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A COMPARATIVE EVALUATION OF LEAD I ELECTROCARDIOGRAM IN LARGE WHITE YORKSHIRE PIGLETS OF DIFFERENT AGE GROUPS

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Abstract: Large White Yorkshire piglets belonging to three different litters aged 2 months (group A, n=6), 4 months (group B, n=6) and 6 months (group C, n=6) were considered for the study. The electrocardiogram was recorded in six male piglets selected from each litter. The ECG was recorded in a standard twelve lead ECG recorder. Highest P-wave amplitude was recorded in group A and group C. Similar P wave duration was recorded in all the three age groups. The amplitude of QRS complex recorded highest in group B. Incidence of negative amplitude of T wave was observed in two out of six cases in group A and two out of six cases in group C while the amplitude of T wave recorded positively in all the cases in group B. The heart rate showed a decreasing trend with an increase in age of the animals.
Keywords: Electrocardiogram, Age, Large White Yorkshire, Lead I.

Introduction

An ECG is the recording of electric potentials generated by the cardiac impulse by placing electrodes on the surface of the body on opposite sides of the heart (Pradhan *et al.,* 2017). The Large White Yorkshire is basically used for bacon purpose. The incidence of cardiac malformation in pigs was reported to be highest between 29 to 56 days of age (Hsu and Du, 1982). This research was carried out to record the changes in the electrocardiograms of Large White Yorkshire pigs with advancing age. The measured electrocardiographic values can be used as a standard reference guide for diagnosing cardiac problems in the Large White Yorkshire. Swine is now used as an experimental animal model of human cardiovascular diseases due to similarity of heart size and propensity to spontaneously develop atherosclerosis and the similar diameter in coronary arteries (Link *et al.,* 1998).

Materials and Methods

Eighteen Large White Yorkshire piglets belonging to three different litters aged 2 months (group A, n=6), 4 months (group B, n=6) and 6 months (group C, n=6) were considered for

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the study. A twelve-lead standard ECG recorder, Cardiart 108 MK-VII (BPL, India manufacture) was used to record ECG (Mohapatra *et al.,* 2017a). The electrocardiograph was set with a paper speed of 25mm/sec and sensitivity of 1 (1 cm=1mv) and the 50 Hz filter of the electrocardiograph was turned "on". ECG was recorded with the animals in standing position and the cubital and stifle joint were the preferred position of electrodes for standard limb leads (Mohapatra *et al.,* 2016) (Figure 1). The ECG was recorded when the animals were in rest with no signs of excitement. Lead I electrocardiogram was compared within the three age groups of piglets and the data were analysed statistically using student's t-test.

Results and Discussion

The results discussed here are represented in Tables Ia and Ib. The amplitude of P-wave recorded positively in all age groups except in one case of group B where it recorded negatively i.e. below the baseline. The findings are in agreement Atmaca *et al.* (2014) who experimented on Angora goats and recorded positive P-wave in all leads except in lead aVR and aVL. The amplitude of P wave was measured to be highest in group A and group C and the amplitude gradually decreased in the intermediate age. Statistically there was a significant difference ($p>0.05$) between the amplitudes of P-wave recorded between group A and C with group B. The piglets of the three age groups recorded nearly equal P wave duration. This is not in agreement with Rubio *et al.* (1989) who recorded an increase in P wave duration between 5 and 45 days of age.

Group B recorded significantly higher QRS wave amplitude. The amplitude of the QRS complex showed variable characteristics in bipolar limb lead I. QRS complex ECG configuration of a 4 months old Large White Yorkshire piglet is depicted in figure 2 . The change in the polarity of QRS complex might be attributed to the fact that the mean electrical axis of the heart exhibits a lot of variation. This is in agreement with Paslawska *et al.* (2014) who reported that the overall range of mean electrical axis of the heart was between 17 to 145 degrees in Polish Landrace pigs. The highest amplitude of positive QRS complex was recorded in group B and the highest amplitude of negative QRS complex was recorded in both group A. The mean duration QRS complex was same in all the groups.

The amplitude of T wave displayed a lot of variations in the electrocardiogram. An incidence of negative amplitude of T wave was observed in two out of six cases in group A and two out of six cases in group C while the amplitude of T wave recorded positively in all the cases in group B. Significantly higher T wave amplitude was recorded in piglets of intermediate age group in this study (group B). Moreover, significantly different T wave amplitudes were also

recorded in group A and group C with the latter recoding higher values than the former. Stubhan *et al.* (2008) also recorded spontaneous change in polarity of T wave in experiments in Gottingen minipigs. When the duration of the T wave was taken into account the mean duration was observed to be significantly highest in group B and group C than group A. Group B and group C recorded almost similar values with no significant difference between them.

Piglets of group C recorded significantly higher PR interval. This lower value of PR intervals in group A and group B might be due to faster atrio-ventricular conduction time in younger piglets. The QT interval represents electrical depolarization and repolarization of the ventricles. Significantly higher QT interval was recorded in piglets of group B. Piglets of group A and group C recorded almost equal QT interval. As far as RR interval is concerned all the three age groups recorded significantly different values. The RR interval showed as increasing trend with the increase in age of the piglets. Significantly different values in all the age groups were also recorded in PR segment. However, group C recorded the highest PR segment and group A lowest. The ST segment and TP segment recorded an increasing trend with an increase in the age of the piglets. Moreover, the values of ST segment and TP segment differed significantly among the three age groups.

Higher heart rates were recorded in group A and subsequently decreased as with advancing age of the piglets. Significantly different heart rate was recorded in piglets of the three different age groups. Similar results were observed by Mohapatra *et al.* (2017b) who recorded higher basal heart rate in crossbred Jersey cows which might be apparently due to shorter RR interval and shorter interval between successive cardiac cycles.

Conclusion

This study highlighted the variation in the electrocardiogram of Large White Yorkshire piglets with increasing age. This also laid down breed specific Electrocardiographic parameters of Large White Yorkshire piglets which can be referred by veterinarians to diagnose cardiac arrhythmias as well as can be used as a reference in experimental animal models in human cardiovascular disease research.

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Figure 1: Restraining the piglet in a wooden platform and attachment of clips.

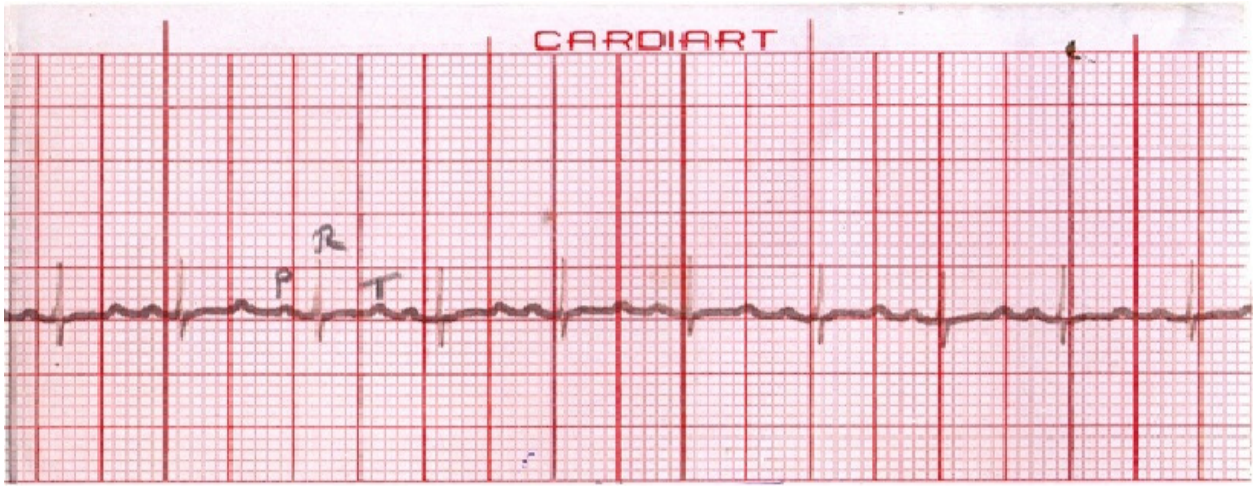

Figure 2. Lead I Electrocardiogram of a Large White Yorkshire Piglet showing long QRS complex

Figure 3: Lead I ECG of a Large White Yorkshire Piglet showing short QRS complex

Table Ia . Lead I electrocardiogram of Large White Yorkshire piglets

Animal	P amplitude	P duration	QRS amplitude	QRS duration	S amplitude	T amplitude	T duration
6 months (Group C)	0.15^{a}±0.00	0.04^{a}±0.00	0.25^{a}±0.00	0.04^{a}±0.00	0.1^{a}±0.00	0.2^{b}±0.00	0.08^{b}±0.00
4 months (Group B)	0.1^{b}±0.00	0.04^{a}±0.00	0.4^{b}±0.00	0.04^{a}±0.00	0.1^{a}±0.00	0.25^{c}±0.01	0.08^{b}±0.00
2 months (Group A)	0.15^{a}±0.00	0.04^{a}±0.00	0.25^{a}±0.00	0.04^{a}±0.00	0.1^{a}±0.00	0.12^{a}±0.00	0.06^{a}±0.00

a, b, c different superscript are significantly different from each other ($p<0.05$).

Animal	PR interval	QT interval	RR interval	PR segment	ST segment	TP segment	Heart Rate
6 months (Group C)	0.1^{b}±0.00	0.12^{a}±0.00	0.56^{b}±0.00	0.16^{b}±0.00	0.20^{b}±0.00	0.28^{b}±0.00	107.14^{b}±0.00
4 months (Group B)	0.04^{a}±0.00	0.16^{b}±0.01	0.42^{c}±0.02	0.1^{c}±0.00	0.17^{c}±0.00	0.22^{c}±0.00	156.25^{c}±9.88
2 months (Group A)	0.05^{a}±0.00	0.12^{a}±0.01	0.32^{a}±0.00	0.12^{a}±0.00	0.14^{a}±0.01	0.12^{a}±0.00	187.50^{a}±0.00

a, b, c different superscript are significantly different from each other ($p<0.05$).

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