

SINUS BRADYCARDIA IN A HORSEA. Rezakhani, M. Goodarzi and M. R. Mokhber-Dezfully¹

*Department of Clinical Studies, School of Veterinary Medicine, Shiraz University,
P.O. Box 1731, Shiraz 71345, Iran, ¹Department of Clinical Studies,
School of Veterinary Medicine, Tehran University, Tehran, Iran*

HISTORY AND CLINICAL FINDINGS

During a routine check up examination on a group of horses of a riding school in Shiraz, Iran, a 4-year old Arubian horse was observed to have very slow heart rate, in the range of 16 to 18 beats per minute, (bpm) on auscultation. A base apex electrocardiogram (ECG) was recorded (using Cardiostat 701, Siemens, Germany) to determine the type of arrhythmia causing bradycardia. At the time of ECG recording, the horse was normal with no apparent sign of any disorder, and respiratory movements and body temperature were in normal range. The horse was given a light exercise and examined immediately after the exercise and for 15 minutes thereafter. The heart rate increased to 80 beats per minute by light exercise but returned to pre-exercise rate 5 minutes after the end of exercise.

Electrocardiogram

Two traces of continuous ECG were recorded on a paper speed of 25 mm/sec and calibration of 5 mm for 1 mV (Fig. 1). Application of the criteria of a normal rhythm showed that the R-R intervals were not regular, indicating concomitant sinus arrhythmia. All the P waves and the QRS complexes were of the same shape and normal, so the conduction of each impulse in the atria and the ventricles was in normal pathway. Each P wave had a QRS and the P-R interval was about 0.27 seconds, which was in normal limit for an adult horse. Measuring the heart rate on the ECG showed that it was about 16 to 18 bpm, which is lower than the minimum normal heart rate of horses; therefore it was taken as a sinus bradycardia.

DISCUSSION

The normal resting heart rate of horses reported in the literature is in the range of 22 to 50 beats per minute (Hilwig, 1977; McGuirk and Muir, 1985; Patteson, 1996; Speirs, 1997; Radostits *et al.*, 2002). The mean heart rates for adult, Standardbred and Thoroughbred have been reported as 34, 35 and 36 bpm, respectively (Fregin, 1985). There is no general

agreement that which heart rate should be taken as sinus bradycardia but in general, heart rate lower than 24 could be accepted as sinus bradycardia.

Sinus bradycardia has been classified as a vagally mediated arrhythmia in the horse (Miller, 1988), although Patteson (1996) believes that it is a pathological cardiac irregularity in horses. Although sinus bradycardia has been described in veterinary textbooks but its occurrence is very uncommon (Wintzer, 1986; Patteson, 1996). A slow heart rate (less than 24 bpm) may occur in other conditions such as sinoatrial block (SAB), sinus arrest, advanced sinus arrhythmia, second and third degree atrioventricular block (AVB) and specially in high grade AVB.

In normal animals heart rate is controlled by a balance between sympathetic and parasympathetic efferent activities and by humoral catecholamines and body temperature. Research work carried out on different species of animals have revealed that in some animals parasympathetic activity in relation to arterial blood pressure is higher than others (Hamlin *et al.*, 1972; Matsui and Sugano, 1987). The horse is an athletic animal so physiological hypertrophy of the myocardium is very common, therefore, the stroke volume and consequently the cardiac output and arterial blood pressure are higher than in animals like small ruminants and the dog. Because of this, waxing and waning of blood pressure, and as a result heart rate, due to alteration of parasympathetic efferent activity is more common in the horse than other species. Training has been shown to have a profound effect on autonomic nervous function in the horse, causing a decrease of heart rate as compared to non-trained horses (Ohmura *et al.*, 2002).

Bradycardia has been reported to develop in horses with different disease conditions such as myocardial depression, electrolyte disturbances, high cranial pressure, space-occupying lesion of the brain, malnutrition, jaundice and hypothyroidism (Detweiler and Patterson, 1972; Patteson, 1996; Radostits *et al.*, 2000). Excessive vagal tone and extreme fitness can also cause sinus bradycardia (Miller, 1988). In cattle vagus indigestion, polioencephalomalacia and food deprivation can decrease heart rate (McGuirk *et al.*, 1990). Some drugs such as phenothiazine tranquilizer,

Fig. 1: Traces A and B are continuous ECG recorded from a horse with a very low heart rate. ECG was recorded on a base apex lead with the paper speed of 25 mm/sec and calibration of 5 mm equal to one mV.

digoxin, β blockers, calcium channel blockers and lidocaine are all capable of causing sinus bradycardia (Radostits *et al.*, 2000). Sinus bradycardia should be differentiated clinically from other arrhythmias that cause slow heart rate such as SAB, second degree and complete AVB and rarely atrial fibrillation (AF). In AF, the rhythm is irregular, the fourth heart sound is not audible and there is variation in the strength of heart sounds. The SAB and 2nd degree AVB can be mistaken by sinus bradycardia only if every other heart beat is blocked either in the sinus node or in the atrioventricular node. In the latter, the fourth sound can be heard during long pauses but in SAB it would be difficult to differentiate even on the ECG.

On the ECG, differentiation of sinus bradycardia and second degree and complete AVB is not difficult as in the former there are more P waves than QRS complexes and the non blocked P waves are associated to the related QRS complexes with normal or longer P-R intervals. In third degree AVB, although the ventricular rate is slow but the shapes of QRS complexes are abnormal, as they usually originate from a focus in the ventricles. However, differentiation of a

sinus bradycardia from SAB with every other blocked impulse may not be easy.

The case presented here was a 4 year old Arab male horse without any clinical sign of any disorder. The horse was being trained almost every day and was a top jumper. The heart rate increased by light exercise to 80 beats per minute but returned to pre exercise rate 5 minutes after the end of exercise. This case can be considered as a functional sinus bradycardia with underlying sinus arrhythmia. However, the owner was instructed to check the performance of animal on a regular basis.

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