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Study on Normal Fractional Shortening of Dare Shuri Racehorse

[1]Aboozar Dehghan, [2]Ali Rezakhani, [1]Siavash Sharifi and [2]Mehdi Zarifi Kalyani
[1]Department of Clinical Science, School of Veterinary Medicine,
Islamic Azad University, Kazeroun Branch, Kazeroun, Iran
[2]Department of Clinical Science, School of Veterinary Medicine, Shiraz University, Shiraz, Iran

Abstract: Echocardiography has been used in veterinary medicine since 30 years ago and is used in horse and cow frequently. Fractional shortening is a particular value for evaluation of cardiomyopathy and left ventricle performance in echocardiography. This study was conducted to evaluate the echocardiography in Dare Shuri horse. Ten male and ten female horses (dare shuri breed) were examined clinically and electrocardiographically. The horses that were found healthy were examined echocardiographically. Echocardiography was performed using B.K. Medical machine (mini focus model) and 2-4 MHZ multi frequency phased array transducer. The horses were assessed by two-dimensional echocardiography (2-D) and M-mode echocardiography using standardized imaging planes. Mean values, standard deviations, 95% confidence interval for the means and 95% confidence interval for the cardiac parameters measured in the population were calculated. Furthermore, a general linear model was conducted considering sex, age and body weight of the horses as independent variables and the echocardiographic measurements as dependent variables. Multivariate linear regression analysis was performed with the level of significance at $p<0.05$ for all the null hypotheses. Reference ranges were established for 2 echocardiographic parameters including left ventricle internal diameter in systole and diastole and fractional shortening. Weak linear relationships between echocardiographic measurements and body weight were observed for fractional shortening. Linear regressions on these parameters were used to calculate the 95% confidence intervals for the predicted values. Age and sex were not showed significant regression with fractional shortening. The data collected in this study provide reference values for the evaluation of dare shuri racehorses. Most echocardiographic parameters and left ventricular measurement can not be affected significantly by body weight in this homogeneous population.

Key words: Dare shuri race horse, echocardiography, heart, fractional shortening, frequency, Iran

INTRODUCTION

Echocardiography is a non invasive, particular and available method to evaluate heart chamber and valves (Pipers and Hamlin, 1977). The knowledge of healthy equine echocardiographic parameters represents the basis for identification abnormal findings. Measurement of chamber dimensions is considered one of the most important tools for assessing heart disease (Zucca *et al*., 2008). Fractional shortening is a special value for evaluation of cardiomyopathy and left ventricle performance in echocardiography (Nautrup and Tobias, 2001). Dare shuri horse is very old breed in Iran and used in race, jump and work. Up to now there is not information about normaldare shuri horse echocardiographic parameters. Normal value ranges for several echocardiographic measurements have been reported forest and ardbreed race horse and ponies (Zucca *et al*., 2008).

The aim of the present study was to develop additional echocardiographic reference standards in a population of 20 healthy Dare shuri racehorses in training, identify important influences of weight, age or sex on left ventricle internal diameter in systole and diastole and fractional shortening and compare these data with those previously reported.

MATERIALS AND METHODS

The study evaluated 20 Dare shuri racehorses, 10 females and 10 males aged between 4 and 9 years old and mean of animals body weight was 331 kg. All horses were fully trained and in competition. The racing interval was approximately every 2 weeks. Physical examination was performed for each horse and heart rate, body temperature and respiratory rate recorded. Then electrocardiography examination for evaluate heart electrical function was

Corresponding Author: Aboozar Dehghan, Department of Clinical Science, School of Veterinary Medicine,
Islamic Azad University, Kazeroun Branch, Kazeroun, Iran

performed and normal horses were selected for echocardiographic study. Echocardiography were performed by using a B.K medical ultrasound machine with a multi frequency (2.5-5.5 MHz) phased array transducer. A simultaneous ECG was recorded for the correct timing of measurements within the cardiac cycle. End-diastolic measurements were taken at the onset of the QRS complex and end-systolic measurements were taken during the maximum excursion of the interventricular septum. All echocardiographic examinations were performed by the same operator and recorded by DVD recorder. Echocardiographic evaluation were performed using intracardiac landmarks to orient the transducer position in order to obtain standardised images according to the previously published methods by Reef *et al.* (1989). The two Dimensional (2D) images from right hemithorax were used to guide the placement of the cursor and obtain accurate M-mode recordings. The leading-edge toleading-edge method was used for all M-mode measurements.

Summary statistics including mean, standard deviation, 95% confidence interval for the mean and 95% confidence interval for the left ventricle internal diameter in systole and diastole and fractional shortening measured were calculated. To identify the influence of sex, age and body weight of the horses on the echocardiographic measures, a general linea rmodel was constructed using age, sex and weightas independent variables and echocardiographic measurements as dependent variables. Multiple linear regression analysis was performed withthe level of significance defined as $p<0.05$ for all the null hypotheses. When a significant linear relationship was identified, 95% confidence intervals for the predicted regression line were calculated. All the statistical analyses were performed using SPSS-v.15.0 for microsoft windows as the software tool.

RESULTS

In horses history no evidence of cardiovascular and respiratory systemdys function. On clinical examination, mean rectal temperature was 36.9°C (SD: 0.2°C), mean heart rate was 37 bit min^{-1} (SD: 4 bit min^{-1}) and abnormal heart sound were not detected. All horses showed normal morphology and movement of the cardiac chambers and valves in real time 2D echocardiography. The mean values, standard deviations, 95% confidence interval for the means and 95% confidence interval (reference range) for the measured and calculated variables are shown in Table 1.

Reference ranges were established for 2 echocardiographic parameters including left ventricle internal diameter in systole and diastole and fractional shortening.

Table 1: Mean of LVIDd, LVIDs, fractional shortening, age and body weight

Parameters	Mean	SD
LVIDd (cm)	9.10	0.22
LVIDs (cm)	5.83	0.47
FS (%)	35.88	4.58
Age (year)	6.45	1.48
Body weight (kg)	331.00	29.71

LVIDd: Left Ventricular Internal Diameter in diastole, LVIDs: Left Ventricular Internal Diameter in systole, FS: Fractional Shortening

Weak linear relationships between echocardiographic measurements and body weight were observed for fractional shortening ($R^2 = 0.293$, B = -0.575, t = -2.982 and p = 0.008). Linear regressions on these parameters were used to calculate the 95% confidence intervals for the predicted values. Age and sex were not showed significant regression with fractional shortening.

DISCUSSION

In this study the data were collected using intracardiac landmarks to orient the transducer position and obtain standardised images according to the methods described by Reef (1998), Long (1992) and Patteson (1999). Measurements of echocardiographic parameters in dogs arereportedly affected by body weight Lombard *et al.* (1984) and Kienle (1998) and age Sisson and Schaeffer (1991) ageand exercise training Wyatt and Mitchell (1974). Unlike dogs, variations in cardiac size among the different horse breeds have not been investigated comprehensively Long *et al.* (1992). A trend for echocardiographic dimensions to increase with body weight was found by Slater and Herrtage (1995) in a study group of ponies and horses (weight range 125e620 kg bwt) however, the researchers reported little or no linear correlation between any of the dimensions and body weight when the small pony, large pony and horse groups were considered individually Slater and Herrtage (1995). Bakos *et al.* (2002) found little or no linear correlation between cardiac dimensions and body weight in a group of 23 healthy standard breds weighing between 350 and 490 kg. In the study, in which body weight was measured with an equine weight scale, a weak but statistically significant linear correlation was observed between body weight and LVIDd and LVIDs. As in dogs, echocardiographic dimensions in young horses seem to be affected by age and reference ranges for cardiac dimensions in foals from birth to 3 months old have been published (Lombard *et al.*, 1984). These findings suggest that echocardiographic measurements in horses may be affected by breed, age (foals versus adult horses), athletic training and possibly by body weight Zucca *et al.* (2008), Kriz and Rose (1996, 2002), Kriz *et al.* (2000), Buhl *et al.* (2004, 2005), Bakos *et al.* (2002) and Reef *et al.* (1989).

CONCLUSION

In this study, it is concluded that the animal weight should be taken into account during echocardiography of horses and might explain small differences in values obtained from horses of different size. Differentiation between Dare shuri race horses fractional shortening with standard breed race horses in Zucca *et al.* (2008) study, acquired the Dare shuri race horse has poor performance compared to standard bred race horse in athletic function.

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