonging to group 2 (range 0.2 to 0.24 sec) was significantly higher than those belonging to group 1 (range 0.12 to 0.16 sec), which might be due to its inverse relationship with heart rate and it is also supported by other studies (Oguchi and Hamlin, 1993).

Significantly prolonged R-R interval was recorded in electrocardiograms of dogs belonging to group 2 (range 0.52 to 0.64 sec) than those belonging to group 1 (range 0.24 to 0.4 sec). A higher heart rate i.e. lower R-R interval is normal for dogs of younger age groups and is caused by a lack of compensatory cardiac inhibitory systems (Haddad *et al.*, 1984).

The highest heart rate was recorded in group 1 ranging from 150 to 250 beats per minute and was found to be gradually decreasing with advancing age. It is frequently observed that younger dogs had a higher heart rate than adults (Shimizu *et al.*, 1986 and Bernal *et al.*, 1995). Higher heart rates in younger dogs may be due to nervousness in a strange environment (Mohapatra *et al.*, 2013).

TABLE: 1 - ELECTROCARDIOGRAPHIC CHANGES OF LABRADOR DOGS WITH AGE

AGE GROUP	P-wave Amplitude(mV)	P-wave Duration (sec)	Q-wave Amplitude (mV)	Amplitude of QRS complex (mV)	QRS Duration (sec)	S-wave Amplitude (mV)	T-wave Amplitude (Mv)	T-wave Duration (sec)
GROUP- 1	0.12 ^a ±0.02	0.03±0.007	0.20 ^b ±0.08	1.1 ^a ±0.08	0.030 ^a ±0.004	0.08 ^b ±0.01	0.26±0.02	0.06±0.004
GROUP- 2	0.16 ^a ±0.02	0.05±0.009	0.22 ^b ±0.03	1.8 ^b ±0.22	0.03 ^a ±0.004	0.00 ^a ±0.00	0.24±0.02	0.06±0.004
GROUP- 3	0.24 ^b ±0.01	0.04±0.004	0.03 ^a ±0.01	1.16 ^a ±0.04	0.04 ^{ab} ±0.004	0.06 ^b ±0.02	0.23±0.01	0.076±0.004
GROUP- 4	0.23 ^b ±0.01	0.04±0.004	0.05 ^a ±0.01	1.2 ^a ±0.05	0.04 ^b ±0.004	0.06 ^b ±0.02	0.22±0.01	0.076±0.004

AGE GROUP	P-R Interval (sec)	Q-T Interval (sec)	R-R Interval (sec)	Heart Rate (bpm)	Pulse Rate (per minute)
GROUP- 1	0.09 ^a ±0.007	0.14 ^a ±0.009	0.30 ^a ±0.02	145 ^b ±19.6	120.0 ^b ±4.47
GROUP- 2	0.09 ^a ±0.007	0.21 ^c ±0.009	0.56 ^c ±0.029	106.72 ^a ±5.2	102.00 ^a ±4.50
GROUP- 3	0.14 ^b ±0.009	0.17 ^b ±0.009	0.44 ^b ±0.014	134.54 ^a ±4.6	117.80 ^b ±2.41
GROUP- 4	0.15 ^b ±0.008	0.20 ^{bc} ±0.012	0.45 ^b ±0.016	122.27 ^a ±5.986	115.4 ^b ±4.57

NOTE: Different superscripts a b c read column wise differs significantly(p<0.05)

The pulse rate in case of groups 1, 3 and 4 had no significant differences amongst each other, but all of them varied significantly from group 2 which recorded the lowest pulse rate. Significantly higher pulse rate was observed in group 1. A pulse deficit was observed in all age groups. However, as each beat does not eject equal amount of blood which could possibly be the reason behind the pulse deficit (Changkija, 2007 b).

The results obtained in this study may assist the clinicians for diagnosing any cardiac abnormality in Labrador dogs of any specific age.

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