Echocardiographic screening of purebred cats: an overview from 2002 to 2005

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Summary

During the last 3 years, a total of 144 cats underwent echocardiographic screening at two investigational clinics before being admitted for breeding. The number of cats presented for that purpose has constantly increased. 8.3% of cats were diagnosed as having hypertrophic cardiomyopathy and 6.9% were diagnosed as suspicious. Male cats were more affected than females (9.4% vs 7.7%). In 4.2 of all presented cats, a congenital cardiac malformation was recognised, most often tricuspid valve dysplasia.

Keywords: cardiology, cardiomyopathy, congenital heart disease, cardiac screening, cat

Echokardiographische Vorsorgeuntersuchungen bei Zuchtkatzen: Ein Überblick von 2002 bis 2005

Während der letzten 3 Jahre wurden insgesamt 144 Katzen zur echokardiographischen Vorsorgeuntersuchung an zwei verschiedenen Kliniken vorgestellt. Die Anzahl der vorgestellten Katzen hat in dieser Zeit stetig zugenommen. Bei 8.3% der untersuchten Katzen wurde das Vorliegen einer hypertrophen Kardiomyopathie (HCM) diagnostiziert und 6.9% der untersuchten Katzen wurden als verdächtig für HCM bewertet. Männliche Tiere waren insgesamt häufiger betroffen als weibliche Tiere (9.4% vs 7.7%). In 4.2% aller vorgestellten Fälle konnte zudem eine angeborene Herzmissbildung festgestellt werden. Hierbei handelte es sich am häufigsten um eine Trikuspidaldysplasie.

Schlüsselwörter: Kardiologie, Kardiomypathie, angeborene Herzmissbildung, Zuchtuntersuchung, Katze

Introduction

Hypertrophic cardiomyopathy (HCM) is the most commonly diagnosed cardiac disease in cats, and its prevalence appears to be increasing. (Fox et al.,1995). A male predisposition for HCM is commonly reported in clinical studies, although in a study of Maine Coon cats, the incidence was the same in males and females. However, males often develop the disease at an earlier age and often develop more severe disease. Consequently, it is likely that the male predominance seen clinically is purely because males develop worse disease, not because they are more predisposed to the disease. (Fox et al., 1995)

The exact cause of feline HCM is unknown, although the disease is inheritable in some breeds. Approximately 50% are inherited in an autosomal pattern. Over 150 mutations in 10 genes that encode for sarcomeric proteins have been identified in human families with HCM. In Maine Coon cats, HCM is known to be inherited as an autosomal dominant trait. It is a progressive disease and HCM is not apparent during the first year of life but becomes apparent by 2 years of age in affected males. (Kittleson, 1996). Females tend to get the disease later, with most of them manifesting the disease by 3 years of age. Some may not show evidence of the disease until 6 to 7 years of age. Meurs et al. (2005) found a specific sarcomeric gene abnormality in Maine Coon cats and a genetic test has been developed for the diagnosis.

HCM has also been identified in a family of American shorthair cats. The disease in this breed also appears to be inherited as an autosomal dominant trait. In addition to these breeds, evidence of inheritance exists in numerous other breeds, including Persian, British shorthair, Norwegian forest cats, Ragdoll, Turkish van, and Scottish fold cats (Baty et al., 2001; Fujii et al., 2001; Nakagawa et al., 2002). However, HCM is most commonly identified in domestic (mixed breed) cats. Whether the disease is inherited in these cats is not known, although heritance has been suspected (Baty et al., 2001; Fujii et al., 2001; Nakagawa et al., 2002). HCM shows extreme intra-familial and inter-familial phenotypic variations. Much of

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the inter-familial variation is thought to be due to the effect of the different mutations segregating in different pedigrees (Blair, 2005). It is known that the Maine Coon breed has a more malignant disease, whereas the American shorthair breed usually has a more benign form. Ragdoll cats seem to have a particularly malignant form of the disease. The number of cats presented to the two participating referral institutions for cardiac screening prior to breeding has increased steadily over the last few years. The aim of the present study to investigate the prevalence of cardiac disease (congenital and acquired) in healthy breeding cats screened by echocardiography.

Animals, Material and Methods

The case records of cats that underwent cardiac screening prior to breeding at the Clinic for Small Animal Internal Medicine, University of Berne and Cabinet Vétérinaire Amberger-Philip in Geneva between January 2002 and October 2005 were reviewed retrospectively. Control examinations were excluded from the present study. Signalement (age, breed, and sex) and echocardiographic findings were investigated. The echocardiographic examination was performed with the cat in lateral recumbency over a cut-out in the examination table and images were obtained by scanning from beneath the patient (Boon, 1998). Two-dimensional echocardiographic parameters were measured following recommended standards (Thomas et al., 1993). M-mode parameters were measured by using the leading-edge to leading-edge method advocated by the American Society for Echocardiography (Sahn et al., 1978). According to Kittleson (2005), cardiomyopathies are classified as *hypertrophic cardiomyopathy (HCM),* dilated cardiomyopathy (DCM), restrictive cardiomyopathy (RCM), arrhythmogenic right ventricular cardiomyopathy (ARVC), unclassified cardiomyopathy (UCM) and specific cardiomyopathy (SCM). The following criteria were used for echocardiographic diagnosis of hypertrophic cardiomyopathy (HCM): Size of the interventricular septum and / or the left ventricular free wall thickness in diastole ≥ 6mm, in a two-dimensionally guided M-mode scanning obtained from the right parasternal short axis view of the left ventricle just above the papillary muscles, abnormal papillary muscle thickening and/or left atrial dilation (Fox et al., 1995).

Mitral valve dysplasia and *tricuspid valve dysplasia* were defined as malformations of the mitral resp tricuspid valve apparatus, including the valve leaflets, chordae tendinea, or papillary muscles, that resulted in valvular insufficiency. The interventricular septum was screened for defects on two-dimensional echocardiography and colour-flow Doppler echocardiography. *Ventricular septum defects* were diagnosed only if shunting blood flow was identified (Fox, 1995; Kittleson, 1996).

Results

Between January 2003 and October 2005, a total of 144 healthy cats of 5 different breeds (Maine Coon, Sphinx, British shorthair, Bengal and Norwegian forest cats) were presented for cardiac screening prior to breeding. Maine Coon cats were the most commonly presented breed. 63.6% of the examined cats were females, 36.4% were males. Signs of HCM were recognized in 12 of 144 cats (8.3%). Overall, males were more affected than females (9.4% vs 7.7%). Equivocal changes were found in 10 of the 144 cats (6.9%). A congenital defect was diagnosed in 6 of the 144 presented cats. This represents 4.2%. Three of 53 (5.67%) were males, and 3 of 91 (3.3%) were females. Tricuspid valve dysplasia was the most frequently diagnosed congenital defect. Other malformations incude mitral valve dysplasia and ventricular septum defect. In one cat of the present study an abnormal jet could be observed entering the left atrium at its dorsal aspect. The localisation and the high velocity was not typical for a normal pulmonary vein and therefore it was classified as a pulmonary shunting vessel. Regrettably, final diagnosis was not possible because the owner declined diagnostic cardiac catherisation. The results of the cardiac screenings are summarised in Table 1.

Discussion

Our study provides information about the relative frequency of congenital and myocardial heart diseases in healthy cats presented for screening prior to breeding. There are limitations to a study of retrospective nature depending highly on the quality of the echocardiographic examination, e.g. changes and expertise or level of training of the operator and changes in the equipment. Despite theses limitations, the present study provides valuable information to practitioners, cardiologists and breeders as well.

In this study, HCM represented the only form of feline cardiomyopathy. Evidence of HCM was only found in 2 of the 5 breeds presented for cardiac screening. Because of the small number of cats of the 3 other breeds, no conclusion about incidence of HCM should be drawn. In the overall evaluation of hypertrophic cardiomyopathies, males were more affected than females. This corresponds with the literature (Bright et al., 1992). We were able to document that HCM represents a problem in Maine Coon and Sphinx. Similar to previous breeder's reports in USA,

Table 1: Signalement (age, sex and breed) of 144 cats.

Signalement		**Maine Coon** (n=107)		**Sphinx** (n=20)		**British blue** (n=3)		**Bengal** (n=2)		**Norwegian** (n=12)	
Age (yrs)		Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Total		2.3	2.5	2.0	0.9	3.0	1.0	2.5	2.1	3.4	2.2
HCM		3.1	2.0	2.5	1.0						
Equivocal		1.9	0.7	2.0	1.0						
Sex		M	F	M	F	M	F	M	F	M	F
Total	N	39	68	7	13	1	2	0	2	6	6
	%	36.4	63.6	35.0	65.0	33.3	66.7	0.0	100	50.0	50.5
HCM	N	3	3	2	4						
	%	2.8	2.8	10.0	20.0						
Equivocal	N	2	7	0	3						
	%	1.9	6.5	0.0	15.0						
Cardiac findings		N	%	N	%	N	%	N	%	N	%
Normal		90	84.1	11	55.0	3	100.0	2	100.0	10	83.3
HCM		6	5.6	6	30.0						
Equivocal		7	6.5	3	15.0						
TV dysplasia		1	0.9							2	16.7
MV dysplasia		1	0.9								
Pulmonary shunt		1	0.9								
VSD		1	0.9								

HCM, hypertrophic cardiomyopathy; TV, tricuspid valve; MV, mitral valve; VSD, ventricular septal defect.

a high percentage of Sphinx cats also showed HCM. This problem is also known in France, Belgium and Germany. Our study found more congenital heart defects (4.2% vs 0.2–1%) than other studies reported in the literature (Oyama et al., 2005). Tricuspid valve dysplasia was the most frequently diagnosed congenital defect. In a study of healthy Maine Coon cats, almost 25% revealed mild tricuspid valve regurgitation (Drourr et al., 2005). As cited in the literature, male cats have more malformations than females (Oyama et al., 2005).

Examens de dépistage échocardiographiques chez les chats de races: restrospective de 2002 à 2005

Durant les 3 dernières années, 144 chats ont été présentés pour examens de dépistage échocardiographique dans deux cliniques différentes. Le nombre de chats présentés a augmenté régulièrement durant cette période. Une cardiomyopathie hypertrophique a été diagnostiquée chez 8.3 % des chats examinés et suspectée chez 6.9% d'entre eux. Les mâles étaient plus atteints que les femelles (9.4% contre 7.7%) Dans 4.2% des cas présentés, une malformation cardiaque a pu en outre être constatée. Il s'agissait le plus souvent d'une dysplasie de la tricuspide.

Esame ococardiografico preventivo nel gatti di allevamento: uno sguardo tra il 2002 il 2005

Negli ultimi 3 anni a 144 gatti è stato fatto un esame ecocardiografico preventivo in due differenti cliniche. Il numero dei gatti esaminati è aumentato di continuo. Nell'8.3% dei gatti esaminati si è diagnosticata una cardiomiopatia ipertrofica (HCM) e nel 6.9% vi è sospetto di HCM. Gli animali maschi erano globalmente più frequentemente colpiti delle femmine (9.4% / 7.7%). Nel 4.2% di tutti i casi presentati è stata costatata una malformazione congenita. In questo caso si tratta maggiormente di una displasia tricuspidale.

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