Case report: exercise-induced cardiac hypertrophy in a dog

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SUMMARY

Cardiac hypertrophy is a physiologic adaptive situation associated with intense sports training. In this case report, cardiac hypertrophy was detected in a military narcotic detector female American Cocker, 3 years old, by echocardiography and was associated with no clinical or functional signs of cardiac disease. Heart morphological changes associated dilatation of the left ventricular (increased diastolic and systolic left ventricle diameter) and increased thickness of the myocardial wall (increased diastolic and systolic interventricular septum and post wall). One month after exercise discontinuation, the echocardiographic parameters tended to return to normal values. These observations confirm that regular intense exercise may induce cardiac asymptomatic hypertrophy in dogs.

Keywords: Heart, dog, echocardiography, left ventricular hypertrophy, exercise, rest period.

Introduction

Healthy cardiac hypertrophy (physiologic hypertrophy or athlete’s heart) is defined as a physiological adaptation to functional and morphological changes taking place during vigorous exercise and pregnancy. Exercise not only overloads the heart but increases its workload overwhelmingly [5, 18, 28, 34, 35]. Physiologic hypertrophy develops during repeated routine workouts [31] and pregnancy in response to increased oxygen needs [14, 35].

Case report

In this case, a female American Cocker dog, 3 years old, 10.5 kg weight, and trained as narcotic detector, was brought to the Animal Hospital of the Faculty of the Veterinary Medicine of Afyon Kocatepe University, Afyon, Turkey for routine medical check-up. At the clinical examination, the body temperature was 38.7°C, the pulse and the respiratory rates were 75 beats per minute and 27 breaths per minute, respectively. The blood count, urinary analyses, and biochemical serum screening were normal (Table I).

The heart was found to be hypertrophic at cardiologic inspection [1] (figure 1). The anamnesis revealed that the dog exhibited no complaints reflecting a cardiac disease and was trained for 45 minutes daily, corresponding to a part of her training program for being a military narcotic detector. Physical examination disclosed neither cardiac arrhythmia at the heart nor murmur at the mitral area. Moreover, electrocardiographic (Esaote Mylab Five) findings were normal, although the accurate examination showed a narrowing in the left ventricular diameter during systole and diastole, and thickening of left ventricular wall in addition to systolic and diastolic interventricular septal thickness (Table II).

The dog was ordered to rest for a month in order to recover. A control echocardiographic examination was performed at the end of the rest period and showed that the heart wall, initially enlarged, was markedly reduced, the left ventricular diameter, initially reduced, was remarkably enlarged and these parameters returned to normal values or to closely related values (Table II). Furthermore, compared to weight-associated reference values [4], no change in the total heart size was observed during the one month period (figures 1A. and 1B).

Discussion

Major morphologic indications of healthy cardiac hypertrophy (physiologic hypertrophy or athlete’s heart) include decrease in ventricular diameter, thickness of ventricular septum, and enlargement of the left ventricular muscle mass [7, 12].
Several studies show that exercise augments the thickness of the left ventricular wall [19]; likewise, the cardiac musculature in race horses is shown to be thicker than that of normal horses [23]. Morphological changes taking place in the heart due to vigorous exercises (athlete’s heart) are clearly described in humans [29].

Studies in hardly trained athletes show a marked increase in the thickness of septal and ventricular walls [8, 21], a reduction in the left ventricle diameter and an enhanced cardiac muscle mass [22]. While the demanding and isotonic sports that require excessive volume load such as marathon runners and swimmers are stated to enhance the thickness of left ventricular wall through excessive volume load, the isotonic gyms that exert intermittent volume load such as wrestling and weightlifter increase wall thickness of the heart [2]. Echocardiographic findings of exercising and non-exercising dogs are illustrated to be similar to those of sportsmen [6, 16, 28].

The present study reports the case of cardiac hypertrophy in a military dog submitted to daily strenuous training exercises. The M-Mode echocardiographic examination performed on the presentation day revealed that the dimensions of the interventricular septum during diastole and systole (dIVS and sIVS, respectively) and the diastolic and systolic post wall thickness (dPW and sPW, respectively) were higher than weight-associated references [4], whereas the diameter of the left ventricle in diastole and systole (dLVD and SLVD, res-
pectively) were markedly depressed. By contrast, after a one month long rest period, the echocardiographic parameters returned to normal values or to values closely related.

Physiologic cardiac hypertrophy associated with exhausting training and exercises is also reported in dogs [5, 31, 34]. Nevertheless, the results of the studies regarding physiological [34], functional and morphological cardiac alterations related to arduous workouts in dogs are conflicting [5, 24, 25, 30, 32, 34]. The foremost echocardiographic finding of the physiologic cardiac hypertrophy in dogs is the presence of increased left ventricular mass (LVM) [24, 30, 34, 35]. Wyatt and Mitchell [34] regularly exercised dogs for 12 weeks and showed that the LVM was significantly increased in these animals. In rats exposed to heavy exercise regime for three months, echocardiographic assessments showed progressive increase in LVM according to time (8% after the 1st month, 12% after the 2nd months and 16% after the 3rd month) [3]. In the present case, the LVM was reduced to normal values in comparison to initial measurement (change rate in mass: -15.30%) after one month rest. Similar increases in the wall thickness of IVS and PW were also reported in cardiac hypertrophies [3]. It was previously reported that the thickness of the interventricular septum (IVS) was increased in diastole and systole after hard exercises [11]. Any forms of physiologic cardiac hypertrophies (left ventricular) are not harmful as long as a cardiac disease is not associated. Indeed, hypertrophy rapidly regresses at the end of the training periods [2, 6, 13, 15, 33]. In agreement, the wall thickness was markedly declined after the one month rest period in the present case and +41.86% and +27.90% increases in the left ventricular diameter during diastole and systole, respectively were recorded; these changes in echocardiographic measures before (during intense training) and after the rest period reveal that regular intense exercises has induced reduction in the left ventricular diameter and increase in myocardial thickness. Such findings, decreased left ventricular diameter and enlarged myocardial thickness, are also illustrated by KRIZ et al. [10]. Heavy exercises are generally shown to be associated with increased LVD [7, 15] although BARAUNA et al. [3] and YANG et al. [35] and reported no exercise-associated change in diastolic LVD. However, increased inner left ventricular diameter measured at the end of the diastole in sportsmen is shown to be pathologic and is thought to be associated with dilated cardiomyopathy [14].

On the other hand, the altered heart morphology was not associated with changes in the EF (ejection fraction) in the present case before and after the rest period. Similarly, no statistically significant difference is reported for the EF between athletes and control groups [8], and functional cardiac studies performed in dogs indicate that exercises do not lead to changes in EF [17, 31]. Besides, no sign of pathologic cardiac hypertrophy such as mitral regurgitation, narrowness at the exit of the left ventricle and chronic hypertension [20] was noticed in the present case.

Physiologic cardiac hypertrophy can occur in the dogs that are on a prolonged and regular exercise regimen and physical training program. In the present case of a military dog, the presence of cardiac hypertrophy was asymptomatic, demonstrated no clinical symptoms, and returned rapidly to normal.

\[ \text{Figure 1: Lateral and ventral radiographic views of the thorax of the female American Cocker dog, 3 years old, with cardiac hypertrophy on the presentation day (A.) and after a one month long rest (B.).} \]
after a rest period. Current observations indicate that cardiac hypertrophy can develop in trained or exercised dogs; therefore, these dogs should be regularly watched for potential cardiac problems and some preventive measures such as an adapted diet regimen including essential fatty acids [27] or inclusion of some agility exercises in the training program [26] have been already proposed in highly trained dogs.

References


