

Original Research Article

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Analysis of Base Apex Lead Electrocardiographic Technique in Normal Jersey Cross-Bred Dairy Cows

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ABSTRACT

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Electrocardiographic technique was analysed in normal dairy cows in order to evaluate the electrical activity of heart and hence to detect abnormalities like cardiac arrhythmia and electrolyte disturbances which is very common in cattle. The base apex system seems to be the best and standard lead which gives clear electrocardiographic changes. The present study was conducted on normal dairy cows with no cardiac arrhythmias or abnormal heart sounds presented to the Large Animal Unit of TVCC, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry. The positive electrode of limb lead 1 was attached to the fifth intercostal space and negative electrode on the jugular furrow and the neutral on the withers. The electrocardiogram was obtained on a single channel ECG machine with paper speed of 25 mm/sec and calibration of 10mm equal to 1mV. The P wave was positive in all cases and the QRS complex was negative. Amplitude of ECG waves and duration of P, QRS, and T and intervals of P-R and Q-T were also recorded.

Introduction

No single electrocardiographic lead system has been universally accepted for use in large animals. Bipolar leads (I, II, III, base-apex X, Y, and Z of the orthogonal lead system) and unipolar leads (aVF aVR, aVL, thoracic) have been described, but the amplitude, duration and configuration of the different waveforms vary widely depending on an animal's breed, size, body type, and sex. In addition, there is liability of certain waveforms within each animal depending on the level of exercise, excitement, or organic heart disease. Large animals have a deeply penetrating Purkinje system, and depolarization from the

ventricular endocardium to the epicardium occurs explosively and in many directions at once. This period of ventricular activation is responsible for the electrocardiographic criteria that indicate ventricular enlargement in small animals but contribute little to generating the QRS complex of large animals. Establishing specific diagnostic criteria for chamber enlargement in large animal species has been difficult because changes in the QRS complex are not sensitive or specific for ventricular enlargement.

The electrocardiogram (ECG) is used primarily to detect cardiac arrhythmias. For this purpose a single-channel machine can be

used, and the lead system chosen can be any that generates distinctive P, QRS, and T complexes. If an arrhythmia is detected, another lead should then be obtained to further characterize the QRS and T complexes and confirm their origin. The lead system should be easy to apply, and the tracing free of artifacts created by muscle tremors, skin movement, shifting of weight, and changes in limb position. Two such leads commonly used to obtain a rhythm strip for the diagnosis of cardiac arrhythmias are the base-apex lead I and the Y lead of the orthogonal lead system.

Review of literature

The ECGs recorded using the limb leads in cattle have low polarities and great variability. This could be due to the position of electrodes relative to position of the heart in the thoracic cavity, and also to distribution of conduction system in the myocardium which causes the cancellation of wave fronts (Abramson and Margolin, 1936). To overcome these problems different lead systems have been tried by different researchers and found base apex lead was working good.

The main objective of this to present the normal ECG values of the base apex system in normal jersey cross bred cows at Pondicherry.

Clinical setting

Large Animal Unit of TVCC, Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry – 09.

Materials and Methods

Selection of animal

ECG was taken on 36 normal cows which is in the age group between 2 and 9 years old and calved at least once, were selected for the

study.

Noise reduction

A troublesome problem which may disturb recording of ECG is electrical noise caused mainly by alternate current. In order to prevent such disturbances, a rubber sheet was used in between the trevices (Fig. 4).

Application of skin electrodes

For setting electrodes on the skin surface, isopropyl alcohol was applied and then ECG gel was applied. A lead is the recording or circuit between two recording points. Depending upon the wiring within the electrocardiograph the same potential difference across a lead could result in an upward or downward deflection of the recording pen

In order to allow standard recording and comparison between recordings the polarity of the electrodes for standard leads has been established by convention and the leads are always recorded at these polarities. The electrodes of a lead are commonly called positive or negative

A positive electrode in a lead is one that, when electrically positive relative to the other, due to a potential difference between them, yields an upward or positive deflection of the recording pen (Radostits, 2006).

The positive electrode of the bipolar lead on the left thorax in the fifth intercostal space at the level of elbow (Green) (Fig. 2), the Negative electrode attached on the right jugular furrow 2/3 of the way from the ramus of the mandible (Red) (Fig. 1) and the ground electrode (neutral) can be attached to any site remote from the heart, can be on the withers (Black) (Fig. 3) (Smith, 2009).

Fig.1, 2, and 3 shows electrode placement on the animal



Fig.1



Fig.2



Fig.3

Fig.4 Schematic diagram of normal ECG with average values

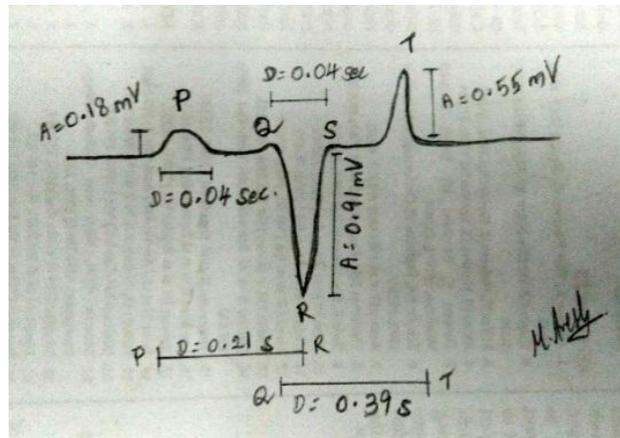


Table.1 ECG values of base-apex lead of jersey cross bred cows

ECG parameters		Minimum	Maximum	Mean
Heart rate/min		60	90	71.22
P wave	amplitude (mV)	0.1	0.2	0.18
	Duration (sec.)	0.04	0.08	0.06
QRS Complex	amplitude (mV)	0.5	1.1	0.91
	Duration (sec.)	0.03	0.06	0.04
PR interval (sec.)		0.16	0.24	0.21
QT interval (sec)		0.32	0.44	0.39
T wave Amplitude (mV)		0.2	0.9	0.55

Results and Discussion

The Morphologies of the P wave and the QRS complex was observed. The amplitude and duration of P, QRS, and T waves and intervals of P-R and Q-T were also recorded. The recorded Electrocardiograph values of base-apex lead of jersey cross bred cows are given in table 1.

Data analysis showed the heart rate of 36 cows ranged from 60-90 beats per minute with the mean value of 71.22, Morphologies of the P wave and T wave was positive in all cases, the QRS complex was negative in all cases, Statistical analysis showed that mean P wave amplitude were 0.18 mV and the duration were 0.06 seconds, The QRS wave amplitude were 0.91 and the duration was 0.04 seconds, The T wave amplitude was 0.55mV, The PR interval were 0.21 seconds and QT interval was 0.39 seconds.

In case of large animals, the purkinje fibers are deep penetrated in the myocardium, so the ECG is not helpful in detecting cardiac chambers enlargement (Hamlin and Smith, 1965).Therefore it is used to detect cardiac arrhythmias. So the base apex lead seems to be the best and standard lead for monitoring large animal's cardiac arrhythmias. Accordingly ECG parameters of this lead in Jersey cross bred cows as standard values. Animal without calving is not included in this

study. The P wave was only positive in this lead with no variability as seen in the limbs leads ECG. Wandering pacemaker was very rare and there was no isoelectric or negative wave, as has been reported by Deroth (1980). In the present study also the P wave was positive and the morphology didn't change. The QRS complex was mainly negative and there was no much variability detected. The T waves are positive in all animals which involved in this study and there was no negative or biphasic T wave noticed. Generally, the T wave is more variable in large animals than in small animals and therefore it cannot be used as an index for cardiac problem (Rezakhani *et al.*, 2004). As per the statistics the PR interval is not varying much in-between the cows and the QT interval also same for the cows.

As per the study, it showed that the base apex lead is a suitable lead for monitoring heart rhythm of adult Jersey cross bred cows, and these values can be accepted as normal values for Jersey cross bred cows.

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