Short comunication

Comparative assessment of electrocardiographic parameters of some birds in ilorin-an essential diagnostic tool

Evaluación comparativa de los parámetros electrocardiográficos de algunas aves en Ilorin - una esencial herramienta de diagnóstico

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ABSTRACT

Introduction: Cardiovascular disease is an important cause of death in birds. Spontaneous turkey cardiomyopathy (STC; round heart), ruptured aorta and sudden death account for over 50% in avians. The diagnosis is usually based on history and gross examination. This work was designed to assess the electrocardiographic parameters of various birds as alternative/additional means of clinical diagnosis.

Objective: of this study was to identify every aspect of the Lead II ECG wave form. The electrocardiogram is a useful tool in avian medicine as it can be utilized to measure heart

rate and to detect arrhythmias, cardiac chamber enlargement, and electrical conductance abnormalities.

Methods: EDAN 10 Veterinary electrocardiographic equipment made in China; with a 200 mm/s paper speed and a sensitivity of 100 mm/mV was used to measure the electrocardiographic. The five alligator clip electrodes were fixed directly to the skin under the feather- on the forearms (muscular part of the wing), on the hind limbs above the stifle joint, and the heart as described earlier by Azeez et al, (2017). Birds were placed on lateral recumbency. The EDAN was connected to the laptop and information about each bird was recorded and saved. Birds considered include Broilers, Domestic duck, White geese, Chinese geese, Laying birds (chicken), point of lay birds and Turkey. They were all carefully restrained. 5 birds from each group were used.

Results: The ECG exhibited positive P wave, inverted (Q)RS and positive T wave in all of them. S-S interval was regular in turkey and duck, irregular in chicken and Chinese geese. The PR interval in the Laying birds and Broilers were very longer with overlap by QRS. The (Q)RS was shorter (29-44ms)in the chicken with very short amplitude, longer (50-65ms)in turkey and duck with longer amplitude. No significant difference in the QRS within the groups. QT interval was longer in turkey, geese and duck (297-456ms) but shorter in chicken.

Conclusions: Electrocardiography is a useful diagnostic tool in birds. However, while interpreting electrocardiographic, Clinicians should always consider history, clinical findings and laboratory results before final diagnosis. More emphasis should be place on use of electrocardiographic by Veterinarians and Clinicians in handling cases of cardiovascular issues in birds.

Key words: Electrocardiography; Heart; Birds; P- wave.

RESUMEN

Introducción: Las enfermedades cardiovasculares son una importante causa de muerte entre las aves. La miocardiopatía espontánea del pavo (MEP; corazón redondo), la ruptura de la aorta y la muerte súbita representan más del 50 % de las muertes aviares. Generalmente el diagnóstico se basa en los antecedentes y en un examen general. En el presente estudio se evalúan los parámetros electrocardiográficos de un grupo de aves como medios alternativos / adicionales del diagnóstico clínico.

Objetivo: Identificar cada aspecto de la forma de onda del ECG de derivación II. El electrocardiograma es una herramienta útil en la medicina aviar, ya que puede usarse para

medir la frecuencia cardíaca y para detectar arritmias, agrandamiento de la cámara cardíaca y anomalías de la conductancia eléctrica.

Métodos: Los parámetros electrocardiográficos se midieron con un electrocardiógrafo veterinario EDAN 10 fabricado en China, con una velocidad del papel de 200 mm/s y una sensibilidad de 100 mm/mV. Los cinco electrodos de presilla tipo cocodrilo fueron fijados directamente a la piel bajo las plumas en el área del antebrazo (parte muscular del ala), en las extremidades posteriores por encima de la babada, y en el corazón según se describe en Azeez et al (2017). Las aves fueron colocadas en posición reclinada lateral. El EDAN se conectó a una laptop para registrar y guardar la información sobre cada ave. Las aves del estudio eran pollos de engorde, patos domésticos, gansos blancos, gansos chinos, gallinas ponedoras, aves listas para empezar a poner y pavos. Todas fueron sujetadas firmemente. Se utilizaron cinco aves de cada grupo.

Resultados: El ECG mostró una onda P positiva, un (Q)RS invertido y una onda T positiva en todas ellas. El intervalo S-S fue regular en pavos y patos, e irregular en pollos y gansos chinos. El intervalo PR fue mucho más largo en las ponedoras y los pollos de engorde, con superposición por el QRS. El (Q)RS fue más corto (29-44 ms) en los pollos con una amplitud muy corta, y más largo (50-65 ms) en pavos y patos con una amplitud más larga. No se hallaron diferencias significativas en el QRS dentro de los grupos. El intervalo QT fue más largo en los pavos, gansos y patos (297-456 ms) pero más corto en los pollos.

Conclusiones: La electrocardiografía es una útil herramienta para el diagnóstico de las aves. Sin embargo, al interpretar la información electrocardiográfica, siempre se deben tener en cuenta los antecedentes, los hallazgos clínicos y los resultados de laboratorio antes de emitir el diagnóstico definitivo. Se debe hacer más hincapié en el uso de la electrocardiografía por parte de los veterinarios y los médicos al tratar casos de problemas cardiovasculares en las aves.

Palabras clave: electrocardiografía; corazón; aves; onda P.

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INTRODUCTION

The avian cardiovascular system is highly developed to accommodate the specialized requirements of various species' abilities to fly, run, and/or swim [1, 2].The anatomy and physiology of the avian heart allows forhighly efficient blood circulation and oxygen delivery[2].The avian heart is situated cranially within the coelomic cavity on theventral midline. There is no diaphragm in birds and the right and left lobes of the liver enclose the apex of theheart on each side[3] Avian cardiac muscle cells are one-fifth to one-tenth the diameter ofmammalian cardiac myocytes, and lack the M-band and transverse tubules (T-tubules) found in mammalian cardiac muscle.[2] The avian heart is proportionally larger than mammals relative to body mass.[3].The proportion of body weight taken up by the heart increases as the size of the bird decreases.[3] Heart disease should be suspected when patients are presented with dyspnea, coughing, weakness, lethargy, exercise intolerance, collapse/syncope, orcoelomic distention.[3,4] Early in the course of cardiac disease, birds maypresent without any obvious signs. Birds may also be presented foracute death singly or in flock with no history to suggest the presence of heart disease.[3,4,5] Detailed history is important to help determine risk factors that may contribute to heart disease.

Predisposing factors

Predisposing factors to heart disease in birds may include Species, age, gender and diet in the development of heart disease in companion avian species[6,7]. For example Broilers (Gallus domesticus) often develop pulmonary hypertension and ascitessyndrome, a spontaneous cardiomyopathy thought to develop as a result of increased demand placed on the cardiovascular system by the largebreast muscle mass and rapid growth[3,8] Copper deficiency may be linkedto the formation of dissecting aortic aneurysms in turkeys and ostriches.[3]

Methods of Examination

- The physical examination is an important diagnostic tool in avian medicine. Birds should first be evaluated in the cage at a close look to assess them at rest. Auscultation of the heart is best performed on the left and right ventral thorax at the base of the sternum.[6] Muffled heart sounds may indicate pericardial effusion or hepatomegaly.[9]

- Complete blood cell count and Biochemical analysis.
- Radiography- there is need understanding of normal avian radiographic anatomy to give accurate interpretation of the radiographs.
- Ultrasound can help to evaluate the coelomic cavity for effusion and soft tissue masses._Ultrasound is a useful tool, but poses some difficulty in birds because internal organs are surrounded by air sacs.
- Electrocardiography (ECG) demonstrates the summed electrical activity of the heart and can be utilized to measure heart rate, to detect arrhythmias, cardiac chamber enlargement, and electrical conductance abnormalities.[10] The ECG demonstrates the summed electrical activity of the heart.[2] In birds, the mean electrical axis is negative (and thus the QRS wave is inverted in lead II); however, in in many other respects the avian ECG is similar tomammals.[2] Avian practitioners have given relatively little attention to electrocardiography probably because of scarcity of reference values in companion, zoo and wild birds.[11] The standard bipolar limb lead II is commonly used to evaluate ECG wave forms in birds.[6,10] Avian ECG differs somewhat from its mammalian counterpart in that the RS wave is inverted in most species as a norm[14].It showed that the avian ECG, unlike the human ECG, had a deep inverted S wave but no R wave[12] To evaluate morphologic features of the avian ECG, it is important to have an ECG machine that has a speed of 100 mm/s or greater (may need 200 mm/s in very small patients). At slower speeds the ECG wave forms are too close together. This work was designed to assess the electrocardiographic (ECG) parameters of various birds as alternative/additional tool of clinical diagnosis. The objective of this study was to identify every aspect of the Lead II ECG wave form in apparently normal birds.

METHODS

EDAN 10 Veterinary electrocardiographic equipment made in China; with a 200 mm/s paper speed and a sensitivity of 100 mm/mV was used to measure the ECG. The five alligator clip electrodes were fixed directly to the skin under the feather- on the forearms (muscular part of the wing), on the hind limbs above the stifle joint, and the heart as described earlier by.[13] Birds were placed on dorso-lateral recumbency. The EDAN was

connected to the laptop and information about each bird was recorded and saved. Birds considered include Broilers, Domestic duck, White geese, Chinese geese, Laying birds (chicken), point of lay birds and Turkey. They were all carefully restrained. 5 birds from each group were used.

RESULTS

In the table shows ECG exhibited positive P wave, inverted (Q)rS and positive T wave in all of them. S-S interval was regular in turkey and duck, irregular in chicken and Chinese geese. The PR interval in the Laying birds and Broilers were very longer with overlap by QRS. The (Q)rS was shorter (29-44ms) in the chicken with very short amplitude, longer (50-65ms)in turkey and duck with longer amplitude. No significant difference in the (Q)rS within the groups. QT interval was longer in turkey, geese and duck (297-456ms) but shorter in chicken.

Table. ECG parameters of birds

	Broilers	Domestic duck	White geese	Chinese geese	Point of Lay	Laying birds	Turkey
HR (bpm)	394±6.4	158±4.1	125±2.1	87±.97	375±8.97	294±3.6	198±2.4
P (ms)	70±1.9	92±2.31	61±1.54	61±1.1	67±1.34	21±0.3	88±1.2
PR(ms)	76±1.7	120±3.17	95±3.21	118±3.3	84±1.74	30±0.67	98±1.6
(Q)rS(ms)	50±1.0	33±1.24	32±0.95	37±0.48	25±0.57	31±1.0	50±0.45
QT (ms)	108±2.3	343±11.23	456±11.4	212±5.1	107±1.9	116±2.3	297±6.1
QTc (ms)	276±3.9	556±12.94	658±14.62	255±7.4	267±6.3	256±5.4	539±8.1

Results showing ECG patterns in different birds

Normal parameters in Broilers showing inverted R. S-S interval is irregular. Can be observed in figure 1.

In figure 2 the electrocardiographic record of waves in Chinese geese it shows the inverted S.S-S interval.

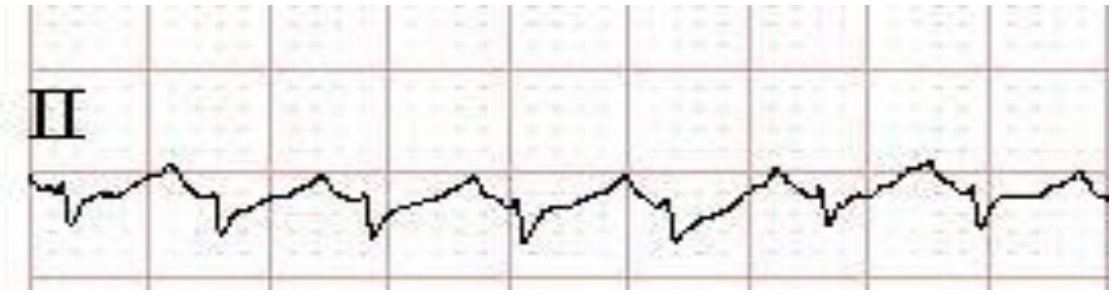

Fig 1. Electrocardiographic record of waves in lead II of normal parameters in Broilers showing inverted R. S-S interval is irregular.

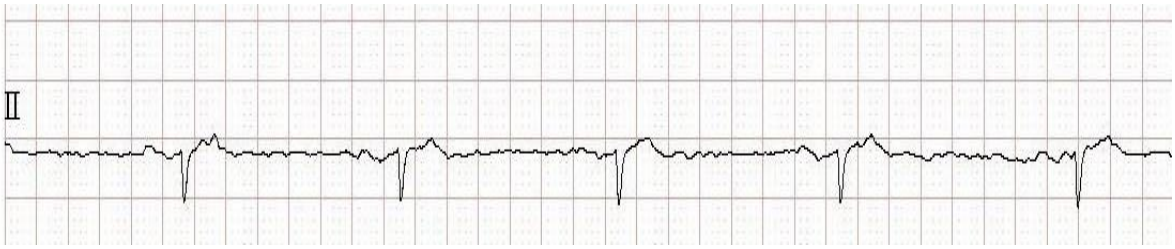

Fig. 2. C Electrocardiographic record of waves in lead II of Chinese geese showing inverted S.S-S interval is regular.

DISCUSSION

In birds, the mean electrical axis is negative (and thus the QRS wave is inverted in lead II); however, in many other respects the avian ECG is similar to mammals. From our results heart rate in broilers, point of lay birds and laying birds was significantly higher than in geese, turkey and duck. We suspect that broiler, laying birds and point of lay birds are kept intensively where there is restricted movement. They have lighter body weight compared with geese, duck or turkey. Boredom, accumulation of fat as they age is common with broilers and the laying birds. This could be a contributing factor to increased heart rate. There is no significant difference in the P and PR interval of all the groups. However, P and PR interval in the laying birds are significantly lower compared with others. There is no significant difference in the QrS complex timing of all the groups. Amplitude of S is significantly higher in geese, duck and Turkey compared with laying birds, point of lay birds and broilers. QT and QTc are significantly higher in the duck, geese and Turkey. For these birds, no real reference values for their ECG values are available.

The avian ECG also starts with a P wave, but is in some groups of birds it is followed by a slight depression of the initial part of the PR interval. This depression, referred to as the Ta wave, represents atrial repolarization and appears to be a physiologic phenomenon as seen in almost all the birds sampled above. The second difference is the form of the QRS complex, which should more accurately be described as a rS complex as described by.[6,12] This is due to the fact that the ventricular depolarization in the avian heart starts sub-epicardially spreading via the myocardium to the endocardial surface, in contrast to the mammalian heart, where it spreads from the endocardial side to the epicardial side. The ST segment is rather short or absent. When present, as found in the Turkey, laying birds and broilers it is often elevated or shows ST-slurring (Swave directly merging into the T wave). The ST segment is absent in the geese and duck. This is similar to the finding of[12] in pigeons or psittacine birds. In mammals, an elevated ST segment or ST slurring is associated with cardiac disease. The T wave is opposite to the direction of the ventricular complex and always positive in lead II. The P-on-T phenomenon (the P wave is superimposed on the T wave) is a normal finding as described by.[12].

CONCLUSION

Electrocardiography is a useful diagnostic tool in birds. The unique high-performance features of the avian heart enable birds to fly, run, or dive. However, pet birds often are compromised in their cardiovascular capabilities by restricted exercise, poor diet, and abnormal climate. Electrocardiography is a useful diagnostic tool in birds. In birds, severe cardiac histopathology is not always reflected in ECG abnormalities. While interpreting ECG, Clinicians should always consider history, clinical findings and laboratory results before final diagnosis. More emphasis should be place on use of ECG by Veterinarians and Clinicians in handling cases of cardiovascular issues in birds.

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Conflict of interests

There is no conflict of interest in relation to the research presented.