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Cardiomyopathy in Birman Cats

Prof. Virginia Luis Fuentes MA VetMB PhD CertVR DVC MRCVS DipECVIM (Cardiology)
Dr. Lois Wilkie BSc BVetMed (Hons) MRCVS
Jose Novo Matos DVM MRCVS DipECVIM (Cardiology)

What is cardiomyopathy?

Cardiomyopathy is a disease of the heart muscle. The most common form is **hypertrophic cardiomyopathy (HCM)**, where the walls of the heart are too thick. There are also other (much less common) forms of cardiomyopathy, such as **restrictive cardiomyopathy (RCM)**, where the walls of the heart are too stiff; **dilated cardiomyopathy (DCM)**, where the walls of the heart are too thin and pump function is reduced and **arrhythmogenic right ventricular cardiomyopathy (ARVC)**, where the right side of the heart may be replaced by fat and scar tissue.

It is currently not clear whether HCM, RCM, DCM and ARVC represent different diseases with different causes, or whether these cardiomyopathies are part of the spectrum of one disease with one genetic cause.

Results of phase one: phenotypic characterization of cardiomyopathy in Birmans

In the past 12 months, we have screened 69 Birmans for heart disease. The majority of cats were normal, but we have also diagnosed HCM and RCM. Heart murmurs were more common in Birmans than in some other cat breeds. However, over half the Birmans with a heart murmur did not have evidence of heart disease on echocardiography. **Heart murmurs are not always a reliable indicator of heart disease in cats**: murmurs are uncommon in Norwegian Forest cats even when they are affected with cardiomyopathy and murmurs are common in non-pedigree cats even when they are normal. Most cats screened were young, most commonly aged 2-3 years. However, the likelihood of detecting HCM increases with age and a single, normal echocardiogram does not guarantee the cat will remain free of HCM.

Nine Birmans have been submitted for pathological analysis and we have found evidence of different forms of cardiomyopathy, including HCM, RCM, DCM and ARVC in these cats. In humans, these types of cardiomyopathy are usually associated with different genetic mutations, but occasionally one genetic mutation can cause multiple types of cardiomyopathy.

Pedigree analysis has revealed families of Birmans that include cats with HCM and RCM and others with HCM, DCM and ARVC. It is possible that there is more than one mutation in these families, but it is also possible that one mutation in a Birman family can result in different types of cardiomyopathy.

We have also investigated whether blood tests (**cardiac biomarkers**) could help identify Birmans with heart disease. Levels of these cardiac biomarkers are increased in the bloodstream when the heart chamber walls are under strain (shown by the biomarker NT-proBNP) or when heart muscle cells are damaged (shown by the biomarker Troponin I). These biomarkers do not appear to be helpful in all breeds when screening for cardiomyopathy, but do appear to be helpful in Birmans. As there is an overlap in biomarker levels between healthy and affected cats, biomarkers will **not be reliable enough to act as the sole test in screening breeding cats**. Biomarkers may be useful however in determining which cats should be investigated further with echocardiography. Early diagnosis of more severely affected cats will allow cats to be started on treatment to reduce the risk

of blood clots (aortic thromboembolism, 'saddle thrombus'), which is a devastating and often fatal complication of cardiomyopathy.

Phase two: genotypic characterization of cardiomyopathy in Birmans

The next stage of our research will be looking for genetic differences in Birmans with cardiomyopathy compared with healthy Birmans. We will conduct genetic testing (targeted gene sequencing) on 18 genes associated with cardiomyopathy in humans in order to look for possible mutations that might be responsible for cardiomyopathy in Birmans. If a possible mutation is identified, we will then test a larger population of Birman cats that that have undergone echocardiography scans to establish whether they have cardiomyopathy or not. If successful, this would lead to a genetic test for cardiomyopathy in Birmans.

We have been storing samples for DNA from all screened cats, as well as those with severe heart disease. However, we still need to screen more cats that are 8 years or older with no history of heart disease in their relatives. We will use DNA from cats with a normal echocardiography scan at 8 years or older, with no family history of heart disease, to serve as our normal group. We would also like to screen greater numbers of severely affected cats. It is desirable for us to collect DNA samples from cats with the less common forms of cardiomyopathy (RCM, DCM and ARVC), as well as those with HCM.