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# The Prevalence of Cardiac Dysrhthmias in Khozestan-Arab Horses

[1]A. Taghavi Razavizadeh, [2]A. Ghadrdan Mashhadi and [3]A.A. Paphan
[1]Department of Clinical Science, Faculty of Veterinary Medicine, Ferdowsi University, Mashhad, Iran
[2]Department of Clinical Science, Faculty of Veterinary Medicine, Shahid Chamran University, Ahvaz, Iran
[3]Department of Basic Science, Faculty of Veterinary Medicine, Shahid Chamran University, Ahvaz, Iran

**Abstract:** An observational field study was performed on a well-know purebred horses in Iran (Khozestan-Arab horse). The study was conducted on 105 apparently healthy horses. To find the prevalence of cardiac dysrhythmias in different sexes and ages, the horses were divided into 2 sexes (63 females and 42 males) and three age groups (0-4, 4-8, >8 years old). After taking the history and performing clinical examination, ECG was obtained on a base apex lead system with the paper speed of 25 mm $sec^{-1}$ and sensitivity of 10 or 5 mm $mv^{-1}$ at rest. The electrocardiograms were evaluated according to the criteria of normal cardiac rate and rhythm. Analysis variance, tuckey test, independent samples t-test and chi-square were used for Statistical analysis. The results showed that, 36.2% of the horses were affected with some types of dysrhythmias. The most frequent dysrhythmias were sinus tachycardia, sinus arrhythmia and heart blocks respectively. After exercise, many cardiac dysrhythmias were disappeared (physiologic dysrhythmias). Although the prevalence of cardiac dysrhythmias in mares and 4 to 8 years old horses were more than stallions and other age groups, respectively, but the differences were not significant ($p>0.05$). There were significant differences between the heart rate of 2 sexes and one age group (less than 1.5 years old) with other groups ($p<0.05$).

**Key words:** Khozestan-Arab horse, cardiac dysrhythmias, ECG

## INTRODUCTION

The terms dysrhythmia and arrhythmia are often used interchangeably. However, in a strict sense, dysrhythmia means a disturbance of rhythm, whereas arrhythmia indicates an absence of rhythm (Rose and Hodgson, 1996). Cardiac dyrhythmias can be either primary or secondary and pathological or functional (Rezakhani *et al*., 2004). Although cardiac dysrhthmias occur frequently (as high as 25 to 30%) in horses, but many are usually normal and benign in the resting horses and do not require antiarrhythmatic therapy. Horses experienced large variations in cardiac rhythm, associated with normal changes in parasympathetic tone (Reef, 1989).

Although physiologic dysrhythmias are not associated with clinical abnormalities, horses with pathologic ones may present with clinical signs ranging from exercise intolerance, to distress or collapse (Patteson, 1996). Electrocardiography is used as one of the most easy, accessible and noninvasive techniques for documenting and analyzing cardiac dysrhythmias (Robertson, 1990). Although several lead systems exist for recording an ECG, But a base apex system produces large, easy-to read complexes that are relatively unaffected by movement artifact (Menzie-Gow, 2001).

Although the prevalence of cardiac dysrhythmias were studied in some breeds of horse, but there is a few similar studies in Arab horses and there is not any studies in Khuzestan-Arab horses. The objective of this study was to determine the prevalence of cardiac dysrhythmias in Khuzestan-Arab horses that is reared in southwest of Iran.

## MATERIALS AND METHODS

This study was performed on 105 registerated (having pedigree) Khozestan-Arab horses (female: 60% and male: 40%), between 1 and 30 years old of age (mean±SD: 7.74±6.65) and in apparent good health.

The animals had been kept in six horse riding schools in covered stables. They are feeded most occasionally with straw, barley, bran, supplemental feeds and infrequently alfa alfa hays and corn.

At first, it was taken a complete history consist of age, sex, pregnancy status in mares, kind of using with performance history, general health considerations i.e., vaccination, worming, previous diseases and their treatment if any. Also, questioning about clinical signs which may be seen in animals with cardiac diseases, especially signs of CHF was considered.

**Corresponding Author:** A. Taghavi Razavizadeh, Department of Clinical Science, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Azadi Square, Mashhad, Iran
Tel: +985118647581, +989155068879 Fax: +985118763852

In the second step, a complete general clinical examination, include; taking the rectal temperature, determination of respiratory and pulse rate and examination of large intestinal movements were performed. Also, mucus membrane colour and Capillary Refill Time (CRT) were assessed and recorded. Careful auscultation of rate and rhythm of the heart was the most important part of this examination. After ensuring the health of the horses, the ECGs were obtained in a quiet state.

The ECGs were usually recorded in the morning between 7 to 10 and in a standing position in a stock without any tranqulizer, sedative and twitching by a single channel battery driven apparatus (Fukuda, Japan). Alligator type of electrode was used for this recording. A bipolar base apex lead system with the paper speed of 25 mm $sec^{-1}$ and sensitivity of 10 mm $mv^{-1}$ or 5 mv $mv^{-1}$ was considered (the standard deflection used is 10 mm $mv^{-1}$, but 5 mm $mv^{-1}$ may be preferable in order to fit large QRS complexes on to the paper) (Menzie-Gow, 2001).

After cleaning of the area with alcohol and applying ECG jelly, the left arm (positive) electrode was attached to the skin just behind the left elbow over the area of the apex beat and the right arm (negative) electrode to the left jugular furrow two-third of the way down the neck. The ground electrode was attached at a site remote from the heart and lead 1 is selected on the recorder (Robinson, 2003).

Then, the electrocardiograms were evaluated carefully according to the criteria of normal cardiac rhythm (Radostits *et al*., 2000).

For differentiation between physiologic and pathologic dysrhythmia, all the horses affected with cardiac dysrhythmias except for those with sinus tachycardia were given a light exercise and the ECGs were recorded again.

The horses were divided into 2 sexes and 3 age groups (0-4, 4-8 and more than 8 years old).

Also, on the basis of kind of use, the horses were divided into 2 groups: racing horses (course or endurance) and others which were not used in competitions (breeding horses, pregnant mares, foals, etc). The history revealed that 49 out of 105 horses (46.67%) had been acquired athletic degrees and 14 out of them were trained for presence in competitions at the time of this study.

By using of SPSS software version 10, analysis variance, tuckey test, independent samples t-test and chi-square were used for statistical analysis.

## RESULTS

In general, eight different types of dysrhythmias were observed in 36.2% of total studied horses and some of them were occurred in combination with each other. The most prevalent dysrhythmias were sinus tachycardia, sinus arrhythmia and different kinds of heart blocks, respectively. Wandering pace maker combined with other dysrhythmias were also diagnosed in 18.1% of total horses.

The prevalence of cardiac dysrhythmias in different sexes and age groups is summarized in Table 1 and 2. Although the prevalence of cardiac dysrhthmias in the mares (38.1%) was slightly higher than stallions (33.3%), but there was not a significant difference between them ($p>0.05$). Also, the frequency of cardiac dysrhythmias in horses of 4 to 8 years old (group 2) was higher than two other age groups (group 1: 34.4%, group 2: 44.7%, group 3: 28.6%), but there were not significant differences between them, too ($p>0.05$).

Table 1: Frequency of cardiac dysrhythmias in 2 sexes

| | Females | | Males | | Total | |
|---|---|---|---|---|---|---|
| Rhythm | No. | Frequency (%) | No. | Frequency (%) | No. | Frequency (%) |
| Regular | 39 | 61.90 | 28 | 66.66 | 67 | 63.80 |
| ST | 9 | 14.28 | 1 | 2.38 | 10 | 9.53 |
| SA | 5 | 7.94 | 2 | 4.76 | 7 | 6.67 |
| SA+ SAB | - | - | 3 | 7.15 | 3 | 2.86 |
| SA+ $AVB_1$ | 3 | 4.76 | - | - | 3 | 2.86 |
| SA+ APC | - | - | 3 | 7.15 | 3 | 2.86 |
| $AVB_1$ | 2 | 3.17 | 1 | 2.38 | 3 | 2.86 |
| SA+ $AVB_2$ | 1 | 1.59 | 1 | 2.38 | 2 | 1.90 |
| $AVB_2$ | 1 | 1.59 | 1 | 2.38 | 2 | 1.90 |
| SA+ SAr+ SB | 1 | 1.59 | 1 | 2.38 | 2 | 1.90 |
| SA+ SAr | 1 | 1.59 | 1 | 2.38 | 2 | 1.90 |
| APC | 1 | 1.59 | - | - | 1 | 0.96 |
| Total | 63 | 100.00 | 42 | 100.00 | 105 | 100.00 |

ST: Sinus tachycardia, SA: Sinus arrhythmia, SB: Sinus bradycardia. SAB: Sinoatrial block, SAr: Sinoatrial arrest. $AVB_1$: First degree atrioventricular block. $AVB_2$: Second degree atrioventricular block. APC: Atrial premature complexes

Table 2: Frequency of cardiac dysrhythmias in different age groups

| | Age group | | | | | |
|---|---|---|---|---|---|---|
| | 1 (0-4) | | 2 (4-8) | | 3 (>8 years old) | |
| Rhythm | No. | Frequency (%) | No. | Frequency (%) | No. | Frequency (%) |
| Regular | 21 | 65.63 | 21 | 55.27 | 25 | 71.42 |
| ST | 6 | 18.76 | 4 | 10.53 | - | - |
| SA | - | - | 5 | 13.16 | 2 | 5.71 |
| SA+ SAB | - | - | 2 | 5.26 | 1 | 2.86 |
| SA+ $AVB_1$ | - | - | 1 | 2.63 | 2 | 5.71 |
| SA+ APC | 1 | 3.12 | 1 | 2.63 | 1 | 2.86 |
| $AVB_1$ | 2 | 6.25 | 1 | 2.63 | - | - |
| SA+ $AVB_2$ | 1 | 3.12 | - | - | 1 | 2.86 |
| $AVB_2$ | - | - | 2 | 5.26 | - | - |
| SA+ SAr+ SB | - | - | 1 | 2.63 | 1 | 2.86 |
| SA+ SAr | 1 | 3.12 | - | - | 1 | 2.86 |
| APC | - | - | - | - | 1 | 2.86 |
| Total | 32 | 100.00 | 38 | 100.00 | 35 | 100.00 |

ST: Sinus tachycardia, SA: Sinus arrhythmia, SB: Sinus bradycardia, SAB: Sinoatrial block, SAr: Sinoatrial arrest, $AVB_1$: First degree atrioventricular block, $AVB_2$: Second degree atrioventricular block, APC: Atrial premature complexes

Some types of dysrhythmias were observed in fifteen out of 49 horses with athletic degrees (30.61%).

After exercise, dysrhythmias returned to normal sinus rhythm in 85.7% of horses that showed cardiac dysrhythmia but cardiac dysrhythmias were not disappeared in 1, 1 and 2 horses affected with SA, SA+SAR and APC, respectively.

The relationship between sex, age and kind of use with the heart rate were also investigated. The division of studied groups was similar to the previous, only in age groups, in order to discriminate foals from older horses; the animals were divided in to 5 age groups (<1.5, 1.5-4, 4-8, 8-12 and more than 12 years old).

The results showed that, the mean heart rate in all studied horses was 43.02±8.27 bpm at the time of rest (normal range: 28-44 bpm) [19, 17]. The mean heart rate in the mares (47.16±12.41 bpm) and the horses less than 1.5 years old (62±23.25 bpm) were significantly higher than stallions (40.43±8.00 bpm) and other age groups, respectively ($p<0.05$), there were no significant differences between other age groups.

## DISCUSSION

Cardiac dysrhythmias are disturbance in heart rate, rhythm or conduction (Reed *et al*., 1998). Physiological dysrhythmias such as sinus arrhythmia, sinoatrial block, first and second degree atrioventricular block and wandering pacemaker can occur in the absence of heart disease, as a result of excess vagal tone. If these dysrhythmias are abolished by exercise and if there is no evidence of cardiac insufficiency, they are not of pathological significance (Rezakhani *et al*., 2005)

In the present study, a heart rate higher than 60 bpm was considered as tachycardia and lower than 24 bpm as bradycardia (Patteson, 1996). The mean heart rate in 10 horses with sinus tachycardia was estimated 73.6±10.23 bpm (Fig. 1). Although any attempts were made to minimize the stress, but positioning of the horses in stock (not in it's own environment), presence of unknown persons in that place and also pain result from attaching alligator electrodes to the skin were stressor factors (Patteson, 1996). Because of absence of clinical cardiac signs and existence of stressor factors which increase sympathetic discharge, we believe that high frequency of sinus tachycardia and mean heart rate are physiological (Rezakhani *et al*., 2004).

Sinus bradycardia is a rare dysrhythmia that can be associated with high vagal tone, myocardial depression and electrolyte disturbance (Patteson, 1996). We observed it in combination with other dysrhythmias (sinus arrhythmia and wandering pacemaker).

First degree A.V block is diagnosed on the basis of prolongation of the P-R interval (>0.5 sec) (Rezakhani *et al*., 2005). These dysrhythmias have no pathological significance and disappear when the heart rate increases (Rose and Hodgson, 1996). We observe it in 5.71% of the studied horses. Occurrence of heart blocks associated with sinus arrhythmia is completely normal in horse, because, blood pressure variations result in waxing and waning of vagal tone and therefore it plays a role in disturbance of cardiac rhythm (Marr, 1999).

Second degree AV block is nearly always a normal haemostatic mechanism which is involved in the control of blood pressure (Fig. 2). We recorded this dysrhythmia in 2.86% of total horses (merely or in combination with sinus arrhythmia) that is lower than other reports (12-18%) (Reed and Bayly, 1998). Stewart *et al*. (1983) also reported it with lower incidence (5.4%). Most researchers believe that the percentage of animals with second degree A.V block has been probably higher than reported because, horses are naturally wary of auscultation or the use of an ECG. It has been detected in up to 44% of normal horses with 24 h continuous electrocardiographic monitoring. This dysrhythmia is most common in fit race horses (high performance animals) (Reed, 1998). Therefore, in present study, low training of horses may be involved in decreasing frequency of this dysrhythmia (only 13.3% of horses were trained at the time of this study).

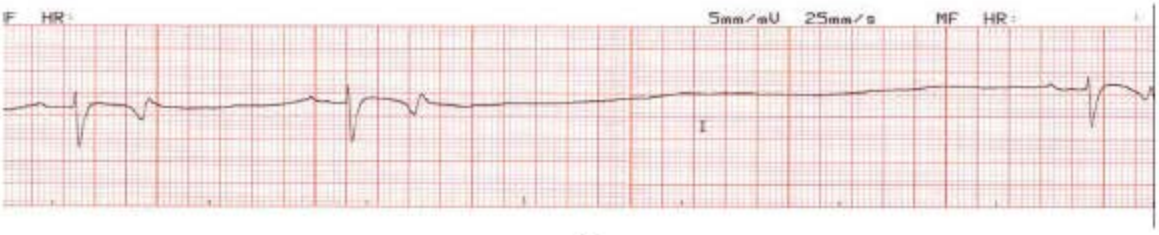
Fregin (1989) evaluated the ECGs obtained from 40 healthy thoroughbred and 40 standardbred horses. He detected incomplete atrioventricular block only in thoroughbred. (15%) and wandering pacemaker almost equally in both breeds (30%).

Horses with sinoatrial block or arrest have a slow heart rate with pause less than or equal (block) or greater than (arrest) two normal R-R or P-P intervals (Fig. 3). Sinoatrial block or arrest is not uncommon in horses (Menzies-Gow, 2001). Sinoatrial block is recorded in about 8% of healthy horses (Smertzer *et al*., 1969).

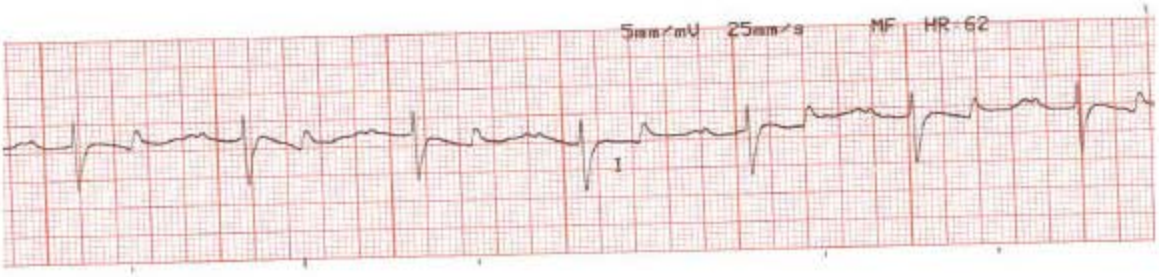
Occasional APCs are sometimes found in apparently normal horses but, Frequent APCs can be a sign of myocardial disease, electrolyte imbalance, hypokalemia, infections, hypoxia, anemia or chronic valvular disease (Patteson, 1996). According to the history, poor nutritional management was evidence in almost all these riding schools. The amount of forage in their diet was very low or occasionally absent for a long time (because of financial limits), where as, we know hay is rich in potassium and this electrolyte is important in cardiac function (Marr, 1999). Therefore, measurement of plasma electrolyte is advisable. The one horse that showed Atrial Premature Complexes (APC), was very old (30 years old), therefore myocardial or valvular diseases may be present in this horse.


Fig. 1: Base apex ECG from a 2-year-old filly with sinus tachycardia (H.R: 110 bpm)


Fig. 2: Base apex ECG from a 3-year-old stallion with second degree atrioventricular block (the third P wave is not followed by a QRS complex




(a)




(b)

Fig. 3: Base apex ECG from a 24-year-old mare before (A) and after (B) exercise, A; sinoatrial arrest (the second QRS complex is followed by a pause which is greater than two normal R-R interval), B; return to normal sinus rhythm

Atrial fibrillation is observed in apparently athletic horses due to their high resting vagal tone and low heart rate together with large atrial mass (Reentry phenomenon) (Kuwahara *et al*., 1997). This dysrythmia is commonly found in some breeds of horse (usually in large size horses under hard training) such as standardbred horse, but we could not detect it in this study (Mc Ewan, 2002). Therefore, absence of atrial fibrillation in studied horses may be due to not using of maximum ability of horses in competitions. In Iran, the horses usually compete in a distance of 1250-1750 m where as, in other countries a distance of about 4000 m is considered. In addition, the small size of Khozestan-Arab horse in comparison with some other breeds should be considered (Patteson, 1996).

## CONCLUSION

In this study many cardiac dysrhythmias were functional with no danger for horses and their jockeys

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