

## THE NORMAL ELECTROCARDIOGRAM IN MONGREL DOGS IN KENYA

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### ABSTRACT

A study was carried out to document the electrocardiograms of mongrel dogs in Kenya and compare it with those that have been published for other dog breeds elsewhere. Electrocardiograms of 18 adult healthy mongrel dogs were recorded in six limb leads: I, II, III, aVR, aVL, and aVF.

The mean amplitudes of Q wave in leads II, III, aVL, and aVF; R wave in leads II, III, aVR, and aVF; and S wave in leads aVR, and aVL in the present study, were significantly higher than those previously reported for other dog breeds. Also the duration of PR interval and QRS complex, in the present study, were significantly higher.

These results suggested that appropriate caution should be taken when interpreting values from mongrel dogs in Kenya as reference values based on other breeds could be misleading.

### INTRODUCTION

Mongrel dogs are commonly used in Kenya as experimental animals because they are readily and cheaply available. Documentation of the electrocardiogram of these dogs would be of help to workers using them for investigations.

There are many reports on the electrocardiogram of the dog (Katz et al., 1934; Petersen et al., 1951; Grollman et al., 1925; Horwitz et al., 1953; Soave, 1954; Lombard and Witham, 1955; Burman et al., 1966; Crawley and Swenson, 1966; Hill, 1968a). The breeds of dogs used in the above study varied from purebred to mongrel dogs. Also the position of the dog during recording varied greatly as did the number of leads recorded. In some of the studies the dogs were anaesthetized during recording while in others they were not. Even among those anaesthetized the type of anaesthesia varied.

The breed, position of the dog during recording, and whether the dog is anaesthetized or not, may affect the electrocardiographic parameters (Crawley and Swenson, 1966; Hill, 1968b; Ettinger and Suter, 1970; Bolton, 1975). Since these factors are known to affect electrocardiographic parameters, there is a need to accumulate adequate electrocardiographic data for the different dog breeds/types. To date the normal electrocardiogram of mongrel dogs in Kenya taken in the standard right lateral recumbency position

and in unanaesthetized state has not been reported. The electrocardiographic data published for dogs elsewhere is assumed to hold true for these dogs. It was for this reason that this study was undertaken. The resulting data should be of aVF assistance in evaluating the health status of these dogs and also serve as a baseline when they are used in experiments.

### MATERIALS AND METHODS

Eighteen healthy adult mongrel dogs (nine males, nine females) whose ages ranged between one and five years and an average bodyweight of 16.8 kg were used. They were washed using an acaricide (Amitraz, Wellcare<sup>®</sup>, Wellcome, Kenya Ltd), dewormed using pyrantel pamoate (Combatrin<sup>®</sup>, Pfizer, Asndwich-England, 14.3 mg/kg) and vaccinated against canine distemper, adenovirus infections, leptospirosis and rabies (Pentadog<sup>®</sup>, Rhone Merieux, France) and parvovirus enteritis (Parvodog<sup>®</sup>, Rhone Merieux, France). The dogs were allowed a one week acclimatization period before experimentation, during which they were weighed and regularly handled to familiarize them with the handler. The dogs were housed in groups of two to four in kennels that were similar in size and had exercise pens connected to them. They were fed a balanced food (Besbix<sup>®</sup>, Proctor and Allan Ltd, Nairobi, Kenya) supplemented with beef once a day. Water was supplied *ad libitum*.

At the end of the acclimatization period, each dog was gently restrained in right lateral recumbency with its head in the normal carriage position and the limbs at right angles to the trunk. The tail was restrained together with the hind limbs so as to prevent its movement. A single channel digital electrocardiograph (Kenz-EGG-103, Suzuken Co., Nagoya, Japan) was used to record the following limb leads: leads I, II, III, aVR, aVL and aVF. Metal alligator clips were used as electrodes. Electrical conductivity was ensured by wetting the skin with a saturated saline alcoholic solution before attaching the clips. Each lead was recorded at a paper of 25 mm/sec and sensitivity of 1 mV equal to 10 mm deflection.

The amplitude and duration of the electrocardiographic complexes were measured to the nearest 0.05 mV and 0.01 sec respectively, on a section of the trace with an even baseline and free of artifacts. For each measurement at least three separate electrocardiographic complexes were examined and

their average value recorded. All the measurements were made under a 10x magnifying glass (Supertek®, Shiversons Instruments (P) Ltd, Kenya). The mean electrical axis (MEA) in the frontal plane was determined using the inspection method (Ettinger and Suter, 1970; Bolton, 1975).

For each wave on the electrocardiogram, the standard error of the mean and the range (minimum value to maximum value) of the amplitudes and also the percent incidence of the wave in the eighteen dogs were calculated. The standard error of the mean and the range for the various durations in lead II were also calculated. Data from the present study was compared with that reported by Hill (1968a) using t-test. Differences were taken to be significant at  $P < 0.05$ .

## RESULTS

The mean range and percent incidence of amplitudes for the various waves recorded in the present study are shown in Table 1. P wave was present in all leads and in the dogs used in the study. The amplitude ranged from  $-0.10 \pm 0.01$  mV in lead aVR to  $0.14 \pm 0.01$  mV in lead aVF.

Q wave was present in all recorded except in lead aVR. The wave was present in all the dogs in leads I, II, III and aVR but

the lead whereas it was highest in lead aVR. Therefore the amplitude of the wave ranged from 0.05 in lead I to  $1.42 \pm 0.10$  mV in lead aVR.

Amplitude of T wave was lowest in lead aVF  $-0.11 \pm 0.07$  mV and highest in lead aVR. It ranged from  $-0.11 \pm 0.07$  in lead aVF to  $0.09 \pm 0.04$  mV in lead aVR. The wave, like P and R waves, was present in all the leads and in all the dogs.

The durations and the range of duration of P wave, PR interval, QRS complex and QT interval in lead II are shown in Table 2.

The mean electrical axis (MEA) in the frontal plane (degrees, mean  $\pm$  SEM) was  $77 \pm 2$  (Table 3). However, the recorded values ranged from 70 to 95°.

## DISCUSSION AND CONCLUSION

Katz et al. (1934), and Hill (1968a) have reported on the electrocardiogram of the normal unanaesthetized dog in standard right lateral recumbency. However, Katz et al. (1934) did not present the electrocardiographic measurement made. Hill (1968a) on the other hand studied a group of dogs made up of different purebreds, and mongrels and presented a detailed analysis of the data so obtained. Data from the present

Table 1. Amplitude (mV, mean  $\pm$  range of amplitudes (mV) and percent of P, Q, R, S and T waves in leads I, II, III, aVR, aVL, and aVF in mongrel dogs in Kenya (n=18)

Wave and parameter	Lead						
	I	II	III	aVR	aVL	aVF	
P-amplitude	0.05 $\pm$ 0.01(n.s)	0.13 $\pm$ 0.01	0.13 $\pm$ 0.01	-0.10 $\pm$ 0.01	-0.07 $\pm$ 0.01	0.14 $\pm$ 0.01(n.s)	
- Range	00.10	0.100.25	0.05-0.25	-0.15-(-0.05)	-0.10-0	0.10-0.25	
- % incidence	100	100	100	100	100	100	
Q-amplitude	0.32 $\pm$ 0.05(n.s)	0.58 $\pm$ 0.05*	Absent	0.43 $\pm$ 0.02*	0.51 $\pm$ 0.06*		
- Range	0-0.70	0.20-1.00	0.10-0.75	0.40-0.50	0.20-1.10		
- % incidence	100	100	100	100	33.3	100	
R-amplitude	0.70 $\pm$ 0.09(n.s)	1.98 $\pm$ 0.10*	1.44 $\pm$ 0.08*	0.49 $\pm$ 0.07*	0.21 $\pm$ 0.03(n.s)	1.76 $\pm$ 0.08*	
-Range	0.10-1.40	1.40-2.65	0.90-2.00	0.15-1.10	0.05-0.55	1.20-2.30	
- % incidence	100	100	100	100	100	100	
S-amplitude	0.05	0.210.05(n.s)	0.22 $\pm$ 0.04(n.s)	1.42 $\pm$ 0.10	0.62 $\pm$ 0.08*	0.19 $\pm$ 0.05(n.s)	
-Range	-	0.10-0.40	0.10-0.40	0.90-2.40	0.15-1.35	0.05-0.40	
- % incidence	5.6	27.8	50	100	72.2	33.3	
T-amplitude	-0.06 $\pm$ 0.01	-0.10 $\pm$ 0.06	-0.06 $\pm$ 0.05	0.09 $\pm$ 0.04	0.02 $\pm$ 0.02	-0.11 $\pm$ 0.07	
-Range	-0.20-0.05	-0.55-0.45	-0.40-0.35	-0.20-0.45	-0.20-0.15	-65-0.40	
- % incidence	100	100	100	100	100	100	

\*- Significantly different from comparable data reported by Hill (1968a;  $P < 0.05$ )

n.s. - Not significantly different from comparable data reported by Hill (1968a;  $P > 0.05$ )

only in 33 percent of the dogs in lead aVL. The amplitude of the wave in the leads where it was present ranged from  $0.32 \pm 0.05$  mV in lead I to  $0.58 \pm 0.05$  mV in lead II.

Like P wave, R wave was also present in all leads recorded and in all the dogs. The amplitude (mV; mean  $\pm$  SEM) of the wave ranged from  $0.21 \pm 0.03$  in lead aVL to  $1.98 \pm 0.10$  in lead aVF.

The incidence of S wave varied among the leads. It occurred in only one out of eighteen (5.6%) dogs in lead I whereas it was present in all the dogs in lead aVR. The amplitude of S wave was lowest in lead I in the lone dog which showed in

Table 2. Duration (sec, mean  $\pm$  sem) and range of durations (sec) of P wave, PR interval, QRS complex and QT interval in lead II in mongrel dogs in Kenya (n=18)

Wave/interval	Duration	Range
P wave	0.043 $\pm$ 0.001	0.04-0.05
PR interval	0.111 $\pm$ 0.004*	0.08-0.13
QRS complex	0.047 $\pm$ 0.002*	0.04-0.06
QT interval	0.206 $\pm$ 0.004(n.s)	0.18-0.24

\*Significantly different from comparable data reported by Hill (1968a;  $P < 0.05$ )

n.s. - Not significantly different from comparable data reported by Hill (1968a;  $P < 0.05$ )

Table 3. Mean electrical axis(MEA) in the frontal plane (MEA, degrees) in mongrel dogs in Kenya

Dog number	MEA
1	75
2	75
3	75
4	75
5	95
6	80
7	75
8	75
9	75
10	75
11	75
12	75
13	75
14	75
15	70
16	75
17	95
18	75

study may be usefully compared with his data since electrocardiograms in the two studies were recorded under similar conditions. Hill (1968a) did not record as much data as done in the present study, hence not all data reported in the present study had comparable data in his report. There were important differences in some amplitudes and durations recorded in our study compared to that of Hill (1968a; tables 1 and 2).

The mean amplitudes of Q wave in leads II, III, aVL, and aVF; R wave in leads II, III, aVR, and aVF; and S wave in leads aVR, and aVL, in the present study, were significantly higher than those reported by Hill (1968a; Table 1,  $P < 0.05$ ).

Comparison of durations in lead II in our study with those of the earlier study by Hill (1968a) revealed that the durations of PR interval and QRS complex were significantly higher in the present study than those reported by Hill (1968a; Table 2,  $P < 0.05$ ).

The values of the mean electrical axis in the frontal plane, in the present study were within the range that has been reported (Hill, 1968a; Morgan, 1969; Ettinger and Suter, 1970; Bolton, 1975).

There were important differences in some amplitudes and durations between the electrocardiogram of the mongrel dog

in Kenya compared to that of dogs used in the study of Hill (1968a). This is probably due to the wide variety of breeds used in Hill's study. These differences would suggest appropriate caution in value interpretation when dealing with the mongrel dog in Kenya as reference values based in other breeds could be misleading.

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