Update on managing feline heart disease

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Classification

- Primary cardiomyopathies
  - Hypertrophic
  - Restrictive
  - Dilated
  - Unclassified

- Secondary cardiomyopathies
  - Metabolic
  - Infiltrative
  - Toxic
  - Inflammatory

Feline Murmurs

- Prevalence of heart murmurs in overtly normal cats ranges from 16-44%.
- Between 25% (Bonagura 2000) and 69% (Paige et al. 2009) of cats with murmurs on physical examination have no echocardiographic evidence of heart disease

Hypertrophic cardiomyopathy (HCM)

- The most common of the feline primary cardiomyopathies
- Etiology is uncertain, but it is inherited in some feline lines and a mutation has been identified in Maine coons and Rag dolls
- Causes of secondary left ventricular hypertrophy must be ruled out to diagnose a cat with HCM (thyrotoxicosis, systemic hypertension)
- Hypertrophic cardiomyopathy (HCM) is a primary myocardial disease that results in mild to severe thickening (concentric hypertrophy) of the left ventricle.
  - Global or regional

Clinical Manifestations- HCM

- Sex: Male > Female
- Breeds: Maine Coon, Ragdoll, Persian, American and British shorthair, Siberian, Norwegian forest cats, Scottish fold, Sphynx, Turkish Van, Himalayan, Birman
- Age: 6 months to 16 years (mean of 6 years)
- Approximately half of cats are asymptomatic and diagnosed incidentally
- Approximately half of cats diagnosed with heart failure secondary to HCM had a precipitating event

Clinical Manifestations-HCM

- Systolic murmurs (36-72% of cats)
- Gallop sound (33%)
- Dyspnea (35%)
- Syncope (4%)
- Other (not cardiac specific)
  - Lethargy
  - Anorexia/weight loss
  - Vomiting
HCM- genetic screening
- Inherited as an autosomal dominant trait with incomplete penetrance in the Maine coon and Ragdoll breeds
  - Disease apparent in most cats by 6 months to 2.5 years
- Inherited form of HCM has also been recognized in a family of American short hair cats, but pattern is less malignant than in the Maine coons
- > 15 mutations have been recognized in humans

HCM-pathophysiology
- Concentric hypertrophy results in diastolic dysfunction which may be exacerbated by myocardial fibrosis
- +/- systolic cavity obliteration and elevated LV filling pressure which leads to left atrial enlargement
- +/- systolic anterior motion of the mitral valve (SAM) and dynamic obstruction

HCM-pathology
- LV hypertrophy
- Often LA enlargement
- Myocardial ischemia due to arteriosclerosis
- Histopathology
  - Myocyte hypertrophy and disarray

HCM-diagnostics
- ECG
  - Evidence of LVH (tall R waves) or LA enlargement (tall P waves)
- Radiographs
  - Normal or left atrial enlargement or generalized cardiomegaly
- Echocardiography
  - Increased LV wall thickness
  - LA enlargement
  - Diastolic dysfunction on transmitral Doppler and tissue Doppler

Restrictive cardiomyopathy (RCM)
- This disease results in diastolic dysfunction secondary to endocardial, subendocardial or myocardial fibrosis or infiltrative disease
- Pathophysiologically similar to HCM since both result in diastolic dysfunction
- Elevated ventricular filling pressure leads to atrial enlargement
- There may be a component of systolic dysfunction, particularly late in the disease

RCM-pathology
- LA enlargement
- Diffuse or focal endocardial plaque
- +/- fibrous adhesions between the papillary muscles and myocardium, distorted chordae tendineae and mitral valve apparatus
- Endocardial/myocardial scar formation
**RCM-diagnostics**
- ECG- similar to HCM
- Radiographs- similar to HCM
- Echocardiography
  - Normal LV wall thickness
  - LA enlargement
  - +/- scarring or fibrosis of LV
  - Restrictive transmirtal filling pattern on Doppler
  - +/- Decreased systolic function (shortening fraction)

**Unclassified cardiomyopathy**
- Mixed aspects of various feline cardiomyopathies making strict categorization impossible
  - Normal wall thickness and systolic function
  - Restrictive filling pattern cannot be confirmed
  - Also called: intermediate or integrade cardiomyopathy

**Dilated cardiomyopathy (DCM)**
- Dilated heart with reduced systolic function
- Taurine deficient DCM is rarely diagnosed currently, although occasionally cats still respond to supplementation with taurine
- Abyssinian, Burmese and Siamese are over-represented

**DCM-pathology**
- Primary dysfunction is systolic with poor contractility, but diastolic dysfunction coexists
- Dilated heart with thin walls and secondary fibrosis

**DCM-diagnostics**
- ECG- +/- tall R waves; +/- arrhythmias
- Radiographs- normal heart size to cardiomegaly, congestive heart failure
- Echocardiography
  - Various findings depending on type of cardiomyopathy
  - Gold standard for diagnosis of cardiomyopathy type
  - Ancillary tests to rule out extra-cardiac cause of hypertrophy
    - Thyroid panel, systemic blood pressure, growth hormone
    - ntr-proBNP?
Screening test: Electrocardiography
- Poor accuracy for diagnosis of cardiomyopathy but test of choice for cats with arrhythmias
- Left ventricular hypertrophy pattern: R wave amplitude >0.9mV in lead II
- Left atrial enlargement pattern: Tall P waves
- Left axis deviation or “left anterior fascicular block” may be present in cats with HCM (10-33%), is not specific and can be seen in normal cats as well

Screening Test: Thoracic Radiographs

Vertebral Heart Size

Screening test: Echocardiography
- Echocardiography:
  - LV wall thickness
  - LV systolic function
  - LA enlargement
  - Diastolic function
  - Transmitral Doppler, LVIVRT, tissue Doppler
Echocardiography

- 2-D echocardiography
- Doppler echocardiography
  - Transmitral Doppler
  - Mitral Annular tissue Doppler

Possible cardiomyopathy outcomes

- Long, slowly progressive disease which never becomes symptomatic (or only very late in disease course)
- Sudden death
- Congestive heart failure
- Thromboembolic disease

“Review of available evidence-based treatment data leaves no uncertainties regarding drugs with established efficacy (in cats with occult disease). There presently are none.”
Feline cardiomyopathy treatment

- Occult affected (asymptomatic) cats
  - No medications have been shown to alter progression of disease
  - Reasons to consider treating
    - Tachycardia/arrhythmia
    - Left atrial enlargement
    - Severe dynamic stenosis (SAM)

DCM is rare but if diagnosed it is the ONLY feline cardiomyopathy treated differently than the others: pimobendan, ACEI, TAURINE

Congestive heart failure

Cardiomyopathy- treatment

- Symptomatic cats with congestive heart failure
  - Acute stage
    - Furosemide is most important medication for cats with CHF
    - Oxygen therapy
    - Nitroglycerin has never been shown effective in cats, but unlikely to cause adverse effects
  - +/- pimobendan
  - NEVER START BETA BLOCKERS IN ANIMALS WITH UNCONTROLLED CHF

Cardiomyopathy- treatment

- Symptomatic cats with congestive heart failure
  - Chronic stage
    - Furosemide
    - ACE inhibitor (enalapril or benazepril)
    - Heart rate control if necessary (atenolol or diltiazem)
  - +/- Anticoagulant therapy
  - +/- Pimobendan (if systolic dysfunction)

Thromboembolic Disease

- Feline patients with cardiomyopathy are predisposed:
  - Virchow's triad (prerequisites of thrombogenesis)
    - Abnormal endothelial surface
    - Abnormal blood flow (LA enlargement)
    - Increased coagulability

The 5 “P”s

- Paralysis
- Pain
- Pulselessness
- Pallor
- Poikilothermia
Echocardiography - FATE

Acute case management - FATE
- Manage pain
- Control congestive heart failure and/or arrhythmias when present
- General supportive care
- Therapies to limit thrombus growth or future thrombus formation

Analgesia
- Fentanyl
  - 2-5 µg/kg/hr as a CRI until fentanyl patch takes effect
- Butorphanol
  - 0.1-0.2 mg/kg IV every 4 to 6 hours
- Buprenorphine
  - 0.005-0.015 mg/kg IV every 6 to 8 hours
- Methadone
  - 0.1-1.0 mg/kg IM or SQ q 4 to 6 hours
  - 0.05-0.2 mg/kg IV q 4 to 6 hours

Nursing care
- Address poor systemic perfusion (primary cause of hypothermia)
  - Cautious fluid therapy with vigilant monitoring of RR, effort and auscultation for development of a gallop sound
  - Cautious warming (avoid peripheral vasodilation and worsening of core perfusion)
- Excellent nursing care and clinical laboratory monitoring
- Physical therapy

Anticoagulant therapy
- Acute
  - No effect on established thrombi
  - Therapy is to prevent or reduce thrombus extension
    - Heparin, clopidogrel
- Chronic
  - Clopidogrel
  - Aspirin
  - Heparin

Feline cardiomyopathy therapeutic summary
- What to treat and when?
  - Address congestive heart failure
  - Address myocardial failure
    - DCM or end stage HCM/RCM/UCM
  - Address symptomatic arrhythmias
  - Address thromboembolic disease
- Otherwise there is no evidence that treatments alters outcome in cats with heart disease
Feline cardiomyopathy therapeutic summary

- Treat congestive heart failure
  - Furosemide +/- pleurocentesis
  - Angiotensin converting enzyme inhibitor
  - Pimobendan if echocardiographic evidence of systolic failure
- Treat arrhythmias
  - Frequent ventricular ectopy or supraventricular tachycardia
    - Atenolol
- Treat/prevent thromboembolic disease
  - Clopidogrel; aspirin