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Why are Cat Heart Sounds So Difficult to Characterize?

A. Gallop heart sounds can be hard to detect.
B. Murmurs in cats all sound the same.
C. Cats are small; the valve areas are close together.
D. The position of the heart in the thorax changes with age.
E. Most feline heart murmurs are dynamic (labile).
F. Knowledge deficits about murmur location, prevalence.
G. All of the Above.

Cardiac Auscultation in Cats

The neglected area: ventral thorax directly over the sternum

Cat Heart murmurs:
• Virtually always systolic
• Location described as left or right parasternal
Why are Cat Heart Sounds So Difficult to Characterize?

The position of the heart in the thorax changes with age.

- Young cat
- Old cat

Why are Cat Heart Sounds So Difficult to Characterize?

Cats are small; the valve areas are close together.

Common Acquired Heart Diseases of Cats

- **Cardiomyopathy**
  - Hypertrophic (HCM)
  - Restrictive (RCM) or Unclassified (UCM)
  - Less Common
    - Dilated (DCM)
    - Arrhythmogenic Right Ventricular (ARVC)

- **Systemic Hypertension (SH)**
- **Hyperthyroidism (HT4)**
Common Acquired Heart Diseases of Cats

Most Common Primary Myocardial Diseases

Left Ventricular Hypertrophy in Cats
Pathology of HCM

- Myocardial Fibrosis
- Myocardial Fiber Disarray
- LV Hypertrophy

The Three Most Common Heart Murmurs of Adult Cats

- Dynamic RVOT Obstruction
- Dynamic LVOT Obstruction
- Mitral Regurgitation
- RVOT Obstruction
- LVOT Obstruction

Dynamic LVOT Obstruction

- Systolic anterior motion (SAM) of the mitral valve
Dynamic LVOT Obstruction

- Dynamic LVOT obstruction:
  - Caused by systolic anterior motion (SAM) of the mitral valve
  - Creates a source of pressure overload to the left ventricle
  - Pressure overload ≡ concentric hypertrophy in an already hypertrophied HCM heart!

Systolic Anterior Motion of the Mitral Valve

- Subsequent to concentric LVH.
  - Results in additional Hypertrophy!!!

Dynamic RVOT Obstruction

- Unlike LV obstruction, RV obstruction is relatively benign and does not appear to cause overload to the heart.
ABCD Classification of Feline Heart Failure

- **At Risk for Heart Failure**
  - **Stage A**: Subclinical, apparently healthy but high risk for developing heart disease
  - **Stage B1**: Subclinical, Normal to mild LA enlargement, Ventricular remodeling
  - **Stage B2**: Subclinical, Moderate to severe LA enlargement, Ventricular remodeling

- **Heart Failure**
  - **Stage C**: Past or current signs/symptoms of CHF or ATE
  - **Stage D**: End stage HF, signs refractory to Rx

### Diagnosis?
- History
- Patient Profiles
- Thoracic Radiography
- Electrocardiography
- Physical Examination
- Laboratory Testing
- Echocardiography

After Hearing a gallop or murmur, what is the next step in the cardiac evaluation?

A. ECG  
B. NT ProBNP  
C. Blood Pressure  
D. Serum Thyroid Levels  
E. Thoracic Radiographs  
F. Echocardiogram
Diagnosis of Systemic Hypertension

- SAP > 190 mmHg on 3 or more occasions
- SAP > 170 mmHg + Ocular lesions
- LV hypertrophy
- CNS signs

HCM: Differential Diagnoses

- Older Cats with LVH
  - Hyperthyroidism
  - Systemic hypertension

- Younger Cats with LVH/DSAS
  - Mitral valve dysplasia

Routine Clinical Evaluation

- ECG, thoracic radiographs, NT ProBNP
- Echocardiography
- Systemic blood pressure (Doppler)
- $T_4$, CBC, chemistry, UA
SNAP® Feline proBNP

Semi-quantitative SNAP test
- Similar to SNAP cPL or SNAP fPL
- Reference spot and a Sample spot
- Read time is 10 minutes

Tool to help assess heart health pet-side
- Abnormal results indicate increased stretch and mechanical stress on the myocardium

Interpreting SNAP Feline proBNP Results

From the SNAP Feline proBNP Diagnostic Update

<table>
<thead>
<tr>
<th>Cardiomyopathy</th>
<th>&lt;100 pg/mL</th>
<th>100-199 pg/mL</th>
<th>&gt;200 pg/mL</th>
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<tbody>
<tr>
<td>Normal SNAP Feline proBNP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Abnormal SNAP Feline proBNP</td>
<td>-</td>
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Field Trial Data

<table>
<thead>
<tr>
<th>SNAP Feline proBNP Result</th>
<th>Cardiomyopathy Result 100-199 pg/mL</th>
<th>&gt;200 pg/mL</th>
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<tbody>
<tr>
<td>Normal</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Abnormal</td>
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<td>23</td>
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Potential Uses for NT-proBNP in Cats

- Detection of heart disease in an asymptomatic cat
- Differentiating causes of dyspnea:
  - Cardiac vs. Respiratory
  - Help interpret radiographs
- The big question is, “Where do we place the cutoff value to avoid false positives and false negatives.”

Interpreting NT-proBNP in Cats

<table>
<thead>
<tr>
<th>Feline NT-proBNP pmol/L</th>
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<tbody>
<tr>
<td>50</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>200</td>
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<table>
<thead>
<tr>
<th>No Symptoms</th>
<th>Cat Dyspneic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Disease Unlikely</td>
<td>Heart Disease Probable</td>
</tr>
<tr>
<td>Recheck in 6-12 months</td>
<td>Echo Indicated</td>
</tr>
</tbody>
</table>

Heart Disease Probable
- Echo Indicated
- Chest Radiographs +/-
- Heart Failure Possible
  - Echo Indicated

Heart Failure Probable
- Chest Radiographs
- Heart Failure Probable
  - Echo Indicated

HCM - Electrocardiography

Left axis shift pattern:
- Left Anterior Fascicular Block
  (Partial Left Bundle Branch Block)
Thoracic Radiography in Cats

Vertebral Heart Scale

Normal Values
Dogs: 8.5 – 10.5 vertebra
Cats: 6.9 – 8.1 vertebra

Valid over a wide range of breeds, chest conformations, and ages in both dogs and cats
HCM - Echocardiography

- Concentric LV hypertrophy
- Asymmetric septal hypertrophy
- Regional hypertrophy
- Dilated LA as disease worsens
- Small LV chamber
- Intracardiac thrombi (usually in the left atrium)
Case 1: Henry

- 9-yr old, 10lb, MN Persian presents to your hospital with a complaint of acute onset, short, rapid breathing.
- Current medications: monthly heartworm preventative
- No murmur
- Mild crackle in the right cranial lung field
- Normal femoral pulses

Henry’s Radiographs

Evaluate:
1. Heart size
2. Heart shape
3. Lung fields
4. Pulmonary vessels

VHS = 8.9
Radiographic diagnosis:
- Moderate enlargement of the left atrium suspected.
- Distended and indistinct pulmonary veins/vasculature.
- There is an alveolar pattern in the right cranial lung field.
- Rule outs include pneumonia or congestive heart failure.

Additional Diagnostics?

How do I decide?
What else can I do?

Perform an NT-proBNP?

260 pmol/L (Positive on the SNAP)
**Henry’s Diagnosis!**

Hypertrophic Cardiomyopathy  
Congestive Heart Failure  
No Outflow Obstruction

**Recommended Medications:**

- *Lasix* (~2mg/kg/day)
- *ACE Inhibitor* (Benazepril 0.5mg/kg BID)

Secondary Treatments: Consider Aspirin or Plavix to prevent thrombus formation. For refractory pulmonary edema or pleural effusion: *Spironolactone* 2mg/kg q 24hrs or possibly *Vetmedin* (Pimobendan 0.25mg/kg BID)
Cat A: Alice CHF

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Cat B: Buttons SAM

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Cat C: Charlotte LAFB

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Who Needs Atenolol Therapy?

A. Alice

B. Buttons: Atenolol can reduce the SAM induced LVOT Obstruction and reduce the left ventricular hypertrophy secondary to the obstruction.

C. Charlotte

Questions?