Update on managing feline heart disease

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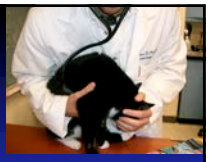
Classification

- 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, Sphinx, 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

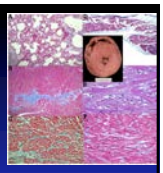
Clinical Manifestations-HCM

- 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

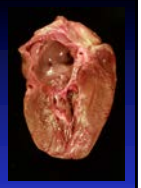
- Inherited as an autosomal dominant trait with incomplete penetrance in the Maine coon and Rag doll breeds
  - Disease apparent in most cats by 6 months to 2.5 years
- Inherited form of HCM has also been recognized in a family of American short hair cats, but pattern is less malignant than in the Maine coons
- > 15 mutations have been recognized in humans

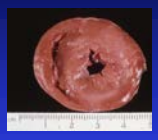
HCM-pathophysiology



- 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

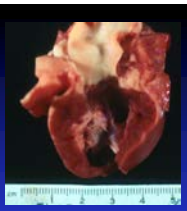
HCM-diagnostics

- 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 transmitral filling pattern on Doppler**
  - +/- Decreased systolic function (shortening fraction)

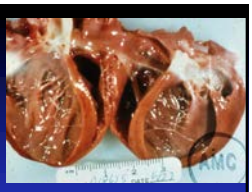
Unclassified cardiomyopathy

- 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

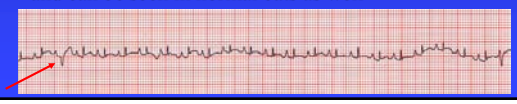
- ECG- similar to HCM
- Radiographs- similar to HCM
- Echocardiography
  - **Chamber dilation**
  - Normal to decreased LV wall thickness
  - **Decreased systolic function (shortening fraction)**
  - Mitral and/or tricuspid valvular regurgitation (central)

Cardiomyopathy diagnostics

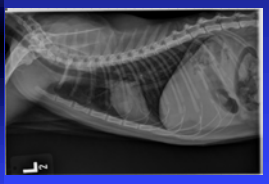
- ECG- +/- tall R waves; +/- arrhythmias
- Radiology- normal heart size to cardiomegaly, congestive heart failure
- Echocardiography
  - Various findings depending on type of cardiomyopathy
  - Gold standard for diagnosis of cardiomyopathy type
- Ancillary tests to rule out extra-cardiac cause of hypertrophy
  - Thyroid panel, systemic blood pressure, growth hormone
  - nt-proBNP?

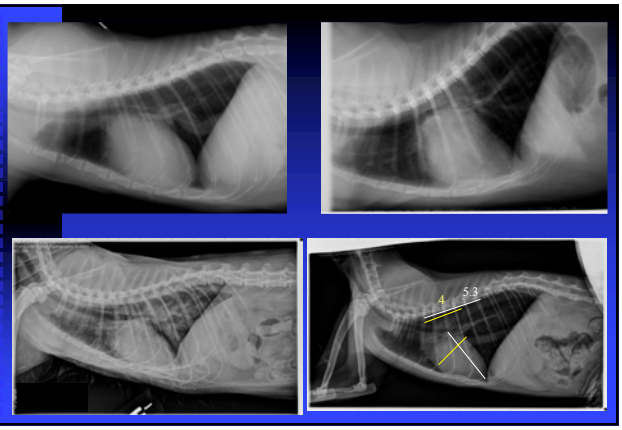
Screening test- Electrocardiography

- 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

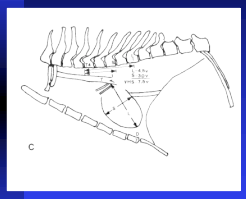


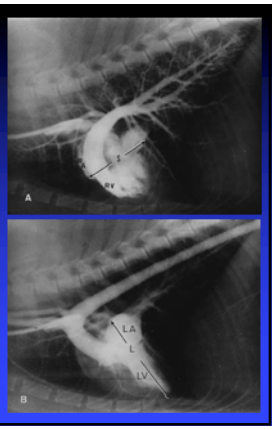
Screening Test- Thoracic Radiographs





Vertebral Heart Size





Use of the vertebral heart scale for differentiation of cardiac and noncardiac causes of respiratory distress in cats: 67 cases (2002–2003)

Meg M. Sleeper, VMD, DACVIM; Risa Roland, DVM, DACVIM; Kenneth J. Drobatz, DVM, MSCE, DACVECC, DACVIM

Objective—To assess the effectiveness of the vertebral heart scale (VHS) system to differentiate congestive heart failure from other causes of dyspnea in cats.

Design—Retrospective case series.

Animals—67 cats with acute respiratory distress.

Procedures—Medical records of client-owned cats evaluated on an emergency basis because of acute respiratory distress during a 1-year period were reviewed. For study inclusion, cats must have undergone evaluation with echocardiography and thoracic radiography within 12 hours after hospital admission. The VHS was calculated for each cat by 2 investigators. Signalment, physical examination, and echocardiographic findings were reviewed for each patient.

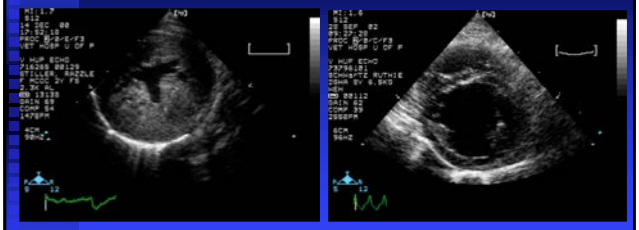
Results—There was 83% agreement overall between the 2 investigators in assessment of cardiomegaly in cats with dyspnea ($\kappa = 0.49$). The VHS cutpoints were the same for both observers in terms of optimizing sensitivity and specificity. A VHS of > 8.0 vertebrae was the best cutpoint when screening for heart disease, whereas a VHS of > 9.3 vertebrae was very specific for the presence of heart disease. Measurements between 8.0 and 9.3 vertebrae suggested the cause of dyspnea was equivocal (ie, secondary to congestive heart failure or respiratory disease), in which case echocardiography would be most useful in providing additional diagnostic information.

Conclusions and Clinical Relevance—Results suggested that the VHS system may be a useful tool to help differentiate cardiac from noncardiac causes of respiratory distress in cats in an emergency situation when an echocardiogram is not available or is not plausible in an unstable patient. (*J Am Vet Med Assoc* 2013;242:366–371)

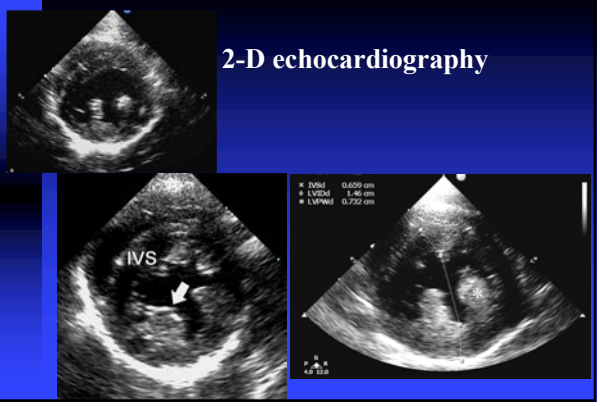
Screening test- Echocardiography

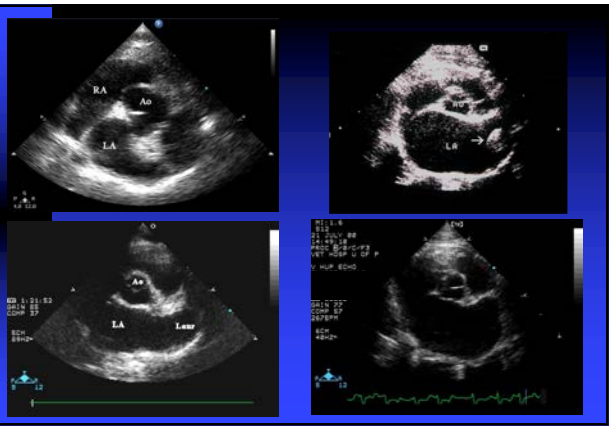
- Echocardiography-
  - LV wall thickness
  - LV systolic function
  - LA enlargement
  - Diastolic function
    - Transmitral Doppler, LVIVRT, tissue Doppler

Echocardiography

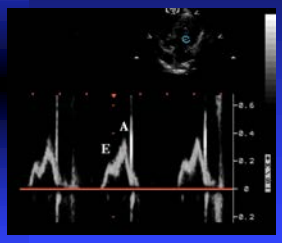


2-D echocardiography

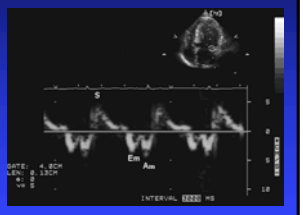




Doppler echocardiography



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

Management of asymptomatic (occult) feline cardiomyopathy: challenges and realities

Philip R. Fox, DVM, M.Sc. [a,*], Karsten E. Schober, DVM, Ph.D. [b]

Journal of Veterinary Cardiology (2015) 17, S150–S158

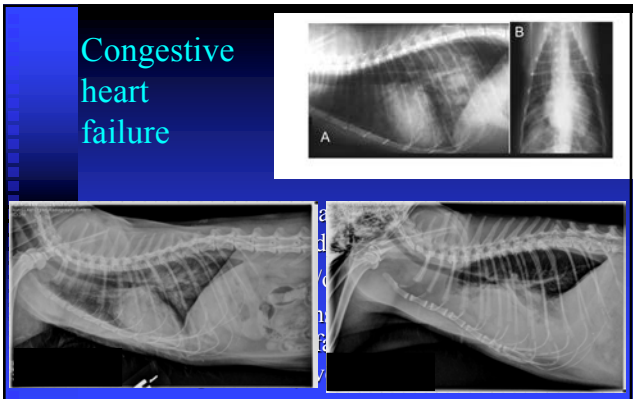
"Review of available evidence-based treatment data leaves no uncertainties regarding drugs with established efficacy (in cats with occult disease). There presently are none."

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



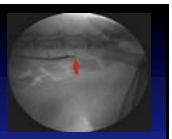
Cardiomyopathy- treatment

- **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

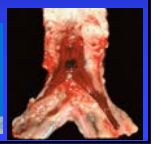
Cardiomyopathy- treatment

- **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



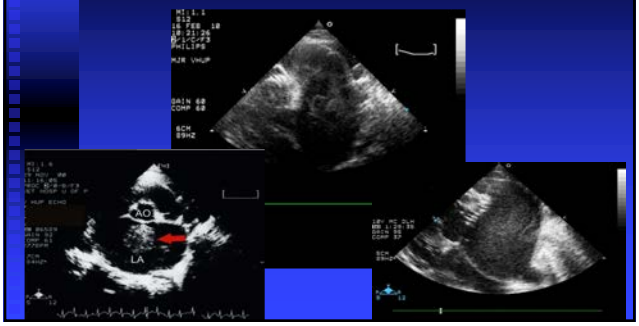
- Feline patients with cardiomoypathy are predisposed:
  - Virchow's triad (prerequisites of thrombogenesis)
    - Abnormal endothelial surface
    - Abnormal blood flow (LA enlargement)
    - Increased coagulability



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