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MANAGEMENT OF FELINE HEART DISEASE
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Myocardial disease is extremely common in cats, but innocent ‘functional’ murmurs are also common. The lack of clinical studies evaluating the effect of therapy in cats makes it difficult to know the best way to manage feline heart disease.

Feline cardiomyopathy is generally classified using the same categories as in human myocardial diseases, but pathological processes such as myocarditis or infarction may occur in any type of cardiomyopathy, often making it difficult to recognize the original form of myocardial disease. Secondary myocardial diseases include hyperthyroid myocardial disease and hypertensive myocardial disease.

Hypertrophic cardiomyopathy (HCM)
Is defined as idiopathic left ventricular hypertrophy (ie. not due to systemic hypertension, aortic stenosis or hyperthyroidism). HCM is by far the most common of feline myocardial diseases. Human HCM is predominantly associated with mutations in sarcomeric proteins, and as mutations in myosin binding protein C have been identified in Maine Coons & Ragdolls with HCM, it is likely that the etiology is genetic in cats too.

Pathophysiology
The combination of impaired ventricular relaxation and increased ventricular stiffness leads to diastolic dysfunction (increased atrial pressures, leading to congestive heart failure [CHF]).

Dynamic left ventricular (LV) outflow tract obstruction occurs in a high proportion of cats with HCM. This is usually caused by abnormal motion of the anterior mitral leaflet during systole (SAM) where the leaflet moves towards the outflow tract during ejection instead of co-aptting normally. This causes outflow tract obstruction & mitral regurgitation.

Presenting signs
Most cats are asymptomatic. A proportion of cats develop CHF, and an even smaller proportion of cats develop aortic thromboembolism.

Physical exam
Affected cats may have a variable intensity systolic murmur. This is very common in asymptomatic cats, but less common in cats with CHF. Gallop sounds are common with heart failure, and most cats will have a prominent apical impulse. Cats with CHF will be tachpnoeic, and some have crackles. Frustratingly, physical exam may be completely normal.

Radiography
Often apico-basilar length of the cardiac silhouette is increased. The appearance of pulmonary oedema is very variable in cats; some cats may have pleural effusion.

Echocardiography:
LV hypertrophy is defined as a diastolic septal or free wall thickness > 6mm (focal or generalized. Demonstration of systolic anterior motion (SAM) of the mitral valve is highly suspicious for HCM.
**Prognosis**
Asymptomatic cats may do well if the left atrium is normal size. The prognosis is much worse with CHF or aortic thromboembolism.

**Dilated cardiomyopathy (DCM)**
DCM is characterized by dilation of all four chambers, with thinning of the ventricular walls and hypokinesis (systolic dysfunction). Originally, DCM was associated with taurine deficiency. This is now uncommon, and most cats with have normal serum taurine levels. DCM is most common in middle-aged and older cats. They may present with low output heart failure, with hypotension, hypothermia and bradycardia. Murmurs are quiet or absent but a gallop may be present. Thromboembolic disease is common.

**Echocardiography:**
The LV is dilated and spherical, with a fractional shortening < 30%, and end-systolic diameter >12mm.
The prognosis is grave.

**Restrictive cardiomyopathy (RCM)**
This is characterized by severely impaired diastolic filling associated with a stiff LV and relatively normal LV dimensions and systolic function.

There are 2 types: an endomyocardial form (with severe endomyocardial scarring), and a myocardial form (with normal LV dimensions). There is severe atrial enlargement in both forms.

**Clinical presentation**
Typically older cats are affected. Dyspnoea from pleural effusion is common, and low output signs may be present. Cats are prone to aortic thromboembolism and arrhythmias.

**Arrhythmogenic right ventricular cardiomyopathy (ARVC)**
This has only recently been recognized in cats, and is characterized by fibrofatty infiltration of the right ventricle (RV). Affected cats may be asymptomatic, syncopal in association with arrhythmias, or may have right-sided CHF. Echocardiography shows severe right ventricular and right atrial dilation. Tricuspid regurgitation is usually present.

**TREATMENT OF FELINE HEART DISEASE**
Although there are a number of different forms of feline myocardial disease, therapeutic strategies may be dictated more by clinical signs and stage of disease than by aetiology.
**A. At risk cats**

Maine coons, Ragdolls etc may be at increased genetic risk of HCM, but MBPC mutation testing is ONLY VALID FOR MAINE COONS. Echocardiography provides a definitive diagnosis, and NT-proBNP can be considered as an initial screening test.

**B. Asymptomatic cats (HCM)**

This is very common, and the prognosis good if the left atrium is normal size. It is reasonable to leave this group UNTREATED, as there is no evidence that treatment helps. Atenolol may be beneficial for control of severe dynamic outflow tract obstruction. The long term benefit is not known.

**C. Past or present heart failure**

The acutely-decompensated cat

*Improve oxygenation*

Administer O₂: cats are small enough for oxygen cages to be practical. It may be helpful to sedate cats, as dyspnoeic cats often become very distressed (eg butorphanol 0.25mg/kg IM)

IV furosemide to effect: initial dose 2 mg/kg, with subsequent doses of 1-2mg/kg every 60 mins until respiratory rate decreases.

Thoracocentesis: Significant pleural effusions should be drained while causing minimal stress (generally with a butterfly cannula).

AVOID IV FLUIDS!! (Will not increase output, & will worsen CHF)

**Home treatment of CHF**

The aims of home therapy are to eliminate abnormal fluid retention, modulate neurohormonal activation, and prevent thromboembolism.

Oral furosemide: 1-4 mg/kg q12-24h PO. Titrate dose to eliminate pulmonary oedema, or until unacceptable azotaemia develops. Decrease dose once congestive signs cleared.

ACE inhibitor: Both benazepril (0.5 mg/kg q24h) and enalapril (0.5 mg/kg q24h) have been used. There is no evidence that abnormal hypertrophy is reversed in cats.

Negative inotropes may decrease dynamic outflow tract obstruction, but it is not known if this results in longterm benefit in cats.

Management of systemic thromboembolism
Arterial thromboembolism is a frustrating condition to treat, and the rate of survival to discharge is <45%. Analgesia is the most important aspect of treatment. Management of electrolyte and acid-base abnormalities can be challenging, and prevention of thrombus extension can be attempted with heparin. Pulses often return within 72 hours, though use of the limb usually takes longer – physiotherapy may be helpful. Thrombolysis is not usually attempted because of the risk of reperfusion syndrome

*Prevention of systemic thromboembolism*

Aspirin is the cheapest and safest (high dose: 40mg /cat q72h, or low dose: 5mg/cat q72h). Warfarin is extremely difficult to use (not recommended). Low-molecular weight heparins are costly, and must be given by subcutaneous injection. Studies are underway to investigate use of Clopidogrel.

**Further reading**
