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ELECTROCARDIOGRAPHIC STUDIES IN BROWN SWISS COWS

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İsviçre Esmeri sığırlarda elektrokardiyografik araştırmalar

Özet : *Yaşları dört ile sekiz arasında değişen toplam 43 adet sağlıklı İsviçre Esmer ırkı sığırda elektrokardiyografik parametreler ölçüldü, hesaplandı ve analizleri yapıldı. Elektrokardiyogramlar bipolar ekstremite, yükseltilmiş ünipolar ekstremite ve ünipolar prekordiyal darivasyonlar kullanılarak bir kanallı, taşınabilir elektrokardiyografa kaydedildi. Elektrokardiyograf her 1 mv için 20 mm.'ye kalibre edildi ve kağıt hızı 25 mm/sn olarak ayarlandı. Elektrokardiyogramlar her sığırda 15 gün içinde iki kez, sabah yemlemesinden sonra kaydedildi. P, QRS, T dalgaları ve PQ, QT ST aralıklarının süreleriyle P, QRS, T dalgalarının amplitüdleri ölçüldü.*

Çalışmanın sonucunda bipolar ekstremite, arttırılmış ünipolar ekstremite ve ünipolar göğüs derivasyonu kayıtlarının, hayvandan hayvana ve aynı hayvanda farklı zamanlarda değiştiği gözlendi.

Summary : *Electrocardiographic prameters in total 43 healthy Brown Swiss cow ranging in age from 4 to 8 years were measured, computed and analyzed. Electrocardiograms were recorded on a one-channel, portable electrocardiograph using bipolar limb, augmented unipolar limb and unipolar precordial leads. The electrocardiograph was calibrated at 20 mm per 1 mV and the paper speed was set at 25 mm per second. Electrocardiograms wera recorded twice in each cow within 15 days in the morning after feeding. The P, QRS, T waves and PQ, QT, ST intervals, as well as, the amplitud of the P, QRS, T waves were measured. The result of the study showed that the recording of bipolar limb, augmented unipolar limb and unipolar precordial leads varied from animal to animal, and in the same animal from time to time.*

Introduction

Electrocardiography (ECG) has been videly used as a tool for diagnosis in small animal and large animal, especially in horses, practice. It is mainly used for two purposes. The prime use is in th detection and diagnosis of cunduction abnormalities and arrhythmic heart disease. The ECG can also be used to detect changes in the state of the myocardium (2).

Refence values for the evaluation of the ECG in the canine (7) and equine (5) species are available. Studies on its contribution to bovine veterinary practice (8), its use for diagnosis of atrial fibrillation (16), various other arrhythmias (3), congenital (11) or acquired (6) heart conditions and various electrolyte disturbances (1, 14) have alluded to its importence. However, the basic parameters of the standart bovine ECG which could be used as a reference values are not available in the consulted literature. The aim of this study was to obtain the reference values for evaluation of the ECG in the normal Brown Swiss cow and to characterize the electrical activity of the bovine heart by unipolar precordial and extremity electrocardiograms.

Materials and Methods

A total 43 healthy Swiss Brown cow ranging in age from 4 to 8 years was used for the study. Electrocardiograms were recorded on one-channel portable electrocardiograph. All the cows having had at least one normal parturation were in lactation.

Recordings of the ECG were made of the animals in a standing position on dry hay in a wooden stock and the limbs placed in paralel position. Electrocardiograms were recorded twice in each cow within 15 days in the morning after feeding. The electrodes were placed on the skin, previously clipped and spreyed with ethanol as a degreasing agent (Fig 1). Modified alligator clip was used for precordial leads. This electrode was placed on a fold of skin. Locations of the electrode arrangements of the 10 leads recorded are described in Table 1.

The electrocardiograph was set at 25 mm per second. For analysis, the tracings were enlarged by means of a magnifying glass. The durations of P, QRS, T waves and PQ, QT, ST intervals (Fig. 2), as well as the amplitude of the P, QRS, T waves were measured three times in each lead and the mean value was recorded as representative for the individual animal. The measurements of intervals and amplitudes and nomenclature of waves used, were in accordance with the recommended procedures of Principles of Clinical Electrocardiography (10).

Mean (x), standard error (s.e), coefficient of variation (c.v) and minimum (min) and maximum (max) values were computed (17). Difference between the first and second recording in the same cow was detected using student t test. The frontal plane electrical axis for ventricular depolarization was measured in each cow.

Results

Heart rates of the cows in the first and second recording were in a range of 68 to 94 and 65 to 96 per minute with a mean (x) of 78 and 76 respectively. The duration (x = s.e) of atrial depolarization (P wave) in the first and second recording was respectively 0.053±0.003 second (s) and 0.051±0.004 s. The electrical current originating from the sinoatrial node (pacemaker) in the first and second recording were propogated to the ventricular cardiac musclecells (PQ interval) in 0.190±0.002 s. and 0.175±0.010 s. respectively. Ventricular depolarization (QRS complex) and repolarization (T wave) in the first and second recording were respectively 0.076±0,004 s.; 0.091±0.003 s. and 0.076±0.004 s.; 0.082±0.005 s. Cardiac electrical systole (QT interval) in the first and second recording were respectively 0.410±0.003 s. and 0.382±0.022 s. The duration of the ST interval (portion of the tracing from J to the end of the T wave) in the first and second recording was respectively 0.323±0.004 s. and 0.299±0.018 s. Interindividual

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variability was commonly too high for these values in esch lead; the coefficient of variation was bigger than 10 % in 106 of total 120 values (Table 2). Diference between the first and second recording in the same animal for these measurements was significant in 13 of total 36 measurements of bipolar limb and augmented unipolar limb leads (Table 2). Wherease, it was found to be significant in only two of total 24 measurements of unipolar precordial leads. The wave of atrial depolarization (P wave), ventricular depolarization (QRS complex) and ventricular repolarization (T wave) varied in amplitude (Table 3) and shape (Figure 3,4) from one lead to another and from one animal to another in the same lead. Difference between the first and second recording in the same animal for these waves was significant in 13 of total 30 measurements of bipolar limb, augmented unipolar limb and unipolar precordial leads.

A positive monophasic P wave was most frequently observed en leads I, II, III, aVF, V_1 V_2 and V_3 (Figure 3). The least variation in the QRS complex was found in V_1, V_2 and V_4 leads (Figure 4). A positive monophasic T wave was most frequently observed in leads V_3 and V_3 (Figure 3).

The mean frontal plane electrical axis for ventricular depalorization in the first and second recording of the cows showed a wide variation; -150 to ± 166 and -150 to ± 170 with a mean of 54.49 ± 12.56 and 49.88 ± 13.75 respectively (Figure 5).

Discussion

The result of the study showed that the recording of bipolar limb, augmented unipolar limb and unipolar precordial leads varied from animal to animal, and in the same animal from time to time.

Lank and Kingrey (13) was used theree different breeds of adult lactating cows to establish reference values for the intervals, the shape and the polarity of the various waves in the three standart limb leads. Ghergariu and Danielesco (9) was used limb leads together with special thoracic precordial leads in young bovine (3 to 12 mounts) Thielsches and Flock (18) was analyzed changes with age. Sellers at al (15) and Konuk (12) made an attempt to identify new leads in the bovine, various unipolar and bipolar leads have been suggested. Deroth (4) carried out a research work to evaluate electrocardiograpihic parameters in the normal lactating holstein cow using bipolar limb leads, augmented unipolar limb lead accompany with special thoracic precordial leads.

In all the studies, it was concluded that bovine ECG is strikingly different from human and canine ones. This distinction derives from anatomical and physiological characteristics of the bovine heart. The distribution of the purkinje network has species characteristics. These fibers in the bovine panetrate the entire thickness of the free walls and the base of the ventricules (12). Due to camplate penetratior from endocardium to epicardium by the purkinje fibers depolarization of both ventricular free walls occurs similtaneously. There are no general fronts of depolarization. The second or therminal phase of vetricular depolarization that characterizes the bovine ECG is the activation from apex to base of the interventricular septum and from the left to right ventricles (12).

The QRS complex was more variable in shape than any other segment of the cardiac cycle. This result were in close agreement with other published work (4,13). It has been reported that the unipolar precordial leads had less amplitude variation than those of the limb leads and were more consinent in the shape and polarity (4). In this study, less variation in the P wave, QRS complex and T wave shape was found in the unipolar precordial leads (Fig. 3-4).

Frontal plane electrical axis for ventricular depolarization is used to detect changes in the state of the myocardium, such as cardiac blocs, hypertrophie of myocardium and myocardial demage (ischemia, fibrosis and degeneration) (10). However, in this study, analyzis of frontal plane electrical axis for ventricular depolarization showed great variation (Fig. 5). So, frontal plane electrical axis for ventricular depolarization showed no clinical importance for detection of the state of the myocardium.

Great interindividual variability and significant difference between the first and second recording showed that bovine ECG may highly be enifluenced by anatomical and hpysiological charactieristics of the bovine heart. And gatrointestinal tract fonctions, especially preventricular fonctions such as rumination my also cause these variations.

The usefulness of electrocardiographic in human medicine is well established. The ECG has already proved to be helpful in other animal species, for diagnosis and manegement of cardiac disease, but furtheri nvestigations is necassery to gain new insight into its clinical meaning in bovine medicine.

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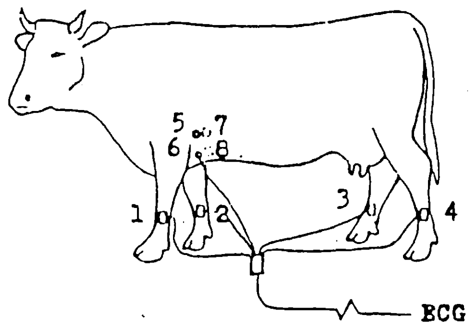
Figure 1. Electrode-saddle and the placement of electrodes for the 10 leads.



1LF	5 V_1
2 RF	6 V_2
3 RH	7 V_3
4 LH	8 V_4

Figure 2. Normal ECG in lead V_1 of the Healthy Brown Swiss cow and measurement of its components.

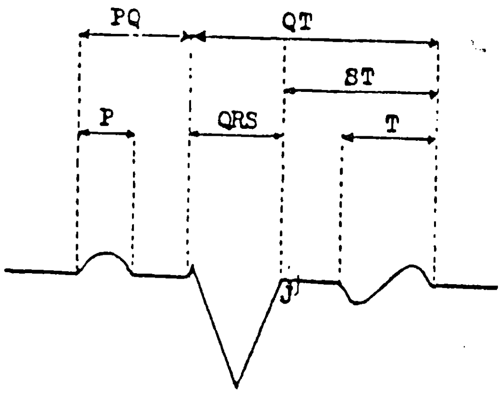


Figure 3. Frequency of the various P and T wave forms in the various 10 leads of the ECG of the healthy Brown Siss cows.

WAVE	LEADS					*
P	I	44	20	6	2	14
	II	59	-	3	2	22
	III	67	1	2	3	13
	aVR	18	48	-	17	3
	aVL	15	34	2	-	35
	aVF	71	1	3	1	20
	V_1	83	1	-	-	2
	V_2	80	1	-	1	4
	V_3	7	2	-	11	65
	V_4	12	-	-	4	70
T	I	6	61	8	11	1
	II	13	18	31	-	25
	III	38	8	40	-	-
	aVR	52	22	2	10	-
	aVL	5	56	3	18	4
	aVF	31	10	44	-	1
	V_1	20	22	44	-	-
	V_2	42	2	41	-	1
	V_3	85	-	-	-	1
	V_4	85	-	1	-	-

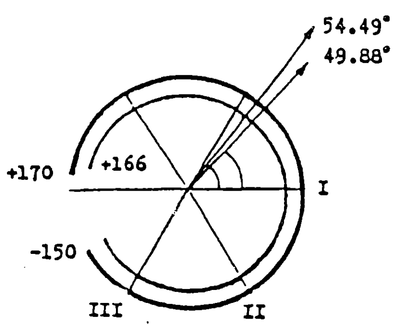
* Pond waves were too small to be classified.

Figure 4. Frequency of various wave forms of QRS complexes in the 10 different leads of the ECG of the healthy Brown Swiss cows.

WAVE	LEADS											*	other
QRS	I	8	21	5	1	1	12	11	1	15	7	-	4
	II	3	2	9	-	14	-	16	2	9	2	24	5
	III	7	1	3	4	33	-	18	2	10	2	-	8
	aVR	7	15	1	11	4	4	2	10	1	21	-	10
	aVL	4	10	7	3	3	19	4	8	2	13	1	12
	aVF	6	4	3	1	29	2	15	1	12	4	-	9
	V_1	2	61	-	2	2	1	2	12	1	3	-	-
	V_2	1	61	-	3	-	-	2	17	-	1	-	1
	V_3	1	3	-	33	-	-	1	22	-	26	-	-
	V_4	1	4	-	17	-	-	-	56	-	8	-	-

* Pond waves were too small to be classified.

Figure 5. Mean frontal plane electrical axis of the QRS complex in the healthy Brown Swiss cow.



	First recording	Second recording
X	-54.49	-49.88
Se	+ 12.56	+ 13.75
Min.	-150	-150
max.	+ 166	+ 170

Table 1. Position and polarity of electrodes.

Leads	Negative electrode	Positive electrode
Bipolar limb Leads		
I	RF	LF
II	RF	LH
III	LH	LH
Augmented Unipolar Limb Leads		
aVR	LF-LH	RF
aVL	RF-LH	LF
aVF	RF-LF	LH
Unipolar Precordial Leads		
V_1	RF-LF-LH	Sixth left intercostal space, 5 to 7 cm dorsal of the costo-chondral Junction.
V_2	RF-LF-LH	Sixth left intercostal space, 5 to 7 cm ventral of the costo-chondral Junction.
V_3	RF-LF-LH	Sixth right intercostal space, 5 to 7 cm dorsal of the costo-chondral Junction.
V_4	RF-LF-LH	Sixth right intercostal space, 5 to 7 cm ventral of the costo-chondral Junction.

RF: Right foreleg, lateral surface of the metacarpus.
RH: Right hindleg, lateral surface of the metacarpus.
LF: Right foreleg, lateral surface of the metacarpus.
LH: Right hindleg, lateral surface of the metacarpus.

Tablo 2. Duration (in the first and second measurements) of the intervals and waves recording of the electrocardiogram of the healthy Brown Swiss cows.

		p		QRS		T		PQ		QT		ST	
		a	b	a	b	a	b	a	b	a	b	a	b
I	x	0.6	0.05 *	0.07	0.07	0.09	0.08*	0.19	0.19	0.40	0.39*	0.33	0.31*
	s.e	0.0023	0.0027	0.0031	0.0036	0.0040	0.0040	0.0037	0.0037	0.0056	0.0049	0.0060	0.0056
II	x	0.06	0.03**	0.09	0.05**	0.10	0.04**	0.18	0.09**	0.39	0.18**	0.30	0.14**
	s.e	0.0032	0.0051	0.0027	0.0031	0.0039	0.0033	0.0047	0.0055	0.0057	0.0047	0.0061	0.0050
III	x	0.05	0.05	0.10	0.09	0.09	0.09	0.19	0.180.	0.42	0.41*	0.31	0.30
	s.e	0.0031	0.0032	0.0027	0.0031	0.0039	0.0033	0.0047	0.0055	0.0057	0.0042	0.0061	0.0050
aVR	x	0.06	0.08*	0.08	0.09	0.10	0.08	0.19	0.20	0.41	0.39	0.32	0.29*
	s.e	0.0044	0.0071	0.0042	0.0065	0.0055	0.0063	0.0061	0.0069	0.0054	0.0113	0.0054	0.0101
aVL	x	0.04	0.04	0.07	0.08	0.06	0.07	0.20	0.18	0.40	0.41	0.31	0.32
	s.e	0.0028	0.0024	0.0028	0.0032	0.0032	0.0035	0.0051	0.0052	0.0111	0.0048	0.0097	0.0051
aVF	x	0.06	0.05*	0.09	0.09	0.10	0.08*	0.19	0.18*	0.41	0.41	0.31	0.31
	s.e	0.0027	0.0040	0.0029	0.0034	0.0049	0.0036	0.0034	0.0052	0.0047	0.0044	0.0063	0.0063
V_1	x	0.06	0.06	0.06	0.06	0.09	0.08	0.19	0.18*	0.41	0.10	0.33	0.31
	s.e	0.0023	0.0022	0.0035	0.0026	0.0037	0.0031	0.0034	0.0029	0.0047	0.0044	0.0060	0.0053
V_2	x	0.03	0.04	0.07	0.09	0.09	0.10	0.18	0.19	0.42	0.41	0.34	0.33
	s.e	0.0039	0.0039	0.0032	0.0194	0.0035	0.0039	0.0054	0.0039	0.0044	0.0034	0.0060	0.0041
V_3	x	0.06	0.07	0.06	0.07	0.10	0.09	0.20	0.18**	0.42	0.41	0.34	0.33
	s.e	0.0024	0.0023	0.0032	0.0027	0.0034	0.0024	0.0033	0.0030	0.0043	0.0038	0.0052	0.0043
V_4	x	0.05	0.04	0.07	0.07	0.09	0.10	0.19	0.19	0.42	0.42	0.34	0.34
	s.e	0.0041	0.0042	0.0034	0.0027	0.0041	0.0031	0.0073	0.0060	0.0108	0.0034	0.0095	0.0041

* : $P < 0.05$
** : $P < 0.01$
a : The first recording.
b : The second recording.

Table 3. Amplitudes (mV) in the first and second recordings of the electrocardiogram of the healthy Brown Swiss cows.

		P		QRS		T	
		a	b	a	b	a	b
I	x	0.06	0.09	0.27	0.33*	0.21	0.33
	s.e	0.0055	0.0053	0.0187	0.0242	0.0153	0.0242
II	x	0.13	0.07**	0.36	0.20**	0.26	0.20**
	s.e	0.0163	0.0121	0.0314	0.0373	0.0229	0.0373
III	x	0.08	0.10	0.36	0.41	0.23	0.41
	s.e	0.0113	0.0162	0.2620	0.0276	0.1480	0.276
aVR	x	0.06	0.05	0.27	0.36**	0.15	0.36**
	s.e	0.0184	0.0580	0.0157	0.0205	0.0150	0.0205
aVL	x	0.09	0.06*	0.33	0.31	0.23	0.35*
	s.e	0.0146	0.0067	0.0187	0.0141	0.0156	0.0141
aVF	x	0.90	0.06*	0.33	0.31	0.26	0.31*
	s.e	0.0079	0.0077	0.0264	0.0273	0.0182	0.0273
V_1	x	0.09	0.08	0.28	0.35*	0.19	.035
	s.e	0.0072	0.0058	0.0257	0.0248	0.0119	0.0.248
V_2	x	0.10	0.08	0.32	0.38	0.23	0.38
	s.e	0.0147	0.0138	0.0220	0.0234	0.0103	0.0234
V_3	x	0.04	0.03	0.31	0.38*	0.17	0.38*
	s.e	0.138	0.0040	0.0194	0.0219	0.0121	0.0219
V_4	x	0.03	0.03	0.34	0.41*	0.23	0.41 *
	s.e	0.0042	0.0048	0.0177	0.0177	0..0113	0.0177

* : P< 0.05
** : P< 0.01
a : The first recording.
b : The second recording.

İN VİTRO DÖLLENMİŞ FARE OVUMLARININ GELİŞMESİ ÜZERİNDE EDTA'NIN ETKİSİ

Tevfik Tekeli [1]

The effect of EDTA on the development of mouse eggs fertilized in vitro

Summary : *The present study was undertaken to whether EDTA exerts beneficial effect on the development of mouse embryos derived from eggs fertilized in vitro. Superovulated eggs were collected from ddY females and were inseminated with epididymal sperm obtained from ddY males. At 6 hours after insemination the fertilized eggs were transferred to the Whitten's medium with or without EDTA and then cultured for 24 to 120 hours. The development of embryos beyond the 2-cell stage at 48 hours was significantly enhanced by the presence of 10 mM EDTA. Fifty seven per cent of embryos cultured for 96 hours in the medium containing EDTA developed morulae stage. Only 13% of embryos cultured for 96 hours in the medium without EDTA developed into morulae stage. On the other hand, 27% of embryos cultured in the medium with EDTA developed into blastocyst stage. As a conclusion, the development of in vitro fertilized mouse embryos beyond the 2 cell stages in Whitten's medium was enhanced by the presence of EDTA.*

Özet : *Sunulan çalışmada, in vitro döllenen fare ovumlarının gelişmeleri üzerinde gelişme vasatına ilave edilen EDTA'nın etkisinin araştırılması amaçlanmıştır. Bu amaçla, ddY ırkı dişi farelerden süperovulasyon ile elde edilen ovumlar yine aynı ırktan erkeklerin epididimislerinden elde edilen spermatozoitlerle in vitro olarak döllendi. Ovum ve spermatozoitlerin fertilizasyon vasatı içerisinde ilk 6 saatlik inkübasyonlarını takiben fertilize ovumlar EDTA'lı ve EDTA'sız Whitten's vasatına nakledilerek 24-120 saat süre ile inkübe edildi ve gelişmeleri izlendi. Embriyoların EDTA ihtiva eden gelişme vasatı içerisinde 48 saat inkübasyonu sonucunda ileri aşamalara ulaşma oranında artış sağlandı. EDTA'lı vasat içerisinde 96 saat süre ile inkübe edilen embriyoların % 57'sinin EDTA'sız vasat içerisinde inkübe edilen embriyoların ise aynı süre inkübasyonu müteakiben yalnızca %13'ünün morula aşamasına ulaştıkları görüldü. Ayrıca bir başka denemede EDTA'lı vasat içerisinde*

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