Electrocardiographic changes in awassi diarrheic suckling lambs in Iraq

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Summary

This study was done to investigate the electrocardiographic changes in 90 diarrheic nursed Awassi lambs, in comparison with 10 clinically healthy lambs of the same breed. Their ages were ranged from 5 days to 2 months, in Karbala City-Iraq, from November 2015 to April 2016. The diarrheic lambs showed significant (P≤0.05) decreased duration of P-wave (0.039±0.0000001 ms and shorter QRS wave amplitudes 0.6 0±0.042 mV with duration 0.041±0.0008 ms , higher T wave amplitude and duration (0.25±0.034 mV and 0.070±0.002 ms) , prolonged QT (0.21±0.004 ms) but ST-segment (0.17±0.004 ms) were its observed sinus arrhythmia with tachycardia in lead-II in diarrheic lambs were recorded compared with non-diarrheic lambs group which their QRS duration and amplitude were it was (0.04±0.000001ms and 0.65±0.026 mV) , T waves duration and amplitude were (0.076±0.004 ms and 0.21±0.012 mV) QT interval (0.20±0.011 ms) and ST-segment (0.16±0.011 ms) .The morphological abnormal of ECG changes in diarrheic suckling lambs characterized by a widening or flattening, bifid(mitral) and pulmonale (tall) shape of P wave, increased P-R interval, increased duration of QRS complex and QT-prolongation, ST-depression or elevation .Inverted or board (slurring) tall, symmetric, peaked shape of T waves. These abnormal shapes appeared alternately in lead I, II, III, aVR, aVL and aVF. Conclusively the diarrheic lambs showed serious abnormal changes of electrocardiography..

Keywords: Diarrhea, Electrocardiograph, suckling lambs

Introduction

Diarrhea is defined as an increased fecal water content or an increased volume of excreted feces or combination of both and characterized clinically by rapid dehydration as extensive loss of fluid and resulting in a electrolyte imbalance, beside that the initial intestinal damage complicates, the cases and death occurred due to both dehydration and electrolytes loses (1). High economic loss in sheep flocks occurs because of diarrhea (2). Different cardiac parameters of sheep kids have detected by electrocardiographic tracing as BP, CO and peripheral vascular resistance (3). The normal ECG picture at first lamb life was predominant sinus heart rhythm, progressive decrease in the heart rate and R and T wave amplitude with progressive increase in the PR, QT, and RR intervals (4). ECG patterns during diarrhea may be suitable as an indicator of the severity of serum electrolyte changes (5). So the diarrheic sheep ECGs showed shorter QRS wave amplitudes, longer T wave duration, sinus arrhythmia with tachycardia and the time intervals between R waves are not equal (6)

Materials and Methods

Ninety diarrheic Awassi lambs aged from 5days to 2 months were subjected to electrocardiographic studies and other ten non diarrheic, clinically healthy lambs from the same breed and within the same age range, were used as a control. The ECG traces were recorded on a bipolar limbs lead system in all animals using six leads, in right-side recumbency then when lambs were calm, before connecting ECGs, clipping &shaving the hair of area limbs after that attaching alligator-type electrodes to the skin after cleaning the wool special EKG gel (ultrasound gel transmission) was applied for good contact. Red electrode (RA) placed on the right and yellow electrode (LA) placed on the left fetlock joint of forelimb. Both hind limb electrodes (green LL] and black) were attached to the left and right stifle joints, respectively as shown in (Fig .1). All ECGs were obtained with a single channel electrocardiographic apparatus (Shenzhen Bio care) as shown in (Fig 1) with paper speed of 25 mm/s and calibration of 10 mm equal to 1 mV. The amplitudes and durations of all wave form were calculated

manually, were each small square represent 0.04s on the horizontal and0.1mv vertical plan (7).

Fig (1) limbs lead method in suckling lambs

Results and Discussion

The ECGs in non-diarrheic lamb group showed positive direction of the P wave is very clear and prominent with duration (0.04± 0.000001ms) and amplitude (0.1±0.01 mV) in all leads as in (figures 2, 3). These values were close to other studies (4, 8). As compared with diarrheic lambs the P-wave were negative direction in aVR and aVL with (0.04 ± 0.0000001 ms) in all leads but amplitude in lead-II (0.116±0.004 mV) vary in others leads as in tables (1 , 2) and in . The P-waves are mostly negative in aVR and aVL while, the biphase shape is appeared in lead-II and flat or absent in lead-III as (Fig .4-6). The diarrheic electrolytes imbalance was responsible for hyponatremia, hyperkalemia ,hypomagnesemia , sinus tachycardia and various types of heart block that lead to widening and flattening of P wave and low amplitude due to slowing of conduction (8,9). These abnormalities may be occurring due to another defect as resulting from diarrhea (infectious causes) and electrolytes imbalance as left atrial enlargement and atrial fibrillation that appear in inferior leads (lead-II) associated with delayed atrial conduction of Bachmann′s bundle and circling impulse propagation from the lower right atrium to the left atrium.(10)

In clinical healthy lambs the QRS complexes were long negative in all leads except aVR were positive with (0.65±0.026 mV) duration and amplitude lead-II. The hyponatremia, hyperkalemia and high magnesium level were responsible for long duration and short amplitude QRS of diarrheic lamb (11). The abnormal forms of QRS-wave appear Q-pathological shape, in aVR and aVL appear small QRS wave but in lead-III appear M-shape (Fig.7) which occur due to right bundle branch block that caused by right ventricular hypertrophy, ischemic, rheumatic heart disease, myocarditis (12). In Lead-I and aVL showed up narrow shape as in (table-3) and as (Fig .8) as a reason to hypocalcaemia. The Deep-S show up in lead-II) occurs due to left bundle branch block that caused by hyperkalaemia, hypertension (13)

The T waves in non-diarrheic lambs were long amplitude positive except was negative in aVR compared with diarrheic suckling lambs was long duration and amplitude as a reason to hyperkalemia and high magnesium level (14). The Bifid (notched) shape in Lead-I that caused by cardiomyopathy and often associated with electrolyte imbalance (15). In lead-II show up Biphasic T-wave as due to ischemia and hypokalemia (16) also in aVR show up inverted shape that occur due to hypocalcaemia.

The abnormal morphology of ST-segment in all leads show depression which occured mainly by hypocalcaemia although can be occur by low potassium / low magnesium but elevation appear as in figures (8and 9) as a reason to hyponatremia , hyperkalemia (17) also because acute ischemia ,early repolarization, acute pericarditis (ST elevation in all leads except aVR) hypothermia (ST elevation in II, III and aVF) , hypertrophic cardiomyopathy and Left ventricular hypertrophy (18).The abnormal of QT-segment show up prolong as (figure-9) because hypocalcaemia and high magnesium level according to our results ECG patterns indicator of the severity of serum electrolyte changes and can be used to estimate diarrheic severity of lamb.

Table (1) Electrocardiograph values in different bipolar lead (mean± ST) in non-diarrheic and diarrheic lambs.

Lead		Wave	(Non -diarrheic)	Diarrheic
I	Duration(ms)	P	0.04±0.000001 B	0.04±0.0000001 A
		PR	0.08±0.004 A	0.081±0.00087 A
		QRS	0.040±0.000001 B	0.043±0.00114 A
		T	0.06±0.00667 A	0.07±0.00237 A
		ST	0.172±0.00854 A	0.173±0.00424 A
		QT	0.212±0.00854 A	0.211±0.00425 A
	Amplitude(mv)	P	0.10±0.01 A	0.102±0.00199 A
		QRS	0.75±0.03416 A	0.57±0.03154 B
		T	0.17±0.03 A	0.18±0.01138 A
II	Duration(ms)	P	0.04±0.000001 B	0.039±0.0000001 A
		PR	0.084±0.004 A	0.086±0.004 A
		QRS	0.04±0.000001 A	0.041±0.0008 A
		T	0.076±0.004 A	0.070±0.002 A
		ST	0.16±0.011 A	0.17±0.004 A
		QT	0.20±0.011 A	0.21±0.004 A
	Amplitude(mv)	P	0.11 ±0.01 A	0.116±0.004 A
		QRS	0.65±0.026 A	0.6 0±0.042 B
		T	0.21±0.012 B	0.25±0.034 A
III	Duration(ms)	P	0.04±0.000001 B	0.04±0.0000001 A
		PR	0.88±0.00533 A	0.082±0.00097 B
		QRS	0.040±0.000001 A	0.042±0.00097 A
		T	0.06±0.00667 B	0.07±0.00179 A
		ST	0.18±0.02108 A	0.17±0.00422 B
		QT	0.22±0.02108 A	0.20±0.00419 B
	Amplitude(mv)	P	0.10±0.01 A	0.108±0.00302 A
		QRS	0.56±0.03055 A	0.55±0.02677 A
		T	0.17±0.03 A	0.18±0.00937 A

Table (2) Electrocardiograph values in lead (mean± ST) in non-diarrheic and diarrheic lambs.

Lead		Wave	(Non Diarrheic)	Diarrheic
aVR	Duration(ms)	P	0.04±0.000001 B	0.04±0.0000001 A
		PR	0.08±0.004 A	0.081±0.00087 A
		QRS	0.040±0.000001 A	0.042±0.00099 A
		T	0.056±0.00653 B	0.069±0.00241 A
		ST	0.18±0.00653 A	0.17±0.0043 A
		QT	0.22±0.00653 A	0.21±0.00427 B
	Amplitude(mv)	P	0.10±0.01 A	0.104±0.00232 A
		QRS	0.69±0.04583 A	0.54±0.02305 B
		T	0.15±0.01667 B	0.18±0.00937 A
aVL	Duration(ms)	P	0.04±0.000001 B	0.04±0.0000001 A
		PR	0.08±0.004 A	0.082±0.00097 A
		QRS	0.04±0.000001 B	0.043±0.0013 A
		T	0.068±0.00611 A	0.069±0.00235 A
		ST	0.21±0.00611 A	0.17±0.00473 B
		QT	0.252±0.00611 A	0.21±0.00452 B
	Amplitude(mv)	P	0.1±0.01 A	0.10±0.00124 A
		QRS	0.59±0.04583 A	0.47±0.02399 B
		T	0.14±0.01633 B	0.16±0.00797 A
aVF	Duration(ms)	P	0.04±0.000001 B	0.04±0.0000001 A
		PR	0.084±0.004 A	0.082±0.00106 A
		QRS	0.040±0.000001 B	0.041±0.00076 A
		T	0.072±0.00533 A	0.068±0.00256 A
		ST	0.18±0.00653 A	0.17±0.00455 B
		QT	0.22±0.00653 A	0.21±0.00456 A
	Amplitude(mv)	P	0.11±0.01 A	0.10±0.0022 B
		QRS	0.42±0.01333 A	0.49±0.02559 A
		T	0.16±0.03055 B	0.18±0.00972 A

Table (3) showed abnormal morphology of electrocardiographic wave's diarrheic lamb.

Waves	Shapes of wave	Leads					
		I	II	III	aVR	aVL	aVF
P	Bifid(mitrale)	17	6	6	6	7	**10**
	Tall(pulmonale)	9	20	14	3	4	**21**
	Biphase	16	20	14	7	8	**15**
	Inverted	12	4	13	56	37	**2**
	Flat	31	14	23	13	37	**16**
QRS	M-shape	10	10	24	7	16	**26**
	Q-pathologic	43	30	33	36	40	**24**
	Deep-S	20	31	16	16	10	**13**
	Narrow	15	13	12	11	14	**18**
	Small	36	31	32	26	42	**40**
T	Bifid(notched)	16	11	10	7	11	**12**
	Tall(peak)	43	46	30	31	29	**28**
	Biphase	8	16	12	11	15	**9**
	Inverted	8	4	7	24	14	**4**
	Board(slow)	37	27	34	30	45	**29**
Segment	PR-prolong	10	16	20	10	25	**33**
	ST-depression	12	20	10	7	8	**15**
	ST-elevation	7	9	6	6	10	**6**
	QT-prolong	22	45	30	24	34	**40**

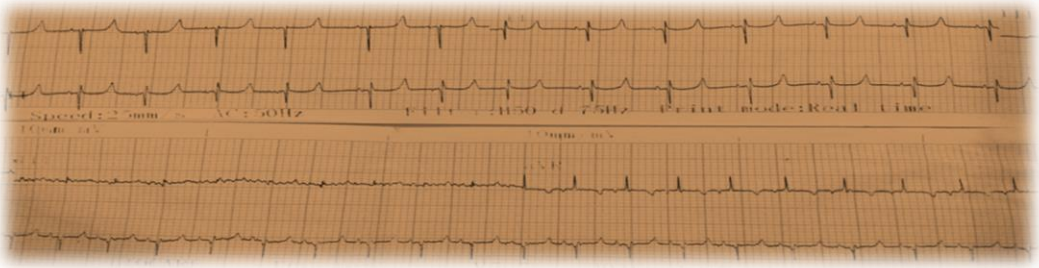

Fig (2) shows normal electrocardiography in lead –I, II, III and aVR in 50 aged female notice that the intervals between R waves (RR interval) are equal. The heart rate is 136. The trace is recorded at paper speed of 25 mm/sec and calibration of 10mm/mV (1 cm= 1 mV).

Fig (3) shows normal electrocardiography in lead aVL and aVF.

Fig (4) Abnormal Electrocardiography changes in diarrheic lamb showed shorter QRS wave amplitudes, longer T wave duration, sinus arrhythmia with tachycardia that the intervals between R waves are not equal (variable RR intervals). The heart rate is 188. Trace is recorded at paper speed is 25mmlsec and calibration of 10mm/mV (1 cm=1mv).

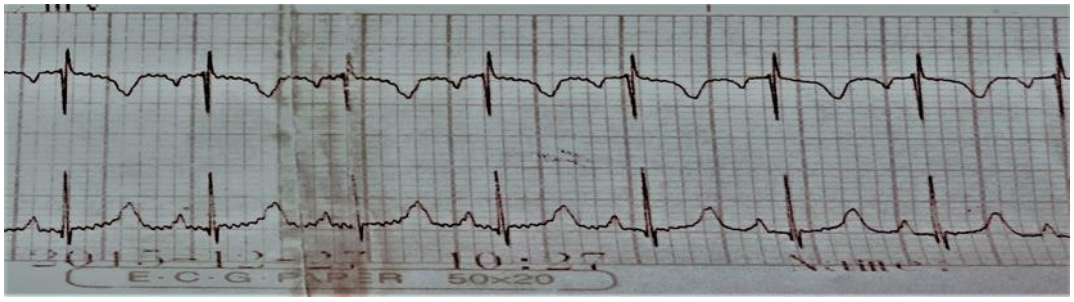

Fig (5) shows bified(mitral), inverted P-wave and inverted, bifid T-wave

Fig (6) shows flat P-wave with M-shape in QRS-wave. PR –prolongation.

Fig (7) showed Q-pathological, small QRS-wave with board (slow) T-wave

Fig (8) narrow QRS-wave, biphase T-wave, ST depression with QT prolongation

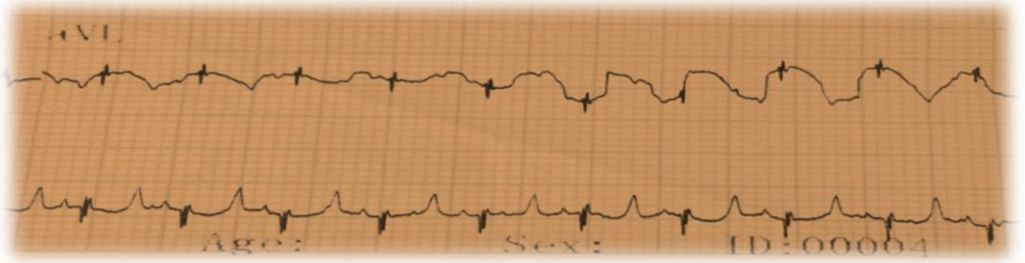

Fig (9) showed ST-elevation with tall (peak) T-wav

Conclusions:The standard electrocardiographic in non-diarrheic lambs is involved positive direction of the P waves and appear clear and prominent, The QRS complexes were long negative in all leads except aVR which positive and T waves were long length and positive except were are negative in aVR.

ECGs changes in diarrheic lambs showed flatted(absent) P-wave, QRS wave shorter amplitudes and long duration, longer duration and amplitude of T wave, the short duration values of ST and QT segment sinus arrhythmia with tachycardia and the time intervals between R waves are not equal.

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التغيرات في تخطيط القلب الكهربائي في الحملان العواسية التي تعاني من حالات الاسهال

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الخلاصة

أجريت هذه الدراسة للتحقق من التغيرات الكهربائية المحتملة في 90 لحمل عواسي غير مفطوم مصابة بالإسهال، مقارنة مع 10 حملان صحية سريريا من نفس السلالة. تراوحت أعمارهم بين 5 أيام إلى شهرين في مدينة كربلاء في العراق من نوفمبر 2015 إلى أبريل 2016. اظهرت الحملان المصابة بالإسهال انخفاضا معنويا ($P\leq0.05$) في مدة الموجة (0.039 ± 0.0000001) p جزء من ثانية وأقصر موجة QRS((0،041 ± 0، 0008 جزء من الثانية 0.6 ±0.042 ملي فولت)، اطول المدة الزمنية وارتفاع موجة T (0،25 ± 0،034 ملي فولت و 0،070 ± 0.002 جزء من الثانية) و مدة طويلة من QT (0،21 ± 0،04جزء من الثانية)، ولكن الجزء0.16 ± 0.011 ST(جزء من ثانية) حيث يلاحظ عدم انتظام ضربات القلب الجيبي مع عدم انتظام دقات القلب في القطب الثاني في الحملان المصابة بالإسهال التي سجلت مقارنة مع مجموعة الحملان غير المصابة بالإسهال حيث المدة الزمنية وارتفاع الموجة 0.026 ± 0.65 (0.000001 ± 0.04 , QRS)،مدة وارتفاع الموجة T 0.004 ± 0.076) جزء من الثانية و 0.21 ± 0.012ملي فولت) و فترة 0.011 ± 0.20)QT جزء من الثانية) و المقطع- ST 0.011 ± 0.16) جزء من الثانية) . التغيرات الشكلية غير الطبيعية لتخطيط القلب الكهربائي في الحملان الرضيعة المصابة بالإسهال التي تتميز بتوسيع أو تسطح، تفرع (ثنائي) وطول في شكل الموجة P، زيادة فترة PR، وزيادة مدة الزمنية لمعقد QRS واطالة QT، ارتفاع او انخفاض ا .STانقلاب او عرض (بطئ)، طول، تماثل في شكل موجات. T هذه الأشكال غير طبيعية ظهرت بالتناوب في القطب الأول والثاني والثالث، aVR،aVL وaVF. بشكل قاطع الحملان المصابة الإسهال أظهرت تغييرات غير طبيعية مهمة في تخطيط القلب الكهربائي....

الكلمات المفتاحية: الحملان ، اسهال، تخطيط القلب الكهربائي.