

PREVALENCE OF HYPERTROPHIC CARDIOMYOPATHY IN A POPULATION OF CATS IN UKRAINE

PREVALENȚA CARDIOMIOPATIEI HIPERTROFICE ÎN POPULAȚIILE DE PISICI DIN UCRAINA

O. KOSTIUK^{1),*}, M. TSVILIOVSKY¹⁾,
V. ENCIU^{2),*}, O. MELNYK¹⁾

ABSTRACT | REZUMAT

The prevalence of hypertrophic cardiomyopathy (HCM) has been described previously in literature, but until now, no reports have been published describing the prevalence of the disease in Ukraine. The aim of this study was to evaluate the prevalence of HCM among asymptomatic and symptomatic cats, and to evaluate the prognosis and risk factors that may affect the death. Three hundred and fifteen cats of different breeds presented for routine HCM screening or because of signs of heart failure. The period of evaluations was from January 2016 to June 2019. Retrospective study in which all cats were screened for HCM by echocardiography. A total of 315 cats were examined, 110 females and 205 males, with a median age of 4.5 years (range 2-14 years). 103 cats had no clinical signs of heart disease. Forty-six cats (14%) were classified as HCM-positive, 9 (4%) as equivocal, 260 (82%) as HCM-negative. Male cats had higher occurrence of HCM (60%) compared with the females (40%) in HCM positive cats. The British shorthair cats in our population had a highest prevalence of HCM – 28%, domestic shorthair breeds had significantly lower prevalence – 7% and male sex predisposition. We strongly recommend echocardiographic screening every cat before the anaesthesia, and cats used for breeding.

Keywords: domestic shorthair cats, British shorthaired cats, interstitial oedema, interstitial pattern, lung field

Prevalența cardiomiopatiei hipertrofice (HCM) a fost descrisă anterior în literatură, dar până în prezent nu au fost publicate rapoarte care să descrie incidența acestei boli în Ucraina. Scopul acestui studiu a fost de a evalua prevalența HCM în rândul pisicilor asimptomatice și simptomatice și de a evalua prognosticul și factorii de risc care pot provoca decesul. Trei sute cincisprezece pisici de rase diferite au fost supuse screening-ului de rutina HCM sau din cauza unor semne de insuficiența cardiacă. Perioada de evaluare a fost din ianuarie 2016 până în iunie 2019. S-a realizat un studiu retrospectiv în care toate pisicile au fost testate pentru HCM prin ecocardiografie. Au fost examinate în total 315 pisici, 110 de sex feminin și 205 de sex masculin, cu o vârstă medie de 4,5 ani (intervalul 2 - 14 ani). 103 pisici nu aveau semne clinice de boală cardiacă. Patruzeci și șase pisici (14%) au fost clasificate ca HCM – pozitive, 9 (4%) ca echivalente, 260 (82%) ca HCM-negative. Masculii au prezentat mai mult HCM (60%) comparativ cu femelele (40%) la pisicile HCM- pozitive. Pisicile Britanice cu blana scurtă din populația cercetată de noi au avut prevalența cea mai mare a HCM – 28%, rasele locale cu păr scurt a avut o prevalență semnificativ mai mică – 7% și cu predispoziția masculină. Recomandăm cu fermitate screening-ul ecocardiografic la fiecare pisică înainte de anestezie și la pisicile folosite pentru reproducere.

Cuvinte cheie: pisici locale cu păr scurt, pisici Britanice cu păr scurt, edem interstițial, model interstițial, câmp pulmonar

Hypertrophic cardiomyopathy (HCM) is a primary disease of the myocardium, characterized by thickening of the left ventricle walls at the normal size of its cavity of the left ventricle, described by (4,5). The disease has is familial in humans. HCM is diagnosed in humans in 1 case per 500 in the adult population (8).

HCM in cats is the most common cardiomyopathy

in cats. Thus, HCM is 57.5 % among cats' cardiomyopathies according to some researchers (3). HCM was found in more than 15 % of healthy cats in another study (9). Data on the incidence of HCM in cats vary in different countries. At the same time, results on the incidence of the disease among cats in Ukraine are not available in the literature, although the prognosis and risk factors for cat death from HCM have been reported in some studies (1, 4, 13). Therefore, the objective of our work was to evaluate the prevalence of HCM among asymptomatic cats, and to evaluate the prognosis and risk factors that may affect the death of ani-

1) National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine

2) Agrarian State University of Moldova, Chișinău, Republic of Moldova

*) Corresponding author: kostiukelena@gmail.com; enciu@bk.ru

mals with symptoms of cardiovascular failure.

MATERIALS AND METHODS

The study was retrospective, during which the records from the electronic database of the network of veterinary clinics ZOOLUX (City of Kyiv) were evaluated for the period from January 2016 to June 2019. Cats from 2 to 14 years of age who had a cardiac diagnosis were selected, or the owners of the animals visited clinic for a scheduled ultrasound examination of the heart (EchoCG) or for signs of heart failure in the animals. An echocardiography was carried out by one operator. The exams were carried out using an ESAO TE MyLab 70 and a Mindray DC7, with 7.5–10 MHz sensors. Animals were kept on the table in the lateral position, without the use of medical fixation devices. All records were retained manually in the storage space of the apparatus, and then we analysed the data obtained. All cats were divided into several groups: positive for hypertrophic cardiomyopathy, negative for hypertrophic cardiomyopathy, with suspected hypertrophic cardiomyopathy. Other types of myocardial disease were not analysed.

Further, we analysed the EchoCG recordings and chest X-ray images of animals (if available). Basic measurements of the size of the left and right cardiac chambers were performed during the ultrasound examination and the evaluation of diastolic and systolic functions was performed. The image quality was high. The recording of each view must include at least four heart cycles for qualitative measurement.

The size of the left ventricle in the short axis, in the right parasternal view, as well as left atrium - aorta width ratio (LA/Ao) should be included in the exam record. Measurements of transmitral flow using Doppler imaging, time of isovolumic relaxation, tissue Doppler were used to evaluate diastolic function.

Left ventricular hypertrophy was confirmed if the thickness of the interventricular septum and/or the left ventricular posterior wall exceeded 6 mm when measured in late diastole (3). The size of the left atrium was evaluated in the long axis (normal range is up to 16 mm) and in the short axis at the level of the aorta (right parasternal access). Aorta-to-atrium width ratio should not exceed 1,5 (2). X-ray images were taken using an Agfa CR 30-X digitizer. The images were evaluated in frontal and/or right lateral view.

All data were stored in the electronic veterinary database of E-note. Each medical record was reviewed and the age, sex, breed of animals, date and time of the exam were evaluated. The records also contained data on heart rate, respiratory rate, heart murmur, arrhythmia or cantering rhythm. The clinical status of each cat was also evaluated.

All cats were classified as “asymptomatic” and

“with signs of congestive heart failure” due to heart disease according to the data obtained. Characteristic signs of congestion in the lungs were: open mouth breathing, increased respiratory rate above 50 breathing movements per minute, loss of consciousness, signs of thromboembolism.

Drugs prescribed by the veterinary physicians in the clinical settings were record and retained in an E-note database. The percentage of survival of animals and the time to discharge from the in-patient department for long-term out-patient treatment were evaluated separately.

RESULTS AND DISCUSSIONS

Experimental animals

An echocardiographic exam of 315 cats whose owners visited the clinic for complaints of dyspnoea or for a routine check-up was conducted from January 2016 to June 2019. All cats were domestic and had owners. 65 % (205) male cats and 35 % (110) female cats were examined. The average age of the animals was 4.5 years (from 2 to 14 years), the average body weight was 4.2 kg (from 2.2 to 8.3 kg).

Clinical check-up data

45 animals (14 %) had changes during auscultation —systolic murmur (35 cats) and cantering rhythm (10 cats). Changes during the check-up were observed in both asymptomatic cats and in cats with clinical signs.

The experimental groups (Fig. 1) included cats of different breeds: British and Scottish fold (n = 157), domestic shorthair (n = 131), Bengali (n = 15), Maine Coon (n = 6), and sphinx (n = 6).

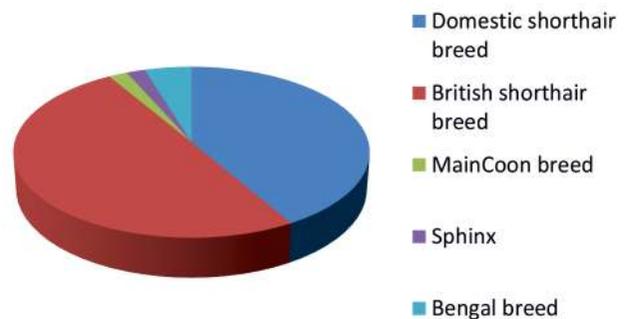


Fig. 1. Breeds of cats presented in the group of experimental animals

Prevalence of HCM in a population of cats with the symptoms of heart failure

The owners of 36 cats visited the clinic with complaints of dyspnoea and poor general condition of the animals. Out of them, 16 animals (46 %) died.

The owners of 10 cats complained of decreased mobility, pelvic ataxia and sudden paraparesis. These

cats were diagnosed with complete or partial abdominal aortic thromboembolism. Animal mortality in this group was much higher – 80 %. All animals showed signs of cardiomyopathy during EchoCG.

Overall prevalence of HCM in the domestic cat population. Hypertrophic cardiomyopathy was diagnosed in 46 experimental animals (14 %). Nine healthy cats (4%) were suspected of having hypertrophic cardiomyopathy during EchoCG. A significant proportion were males – 60 % (Fig. 2) in the group of animals with signs of HCM. 2).

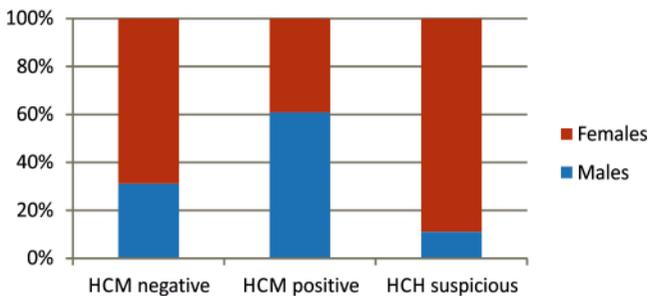


Fig. 2. Distribution of animals by sex among healthy (n=260), HCM cats (n=46) and suspected cats (n=9)

The most represented breeds were British fold and domestic shorthair. We analysed separately the prevalence of hypertrophic cardiomyopathy in animals of different breeds. It turned out that the disease is much more common among British fold cats and is 24 %, (Fig. 3).

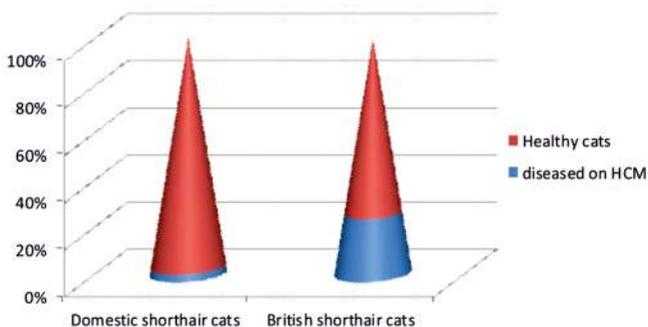


Fig. 3. Prevalence of hypertrophic cardiomyopathy in British fold cats and domestic shorthair cats

Features of echocardiographic changes in cats with hypertrophic cardiomyopathy

The most common abnormality was symmetric left ventricular wall hypertrophy, which was diagnosed in 82 % of cases with confirmed diagnosis of hypertrophic cardiomyopathy (n=37). Local changes, or asymmetric lesions of the interventricular septum, or left ventricular posterior were observed in the rest of the animals. Twenty-six cats (21%) had dynamic obstruction of the left ventricular outflow tract, and two cats had papillary hypertrophy. The left atrium is enlarged

in most cats. In addition, we noted that animals with more severe hypertrophy were more likely to have signs of heart failure. Left atrium-to-aorta width ratio was greater in the group of animals that had symptoms of heart disease. The evaluation of the left atrium was performed in both long and short axes (Table. 1).

The age of healthy cats and cats with chronic heart failure (CHF) also differed. Thus, the mean age of sick animals averaged 6.9 ± 0.94 years, whereas the mean age of animals without CHF symptoms was 4.8 ± 0.74 years.

Evaluation of cats without symptoms of heart failure and their owners visited the clinic for routine ultrasound exam of the animal's heart

One hundred and three animals did not show disease symptoms from the total number of cats tested (315 animals). Most of them belonged to the groups "negative for HCM" and "suspected of HCM".

The prevalence of hypertrophic cardiomyopathy among British fold cats was 18%, while the prevalence of HCM was much lower – 7 % among domestic shorthair cats. Cats with 5.5-6 mm interventricular septum values or papillary muscle hypertrophy were included in the group of patients suspected of HCM during routine exams. This was not registered in most cats.

In this study, we have found that the majority of cats with signs of heart failure belonged to the breed of British fold (36 animals) among animals whose owners visited the clinic. Heart disease was found in 14 % of cats of the total number of animals tested. The parameter we obtain exceeds previous data (1, 10). Most likely, this is due to our evaluation of not only asymptomatic animals but also animals with signs of heart disease.

This study is the first in Ukraine to describe the overall prevalence of hypertrophic cardiomyopathy among cats whose owners visited the clinic for signs of heart failure in these animals and among cats that have no symptoms of heart disease. Similar studies have been conducted among Maine Coon and British fold cats in different countries (6). The prevalence of the disease among Maine Coon cats is also much higher. But the number of Maine Coon cats was very small (6 animals) in the animal population we studied, so the data cannot be considered reliable.

The nature of cardiac hypertrophy can be different and often depends on the breed of cats. Hypertrophy in Maine Coon cats is not symmetrical and commonly affects the left ventricular posterior wall (6).

In our study, we have noted that hypertrophy had a more symmetrical course in British fold cats, and lesions were noted in the interventricular septum and the left ventricular posterior wall. It should also be noted that extra chords in the lumen of the left ventricle are commonly found in British fold cats.

Table 1
EchoCG data that had an effect on clinical signs in cats with hypertrophic cardiomyopathy, M±m

ECHO variables	Healthy animals n= 103	Diseased cats, n =203	p
LA in long axis view, mm	13,78±0,41	16,7±0,8*	<0,01
LA in short axis view, mm	11,05±0,37	15,4±1,09*	<0,01
IVSd, mm	4,18±0,2	6,24±0,4**	<0,001
LVWd, mm	4,0±0,23	6,27±0,39**	<0,001
LA/Ao, mm	1,34±0,22	1,99±0,41	

Note: *p ≤ 0.01, **p ≤ 0.001 compared to clinically healthy cats

Systolic murmur in the heart was detected during a clinical check-up of cats (45 animals) in our study. We examined separately animals in this group and found that heart murmur was absent in 40 % of cats with signs of heart failure, whereas gallop rhythm always indicated heart disease (hypertrophic cardiomyopathy), which was confirmed by ultrasound. The cause of auscultation murmur, in addition to heart disease, may be dynamic obstruction of the right ventricular outflow tract (12).

Thus, it can be concluded that cardiac murmur does not always mean the presence of heart disease. This feature was previously noted in the literature (12). However, the appearance of a gallop rhythm indicates a decrease in myocardial elasticity and often accompanies cardiomyopathy with significant diastolic dysfunction (4).

We have identified parameters that can be used as prognostic factors when analysing EchoCG data. Cats with signs of heart failure had a relatively larger size of the left atrium and thicker walls of the left ventricle. This relationship is easy to explain because the greater the hypertrophy of the walls, the more severe the diastolic dysfunction. Increasing end-diastolic pressure in the left ventricle leads to increased pressure in the left atrium, which leads to signs of dyspnoea due to pulmonary oedema.

Secondary enlargement of the cavity of the left atrium leads to a decrease in the velocity of blood flow in the lumen and to microscopic disorders of the integrity of the atrial walls. These changes are the substrate for the formation of blood clots.

Therefore, it can be concluded that the overall prevalence of hypertrophic cardiomyopathy in cats in Ukraine does not exceed its prevalence in other countries. The problem is diagnosed most common in cats of British fold breed.

Cats of this breed are extremely vulnerable to genetically-caused heart defects.

As a result of our research, changes in EchoCG, such as a significant enlargement of the left atrium and thickening of the walls of the left ventricle, are at risk for heart failure in domestic cat.

CONCLUSIONS

The British shorthair cats in our population had a highest prevalence of HCM – 28%, domestic shorthair breeds had significantly lower prevalence – 7% and male sex predisposition.

We strongly recommend echocardiographic screening every cat before the anaesthesia, and cats used for breeding.

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