Congestive heart failure

Canine and Feline
Acute and Chronic Management
Bill Tyrrell, DVM, DACVIM-cardiology
VVMA VVC February 2018

Agenda

- Feline CHF
  - Diagnosis
  - Treatment
  - Prognosis and Complications
- Canine
  - Diagnosis
  - Treatment
  - Prognosis and Complications
- Cases

Auscultation

- Murmur = Pay attention
  - 43% of control cats and 80% of cats with occult disease had murmurs
  - 2x probability of HCM (IVM 2011)
- Arrhythmia and Gallop = Concern
  - Risk of cardiac related death
    - Hazard ratio 1.8 – Gallop
    - Hazard ratio 3.2 – Arrhythmia (IVM 2013)

DIAGNOSTICS

- Good history
  - Signalment
  - Stressful event?
  - Depo?
  - Thyroid status?

Cardiac Auscultation: Tips

- Take your time
- Adequately restrain
- Minimize panting, growling, purring
- Focus on heart sounds first, then breath sounds
- Develop a consistent and repeatable pattern
- Listen for 3rd heart sounds (clicks vs. gallops)
- Consider the signalment of the patient
  - Common things happen commonly
  - Congenital vs. Acquired
  - Breed-specific defects
Chest Rads: Feline Review
- <70% height of chest; < 2-3 ICS
- <50% width of chest

Radiographs
- HCM = concentric hypertrophy
- Cardiac silhouette not expected to enlarge
- JAVMA 2013 – VHS > 9.3 = cardiac cause for dyspnea (N 7.5)

Chest Radiographs: Quick Review
- VHS 6.7-8.1 (mean 7.5)

DIAGNOSTICS
- PE
- Rads
- ECG (if arrhythmia present)
- Labwork incl. T4
- ?

Cat in a Box Radiograph Trick

DIAGNOSTICS
- PE
- Rads
- +/- ECG
- Labwork incl. T4
- NT-ProBNP
**NT ProBNP – Dyspneic cat**

- Strongest data for use of NT-proBNP in vet med
- Using a cutoff in symptomatic cats of 265 pmol/L – 90% Sn and 88% Sp
  - 10% of cats with CHF diagnosed with Resp Dx
  - 12% of cats with Resp Dx diagnosed with CHF
  - Study did not include cats with respiratory diseases that affect the heart (e.g. HUO, PTE, PHF)
  - "Cage side" SNAP test ABN at >150-200 ng/dL

**Rule Outs: Feline**

- Causes of Dyspnea (Big 3)
  - CHF
  - Asthma / Inflammatory bronchitis disease
  - Pneumonia / infection
- Pleural effusion
  - R ty. Budded (parietal Vs visceral)
  - R/O Neoplastic
- CHF Pulmonary Infiltrates
  - Cardiomegally
  - Diffuse and variable

**Interpreting SNAP Feline proBNP Results**

- From the SNAP Feline proBNP Diagnostic Update

**SNAP w Moderate to Severe Disease**

- 146 client-owned cats with a murmur, gallop, arrhythmia, or cardiomegaly
- 43 healthy cats, 50 mild, 31 moderate, 6 severe, 16 equivocal
- Positive POCLISA increased likelihood of moderate or severe OCHD by a factor of 4.8
- Differentiated cats with moderate or severe OCHD
- Sensitivity/specificity of 88.6%/81.3%

**Seemed fine yesterday...**

- Effect of NT-proBNP Assay on Accuracy and Confidence of General Practitioners in Diagnosing Heart Failure or Respiratory Disease in Cats with Respiratory Signs

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In Hospital Monitoring
- BP – q 6 hours, q 1hr if hypotensive
- Renal panel with hlytes q 24 hours
- Rads q 24-48 hours.
- Individualize
- Body temperature

Supportive Care is Crucial to Survival
- Heat
- NE tube
- Anti-thrombotics
  - Heparin vs. Clopidogrel
- Basic monitoring
- Mirtazapine/Cerenia, etc.
- No IV fluids

Therapy - Feline Acute CHF
- Treat pulmonary edema and/or pleural effusion
  - O2 support (tage vs. nasal canula)
  - Furosemide (1-4 mg/kg) IM vs. IV
- Thoracentesis
- Maintain BP/CO
  - Furosemide 0.25 mg/kg PO
  - Dobutamine CRI 1-3 mcg/kg/min
- Unlikely:
  - Sedation – Butorphanol 0.2 mg/kg
  - Nitropresside CRI 0.5 – 2 mcg/kg/min

Prognosis of CHF and Cats
- Hypotensive + Hypothermic + Dehydrated = Poor Prognosis
  - Need NE tube for caloric and rehydration needs
- Cats that do not respond to standard therapy = Poor Prognosis
  - Cats are more sensitive to CRI
  - Nitropresside can be very useful (if BP is normal)
Worst case scenario?

- Silent/occult cardiomyopathies
- 250 FATE cases
  - Only 11% had previous diagnosis of heart disease
  
FATE

- Unfractionated Heparin
  - 250 U/kg IV 1st dose, then 250 U/kg SC TID
  - Discontinue over 2-3 days once stable and receiving aspirin/clopidogrel
    - May need to send home syringes in D:
- Plavix 75 mg tablets
  - Loading dose
  - 1/4 tablet once daily

FATE - Therapy

- Pain management
  - Fentanyl
  - 5 mg/kg IV/PO
  - 3–4 mg/kg/h oral CRI
- Hydromorphone
- Buspironazine
- Prednisone (do not send home)

- Cyproheptadine
  - 2 mg/kg PO BID
- Anti-emetics
- Prozac (fluoxetine, oral liquid)
- No effect after 10 days
- Appetite stimulant

FATCAT study – Plavix/Clopidogrel vs. ASA

- Prospective, 72 cats – 50% ASA/50% Plavix
- Locked at cats that had survived FATE
- On Plavix, MST 443 days
- On ASA, MST 192 days

Chronic monitoring

- Blood pressure
- Chem/T4
- Appetite, vomiting, maintain body weight
- PE – new arrhythmia/gallop/loss of murmur
- At home RR monitoring
- Rads/Echo
Take Home Feline Pearls

- Thoracocentesis
- Judicious Lasix
- NE tube
- Pimobendan
- Clopidogrel

Physical Examination

- Heart/breath sounds muffled bilaterally
- Increased WOB
- HR 220 with extrasystolic beats
- Gallop
- No murmur
- T nodule

Questions?

Case: Tut

- 12 year old MC DSH
- 11 lbs.
- Off for the past 2-3 weeks with slight decreased appetite
- Presented to neighboring ER with dyspnea
- Transferred to our ER for further therapy and diagnostics
- Normal renal values from ER
Treatment—in Hospital

- Thoracocentesis
- Lasix 2 mg/kg IV TID
- Pimobendan 0.25-0.3 mg/kg PO BID
  - Often use TinyTabs for cats
- Clopidogrel 18.75 mg total PO
Other Diagnostics
- T4=5.0
- Repeat renal/lytes—all WNL.
- Began to eat post thoracocentesis so no need for NE tube.

Canine CHF

Discharge/At Home Therapy
- Pimobendan 1.25 mg PO BID
- Methimazole 2.5 mg PO BID
- Furosemide 10 mg PO TID for 3 days, then decrease to BID provided doing well
- Clopidogrel 18.75 mg PO (Total dosage)
- In 4-5 days, titrate Benazepril up to 2.5 mg PO SID

Diagnosis
- History
  - Presence of a murmur
  - Duration of symptoms
- PE
  - Heart rate
  - BCS
- NT-proBNP?
- Rads/Echo
- Furosemide trial

Further Recommendations
- Owner to monitor resting RR/RE at home
- Recheck CBC/CHEM/T4 in 2-3 weeks
- Recheck echocardiogram in 4-6 months
- Prognosis?

Crackles ≠ CHF

<table>
<thead>
<tr>
<th>Cardiac</th>
<th>Respiratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>+/+ Exercise intolerance</td>
</tr>
<tr>
<td>Weight/BCS</td>
<td>&lt;5 Weight loss</td>
</tr>
<tr>
<td>Lungs Sounds</td>
<td>Normal to RV sounds</td>
</tr>
<tr>
<td>Heart sounds</td>
<td>&lt;5 Soft crackles</td>
</tr>
<tr>
<td>RR/RO/Patents</td>
<td>Normal to Tachycardia</td>
</tr>
<tr>
<td>I&amp;O/other</td>
<td>Normal to NSA</td>
</tr>
<tr>
<td>CXR</td>
<td>VRH High</td>
</tr>
</tbody>
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Degenerative Valve Disease

**SIGNALMENT**
- History
- Ollar, small breeds
- Chronic, loud murmur
- Recent signs

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Canine Data - glitch

****Some of the highest values are found in dogs with Pulmonary Hypertension****

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**NT ProBNP – Symptomatic K9**

Evaluation of circulating amino terminal pro-B type natriuretic peptide concentration in dogs with respiratory distress attributable to congestive heart failure or primary respiratory disease. *Front Dis, Canine Med Assoc. 2005;232:1674-9*

- >1,400 pmol/L = 92% accuracy in detecting CHF vs. Respiratory disease
  - CHF median NT-proBNP - 2,554
  - Primary Resp Dist median NT-proBNP – 357
- Some of the highest values are found in dogs with pulmonary hypertension

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**Rads**

VHS, 9.7 +/- 0.5 for dogs

Insist on inspiratory radiographs
- LA size
- Pulmonary vasculature
- VHS

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**NT-ProBNP K9 Recommendations**

- With clinical signs:
  - < 900 pmol/L – unlikely cardiac
  - 900-1800 pmol/L – equivalent, need echo
  - > 1800 pmol/L – high likelihood of CHF

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**Rads**

- Normal dogs: 8.5-10.7 (9.7 +/- 0.5)
- Boxers: 10.3-12.6
- Labrador Retrievers: 9.7-11.7
- CKCS: 9.9-11.7
**CHF: Classification**

<table>
<thead>
<tr>
<th>Case</th>
<th>Diagnosis</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acute</td>
<td>Hospitalization, supportive care</td>
</tr>
<tr>
<td>2</td>
<td>Chronic</td>
<td>Medical management, dietary changes, lifestyle modifications</td>
</tr>
<tr>
<td>3</td>
<td>Compensated</td>
<td>Management of underlying disease, medication adjustment</td>
</tr>
<tr>
<td>4</td>
<td>Decompensated</td>
<td>Hospitalization, aggressive therapy, close monitoring</td>
</tr>
</tbody>
</table>

**Normal Vertebral Heart Score Variation**

<table>
<thead>
<tr>
<th>Breed</th>
<th>VHS</th>
<th>Range (5%–95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beagle</td>
<td>8.7</td>
<td>7.9–10.7</td>
</tr>
<tr>
<td>Pomeranian</td>
<td>8.7</td>
<td>8.1–10.2</td>
</tr>
<tr>
<td>Dachshund</td>
<td>8.6</td>
<td>8.0–10.3</td>
</tr>
<tr>
<td>Yorkie</td>
<td>8.6</td>
<td>8.0–10.2</td>
</tr>
<tr>
<td>Shih Tzu</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>Boston</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>Whippet</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>Basset</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>German Shepherd</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>Dachshund</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
<tr>
<td>Cocker</td>
<td>8.5</td>
<td>8.0–10.1</td>
</tr>
</tbody>
</table>

**CHF - Variations**

- **Forward Failure**
  - Signs result from low CO and inadequate tissue perfusion
    - Weakness, lethargy, poor renal function, hypotension
- **Backward Failure**
  - Failure of heart to empty blood from the veins - elevated venous and capillary pressures
    - Pulmonary edema, ascites, pleural effusion
- **Cardiogenic Shock**
  - Signs of forward and backward failure and systemic hypotension

**CHF - Mechanisms**

- **Four Mechanisms of CHF**
  - Volume overload
    - MR, PDA
  - Pressure overload
    - HCM, PSS
  - Myocardial failure
    - DCM
  - Arrhythmias
    - AFI, SVT, VT
Goal #1: Reduce Congestion, Edema, Effusion

- Reduce vascular volume (preload)
  - Diuretics – Lasix
    - 2-4 mg/kg IM/IV q2-4h initially
    - Then 2 mg/kg TID/CID
  - Ceiling effect of Furosemide – 12 mg/kg/day
  - Lasix CRI (1-4 mg/kg over 2-4 hours)
- If RR/RF not improving to <40-50/min within 2-3 hours (i.e. 2-3 doses), consider additional therapies or incorrect diagnosis
  - Nitroprusside +/- Dobutamine

Goal #2: Improve CO

- Goal: Increase CO

Goal #2 cont’d: Improve CO

- Goal: Increase CO

Goal #3: Normalize HR and Rhythm

- Arrhythmias make it worse
  - Atrial fibrillation
  - VPCs /VTach
- Stick to meds that do NOT worsen cardiac function
  - Digoxin – 0.003-0.005 mg/kg of lean BW PO BID
  - Can “load” by giving 2x dose for 2 doses (i.e. 24hr)
  - Digitalis – 0.5-2 mg/kg PO TID
  - Lisinopril – 40-80 mg/kg PO TID
  - Metolazone – 5.8 mg/kg PO TID
  - Omeprazole – 0.3 mg/kg PO TID
- Beta-blockers are contraindicated in active CHF
Goal #3: Continued

Atrial Fibrillation/SVT
- Digoxin in acute setting
  - Primary side effect is inappropriateness
  - Difficulty dosing if you can't breath, you won't eat
- Diltiazem
- Delay combination if inequivalent
- If dog acutely recovers due to arrhythmia can give diltiazem IV
  - Initial 5 mg/kg/30 min (over 3 minutes)
- Do NOT expect conversion with atrial fibrillation
- Goal is rate control
  - < 160 bpm ultimately
  - Ondansetron (Zofran®) 0.25-0.5 mg/kg q.d. (4 & 8 mg tabs)

Frequent VPCs or Vtach
- Reasons to Treat
  - Sustained VTach (> 90 bpm for 30 seconds)
  - 8 in 10 (Bond Feeder for VPCs)
- Milrinone
- Lidocaine
  - Bolus - 2 mg/kg IV slow (1-2 min)
  - Repeat up to 5 times
  - CR - 40-80 mg/kg/min
- Moxifloxine (Oral class IIb)
  - 5-10 mg/kg PO/ID
  - Primary MI - ID - give w/ food
  - Start metformin prior to stopping lidocaine
  - Due to the benefit of Metformin, wait 4-6 hours, then wean off lidocaine over 4-6 hours

Atrial Fibrillation as a Prognostic Indicator in Medium to Large-Sized Dogs with MMVD and CHF
- AFB -> MST 142 days
- No AFB -> MST 244 days (8 months)
- Rate control (<160) = Key to survival
- Diltiazem + digoxin -> Mean HR 144 -> MST 130 days
- Diltiazem alone -> 35 days

Chronic monitoring
- Blood pressure
- Chemistry profile
- Body weight
- Physical examination
- +/- chest radiographs
- Echocardiograms
Questions?

Radiographs

Case: Robin
- **Signalment**
  - 8 year old F/S CKCS
  - 22 lbs.
- **History**
  - I/V systolic murmur last year
  - No current medications
  - Acute onset/change to V/VI systolic murmur over the MV region with sudden onset dyspnea/coughing
  - Single syncopal spell when came up deck stairs

Echocardiogram

Physical Examination
- **HR 180**
- **RR 66 with increased abdominal component**
- **Crackles R>L hilar region**
- **BP 90 systolic**
- **MM slight cyanotic**
- **Pulse oximetry 93% on room air**

Diagnosis
- **Degenerative mitral valve disease with acute chordae tendinae rupture**
- **Left sided congestive heart failure**
- **Poor oxygen saturation**

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Therapy
- Oxygen: O2 cage vs. nasal
- Injectable Lasix 2 mg/kg IV/IM q 6-8 hours
- Pimobendan 0.25 – 0.3 mg/kg PO BID
- Monitor blood pressure: if BP continues to decrease, may have to consider Dobutamine/Nitropressure CRI
- Get baseline renal and electrolyte values
- Offer food/water
- No IV fluids other than CRI PRN

Discharge medications
- Pimobendan 2.5 mg BID
- Lasix/Furosemide 20 mg BID for 3 days, then decrease to 20 mg BID; may be able to further decrease pending response
- In 5 days, provided eating okay, start Enalapril 5 mg tablets at 1/4 tablet BID for 4 days, then increase to 5 mg BID
- In 10 days, provided patient is feeling well, start Spironolactone 25 mg tablets at 1/4 tablet BID for 4 days, then increase to 1/2 tablet BID
- Fish oil?

Followup
- Recheck renal profile/electrolytes in 2 weeks and then every 4-6 months
- Owner to monitor RR/RE at home—crucial part of discharge instructions to family
- Recheck echocardiogram in 6 months

Therapy continued
- Repeat BUN/CREA/Lytes in 24 hours
- +/- repeat chest rads
- If O2 saturation and overall work of breathing has normalized, wean off of O2
- Discharge

Take Home Pearls: Canine
- Pimobendan—great acute drug
- Judicious Lasix
- Nasal O2
- At home respiratory rate monitoring
- Enalapril is not an acute drug for CHF therapy
- Early detection is key