Vol 18 No 2, p 243-246

STUDY ON ATRIAL FIBRILLATION IN A DROMEDARY CAMEL

M. Pourjafar, K. Badiei, A.A. Chalmeh, M. Naghib and A.R. Rahmani
Department of Clinical Sciences, School of Veterinary Medicine, Shiraz University, Shiraz, Iran

ABSTRACT

A 5-year old male dromedary camel (*Camelus dromedarius*) had electrocardiographic signs of atrial fibrillation (AF) comprising no P waves, multiple f waves, irregular R-R intervals and tachycardia. Cardiac auscultation of this animal revealed irregular cardiac rate and rhythm and tachycardia. Clinical examinations of this camel showed no cardiovascular insufficiency problems except pulse deficit. Based on electrocardiographic and cardiac auscultation signs, AF was diagnosed. The present case had normal appetite and general state and behaviour were good. Serum electrolytes of this camel were assayed. Serum sodium, chloride, calcium and phosphorus were placed in normal reference range. Serum potassium and magnesium concentrations were slightly lower than normal reference range. According to clinical and para-clinical findings, it could be stated that AF observed in this clinically healthy 5-year old male dromedary camel may be accepted as the functional arrhythmias, and so no treatment is necessary.

Key words: Atrial fibrillation, *Camelus dromedarius,* electrocardiogram, serum electrolytes

Atrial fibrillation (AF) is a cardiac arrhythmia which occurs when normal pacemaker activity and impulse formation in the atria are lost. Coordinated and rhythmic contractions of the atria are replaced by rapid quivering of the muscle and effective atrial pumping no longer occurs. Ventricular electrical independence is usually maintained (Guyton, 1981) because the atrial and ventricular muscle masses are insulated from each other by the fibrous tissue around the heart valves. During AF the ventricles usually depolarise and contract in a normal manner but at an irregular rate. The resulting arrhythmia is characterised as an irregular tachycardia. The rate, rhythm and amplitude of the heart sounds and the amplitude of the peripheral pulse may vary significantly, and pulse deficits are frequently detected. On the electrocardiogram there are no P waves discernible but the baseline shows multiple waveforms (f waves) that occur with a frequency of between 300 and 600 beats/min. QRS-T complexes are normal in configuration but there is wide variation and no pattern in the R-R intervals. AF has been recorded in many of the large animal species (Radostits *et al,* 2007). Although AF is considered relatively common in large animals and well described in them, there are no reports of its occurrence in camel. In the present study, some of the clinical and para-clinical findings of AF in a 5-year old male dromedary camel are presented.

Materials and Methods

During November 2010, the cardiac activity of 97 clinically healthy dromedary camels from several farms in Yazd province, the central part of Iran, was evaluated using cardiac auscultation and electrocardiographic studies. Animals were aged between 5 months to 15 years and comprised both sexes. None of the camels used in this study had any obvious clinical signs of heart diseases (oedema, jugular distension or pulsation). Cardiac rate and rhythm were evaluated before electrocardiogram recordings, based on auscultation of the heart. The electrocardiograms were recorded on a bipolar base apex lead, using limb lead I. Animals were kept in sternal position in the farm without sedation and minimal restraint. No clipping or shaving was carried out for electrode attachment. When the animals were thought to be in a quiet state, the electrocardiograms were recorded, using alligator-type electrodes which were attached to the skin after cleaning it with ethanol and applying electrocardiographic jelly. The positive electrode (left arm) of lead I was attached to the skin of the left thorax at the fifth intercostal space, immediately caudal to the olecranon, and the negative electrode (right arm) was placed on the jugular furrow in the caudal third of the left neck (Radostits *et al,* 2007). All ECGs were obtained on a single channel electrocardiographic machine (Kenz-line EKG 110, Suzuken Co., Ltd., Japan) with the paper speed 25

SEND REPRINT REQUEST TO M. POURJAFAR email: dmp4m@yahoo.com

mm/sec. and calibration of 10 mm equal to 1 mV. The precision of duration was 0.02 sec. and amplitude was 0.05 mV. Blood samples were obtained from the jugular vein of camels and sera were separated by centrifugation (for 10 min at 3,000×g) and stored at −22°C until probable analyses.

Case Presentation

Electrocardiographic studies of all camels showed that a 5-year old male dromedary camel had electrocardiographic signs of AF comprising no P waves, multiple f waves, irregular R-R intervals and tachycardia (Fig 1). According the Pourjafar's *et al* (2011a) study on the heart rate of different ages of dromedary camel, the heart rate of this camel (100-110 beats/min.) is higher than normal reference range (68±0.84 beats/min.). Cardiac auscultation of this animal revealed that there were irregular cardiac rate and rhythm and tachycardia. Clinical examination of this camel showed no cardiovascular insufficiency problems (oedema, jugular distension or pulsation) except pulse deficit. Based on electrocardiographic and cardiac auscultation signs, AF was diagnosed. The owner mentioned that there were normal appetite and general state and behaviour were good in the present case. Serum of this camel was assayed for evaluation of sodium, potassium, chloride, calcium, magnesium and phosphorus. Serum chloride and phosphorus were analysed using routine biochemical procedures (Burtis and Ashwood, 1994). The serum concentrations of sodium and potassium were measured by the flame photometric method (Flame Photometer, FLM, Ontario, Canada). The samples were analysed for magnesium and calcium by atomic absorption spectroscopy (Shimadzo AA-670, Kyoto, Japan). The results of serum electrolytes evaluation of this camel in comparison to normal reference ranges of camels with similar age and sex (Nazifi and Maleki, 1998) are presented in Table 1. The results of Table 1 showed that sodium, chloride, calcium and phosphorus were placed in normal reference range. Serum potassium and magnesium concentrations were slightly lower than normal reference range (Table 1).

Discussion

Atrial fibrillation is the most common dysrhythmia causing poor performance in the horse (Patteson, 1996) and cattle (Brightling and Townsend, 1983) and it has been reported from many different parts of the world. This appears to be the first documented case of AF in the dromedary camel in the world although studies on cardiac arrhythmias of this breed have been reported before (Pourjafar *et al,* 2011b).

AF can convert to sinus rhythm spontaneously without any treatment; however, when it is sustained it should be treated (Deem and Fregin, 1982). Various factors have been incriminated in the production and maintenance of AF in large animals, such as, high vagal tone, atrial dilatation or hypertrophy due to mitral and tricuspid insufficiency, gastrointestinal disorders, atrial myocardial lesions, electrolytes and acid base imbalances, infection, a macerated foetus and premature atrial contractions (Pringle *et al,* 1990 and Wijnberg *et al,* 1998). Vagal stimulation in experimental preparations of anaesthetised dogs can be used to markedly increase the ease of induction and persistence of AF (Abildskov, 1977). Acetylcholine release from postganglionic vagal nerve fibres has been shown to cause the development of hyperpolarisation in atrial myocardial fibres. A shortening of atrial fibre refractory periods occurs which is heterogeneously spread through the atria. This is generally accepted as an environment in which erratic depolarisation and fibrillation of atrial muscle may be established (Abildskov, 1977). The possible contribution of increased vagal tone on development of AF in man has been described (Abildskov and Burgess, 1971 and Marrioit and Myerburg, 1982). On the other hand abdominal pain, the stress of surgery and confinement in a strange environment may also lead to direct stimulation of the branches of the sympathetic nerves innervating the heart or increased levels of cathecholamines. Under these circumstances of sympathetic stimulation the automacity of the heart would be enhanced, increasing the opportunity for arrhythmias to develop (Brightling and Townsend, 1983).

The present case did not show any clinical signs of cardiac problems, gastrointestinal disorders, infectious conditions and abnormality in behaviour. The present animal had good performance on

Table 1. Serum electrolytes (mmol/lit) in a 5-year old dromedary camel affected with AF in comparison to normal reference ranges (Mean±SD) in male adult dromedary camel (Nazifi and Maleki, 1998).

Serum electrolytes	Camel with AF	Reference range
Sodium	147	143±4.1
Chloride	93	98.5±11.9
Potassium*	4.4	5.2±0.4
Calcium	2.2	2.6±0.4
Magnesium*	0.9	1.5±0.4
Phosphorus	2.3	1.9±0.4

* Indicates out of normal reference range in serum parameters of affected camel.

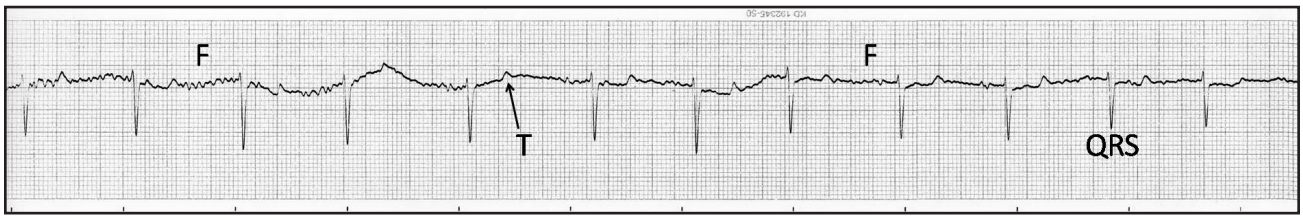

Fig 1. Atrial fibrillation in a 5-year old male dromedary camel. P waves are absent and the baseline shows multiple f waves. There is wide variation in R-R intervals and QRS-T complexes are normal in configuration. This record presents obvious tachycardia.

fattening. In the present case we did not also find any severe electrolyte disorders (Table 1). Serum sodium, chloride, phosphorus and calcium concentrations were within normal ranges but serum magnesium and potassium concentrations were slightly lower than normal reference values (Table 1).

Serum electrolyte concentrations play an important role in the development of AF (Chelazzi *et al,* 2011). Potassium and magnesium deficiencies have all been associated with the development of AF (Christians *et al,* 2001).

The role of potassium in maintaining cardiac rhythm is well established. Hypokalemia causes cellular hyperpolarity, increases resting potential, hastens depolarisation, and increases automaticity and excitability (Auer *et al,* 2004). Thus, electrolyte imbalances and hypokalemia may contribute to the etiology of AF (Svagzdienė *et al,* 2009).

The relationship between hypomagnesemia and AF after cardiac surgery suggests that serum magnesium levels should be kept within normal ranges. The changes in serum magnesium level and their relation with the rate of postoperative AF usually are analysed by most publications (Shiga *et al,* 2004 and Inoue *et al,* 2004). The opinion that magnesium supplementation is helpful to reduce the rate of postoperative AF is predominant. However, there is some evidence suggesting that administration of magnesium may be detrimental. The patients with high serum magnesium levels had a higher incidence of AF and that supra-physiological concentration of magnesium lead to slowing of sinus rhythm rate that can predispose to AF. Inhibition of the sinus node by magnesium is most probably offset by inhibition of acetylcholine release at the vagal nerve terminals (Svagzdienė *et al,* 2009).

Low serum potassium level is often found in association with hypomagnesemia and predisposes atrial fibrillation. Extracellular magnesium is broadly implicated in neuronal control, neuromuscular transmission, and cardiovascular tone. It is not surprising that magnesium metabolism disturbances result in wide spectrum of clinical signs and symptoms. Also it has been shown that magnesium suppresses arrhythmias after acute myocardial infarction, and there are studies confirming correlation between hypomagnesemia and postoperative atrial fibrillation (Wilkes *et al,* 2002). The underlying mechanism of these effects is not well understood but most probably involves magnesium interaction with calcium channels within myocytes membrane. Also, it is not clear if magnesium supplementation is useful for these patients, or it is useful only in hypomagnesemia patients. Opinions on magnesium supplementation for prevention and treatment of atrial fibrillation are controversial. Kaplan *et al* (2003) in their placebo-controlled study had the same incidence of atrial fibrillation in both groups, though it well correlated with lower serum magnesium levels. However, Toraman *et al* (2001) in the similar study reduced incidence of AF significantly by using magnesium supplement. The data of Shiga *et al* (2004) meta-analysis also support the advantage of magnesium supplementation in preventing AF (Svagzdienė and Sirvinskas, 2006).

Although the prognosis for the cattle with AF of organic origin was poor, the recovery rate for those with functional AF is relatively good. Atrial fibrillation in itself is a relatively innocuous condition, rarely accompanied by signs of heart failure in large animals. In comparison, ventricular arrhythmias are serious and life threatening. These arrhythmias can be differentiated only with the aid of an ECG. If AF is diagnosed, cases in which cardiac pathology may be the primary cause must be differentiated from cases where other primary conditions are present (Brightling and Townsend, 1983).

According to history and follow up of this case (return of the electrocardiogram to normal), it was concluded that AF observed in this clinically healthy 5-year old male dromedary camel could be accepted as the functional arrhythmia, and so no treatment was necessary. Furthermore, serum electrolytes of this camel were within normal reference ranges and only serum concentrations of potassium and magnesium were slightly lower than normal values.

Acknowledgements

The authors would like to appreciate Dr. Ali Akbar Hadadzadeh, the Chief Manager of The Veterinary Organiswould also like to appreciate all the staff of the Veterinary Organisation of Yazd Province for their valuable collaborations.

References

Abildskov JA and Burgess MJ (1977). Atrial fibrillation. American Journal of Cardiology 28:263.

Abildskov JA (1977). Ventricular repolarisation in arrhythmias. In: Bayes, A. and J. Cosin. Diagnosis and treatment of cardiac arrhythmias. Oxford, Permagon Press, 44.

Auer J, Weber T, Berent R, Lamm G and Eber B (2004). Serum potassium level and risk of postoperative atrial fibrillation in patients undergoing cardiac surgery. Journal of American College fo Cardiology 44:938-939.

Brightling P and Townsend HGG (1983). Atrial fibrillation in ten cows. Canadian Veterinary Journal 24:331-334.

Burtis CA and Ashwood ER (1994). Tietz Textbook of Clinical Chemistry. 2nd ed. Philadelphia, W. B. Saunders Co. pp 735-888, 4354-1375.

Chelazzi C, Villa G and De Gaudio AR (2011). Postoperative Atrial Fibrillation. ISRN Cardiology, Article ID 203179, 10 pages.

Christians KK, Wu B, Quebbeman EJ and Brasel KJ (2001). Postoperative atrial fibrillation in noncardiothoracic surgical patients. American Journal of Surgery 182:713-715.

Deem DA and Fregin GF (1982). Atrial fibrillation in horses: a review of 106 clinical cases, with consideration of prevalence, clinical signs, and prognosis. Journal of the American Veterinary Medical Association 180:261-265.

Guyton AC (1981). Textbook of Medical Physiology. 6th ed. Philadelphia: WB Saunders. pp 173.

Inoue S, Akazawa S, Nakaigawa Y, Shimizu R and Seo N (2004). Changes in plasma total and ionized magnesium concentrations and factors affecting magnesium concentrations during cardiac surgery. Journal of Anesthesiology 18:216-219.

Kaplan M, Kut MS, Icer UA and Demirtas MM (2003). Intravenous magnesium sulfate prophylaxis for atrial fibrillation after coronary artery bypass surgery. Journal of Thoracic and Cardiovascular Surgery 125:344-352.

Marrioit HJL and Myerburg RJ (1982). Recognition of arrhythmias and conduction abnormalities. In: Hurst, J.W. The heart, Arteries and Veins, 5th Ed. New York: McGraw Hill, 531.

Nazifi S and Maleki K (1998). Biochemical analysis of serum and cerebrospinal fluid in clinically normal adult camels (*Camelus dromedarius*). Research in Veterinary Science 65:83-84.

Patteson MW (1996). Equine Cardiology, Blackwell Science Ltd., Oxford. pp 187-197.

Pourjafar M, Badiei K, Chalmeh AA, Naghib SM, Abdolhoseinzadeh M and Pourmirzaei H (2011a). Standard electrocardiographic parameters of base apex lead system in different age groups of clinically healthy dromedary camel (*Camelus dromedarius*). Journal of Camel Practice and Research 18:1-4.

Pourjafar M, Badiei K, Chalmeh AA, Naghib M, Pourmirzaei H and Abdolhoseinzadeh M (2011b). Prevalence of cardiac arrhythmias in normal *Camelus dromedarius*. Online Journal of Veterinary Reseach 15:297-303.

Pringle J, Gomp R and Magnus R (1990). ECG of the month. Atrial fibrillation in a cow with meningitis. Journal of the American Veterinary Medical Association 196:56-57.

Radostits OM, Gay CC, Hinchcliff KW and Constable PD (2007). Diseases of the cardiovascular system. In: Veterinary Medicine: a text book of the diseases of cattle, horses, sheep, pigs and goats, 10th ed. Elsevier. pp 399-438.

Shiga T, Wajima Z, Inoue T and Ogawa R (2004). Magnesium prophylaxis for arrythmias after cardiac surgery: a meta-analysis of randomized controlled trials. American Journal of Medcine 117:325-333.

Svagzdienė M and Sirvinskas E (2006). Changes in serum electrolyte levels and their influence on the incidence of atrial fibrillation after coronary artery bypass grafting surgery. Medicina (Kaunas) 42:208-214.

Svagzdienė M, Sirvinskas E, Benetis R, Ralienė L and Simatonienė V (2009). Atrial fibrillation and changes in serum and urinary electrolyte levels after coronary artery bypass grafting surgery. Medicina (Kaunas), 45:960-970.

Toraman F, Karabulut EH, Alhan HC, Dagdelen S and Tarcan S (2001). Magnesium infusion dramatically decreases the incidence of atrial fibrillation after coronary artery bypass grafting. Annals of Thoracic Surgery 72:1256-1262.

Wijnberg ID, Van Der Kolk JH, Van Gardenen E and Binkhorst GJ (1998). Atrial fibrillation associated with central nervous symptoms and colic in a horse: a case of equine myopathy. The Veterinary Quarterly 20:73-76.

Wilkes NJ, Mallett SV, Peachey T, Di Salvo C and Walesby R (2002). Correction of ionised plasma magnesium during cardiopulmonary bypass reduces the risk of postoperative cardiac arrhythmia. Anaesthesia and Analgesia 95:828-834.