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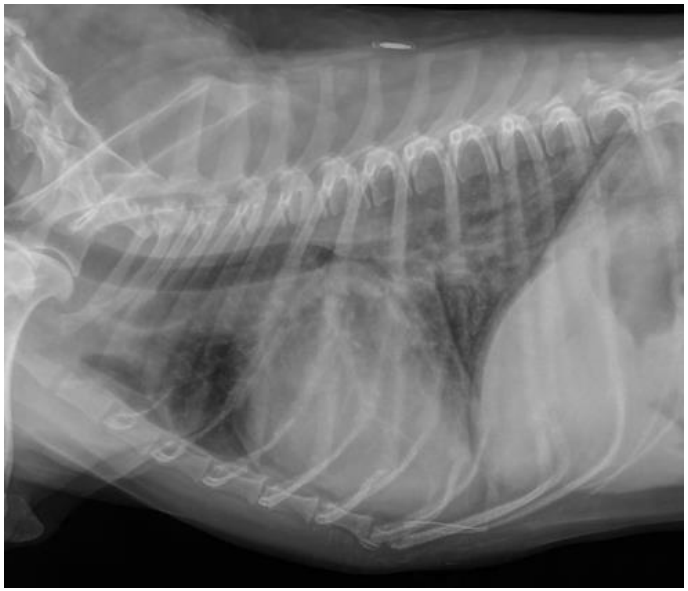
Congestive Heart Failure in the ER/Primary Care Setting





Julie Andrie Alsop, DVM, DACVIM (Cardiology)
CVCA - Cardiac Care for Pets

About me











Congestive Heart Failure in the ER/PCDVM Setting

Objectives:

- Review common presentations and clinical signs of heart failure to help with triage
- Establish a general diagnostic plan to discern between airway disease and CHF (esp. if echo is not available)
- Discuss initial stabilization and therapies for suspected CHF patients
- Review basic principles for management of CHF
- Apply knowledge with case-based examples
- Review updates on diseases/medications in veterinary cardiology

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Patient presents for coughing/increased respiratory rate/dyspnea… What now?



Respiratory vs. Cardiac



- **Signalment (common breeds!)**
- **History**
  - Heart murmur AND severity
  - Duration of signs
  - Diet? (high pulse)
- **PE**
  - Murmur (Grade?), HR, rhythm
  - BCS
  - Lung sounds/breathing pattern
- **NT-proBNP?** Overall not helpful in the ER/urgent setting for dogs
  - *SNAP BNP for cats?* - can be helpful at ruling out CHF (high sensitivity)
- **Radiographs/Echo**
- **Furosemide trial**

CHF - History

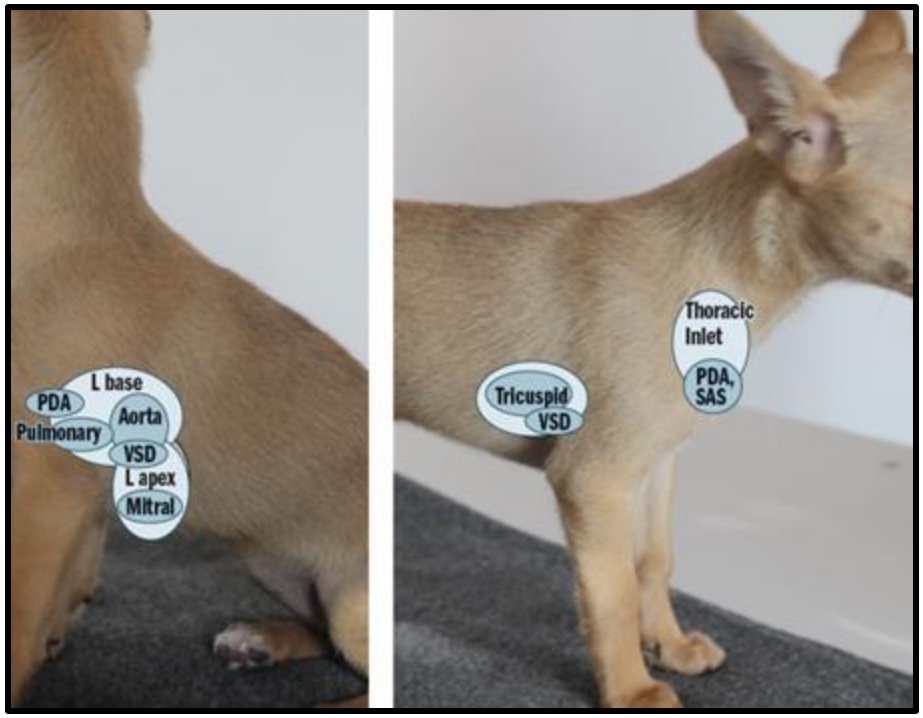
1. Recent onset; usually brief duration (days to weeks)
2. Starts at rest, worsens to all day
3. Can be worse at rest (nocturnal edema)
4. New onset/progressive coughing
5. Non-specific signs: inappetence, lethargy, exercise intolerance, hiding, etc.
6. Can see syncope with CHF cases (vs. PHT or aggressive arrhythmia)





Physical Exam Differentiators

1. **Breathing Pattern**
    a. CHF/pneumonia - mixed dyspnea (can be short, rapid, deep)
    b. Restrictive pattern - pleural effusion
    c. Inspiratory stridor - upper airway obstruction (Lar-par, mass effect)
    d. Expiratory dyspnea/wheezing - lower airway disease, PHT
2. **Hypothermia**
3. **Tachycardia**
    a. common in CHF but patients also stressed in hospital/ER
4. **Murmur/gallop/rhythm**



Crackles ≠ CHF

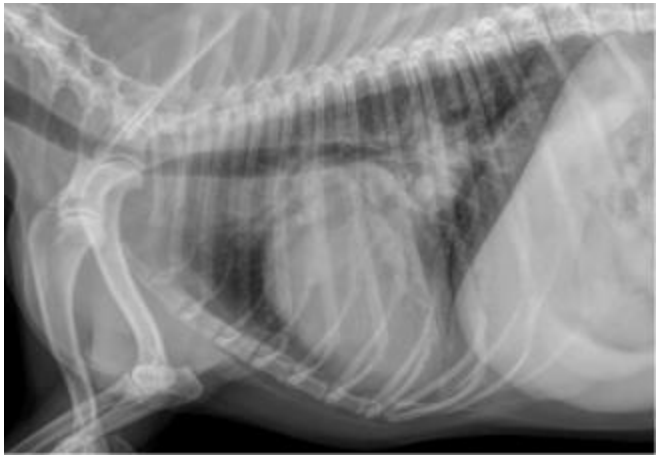
	Cardiac	**Respiratory**
Activity	Exercise intolerance	Normal or decreased
Weight/BCS	Weight loss	Obese
Lungs Sounds	+/- Soft **crackles**	+/- Loud **crackles** +/- Wheezes
RR/RE/Pattern	Short, rapid,+/- abdominal effort	Exaggerated expiration - **abd. push**
HR/Rhythm	Tachycardia*	Normal +/- **RSA**

Thoracic Radiographs



Inspiratory if possible (almost impossible in most settings)

ALWAYS get at least 2 orthogonal views



Looking at:

a. LA Size
b. Pulmonary Vasculature
c. Pulmonary infiltrates
d. VHS/VLAS

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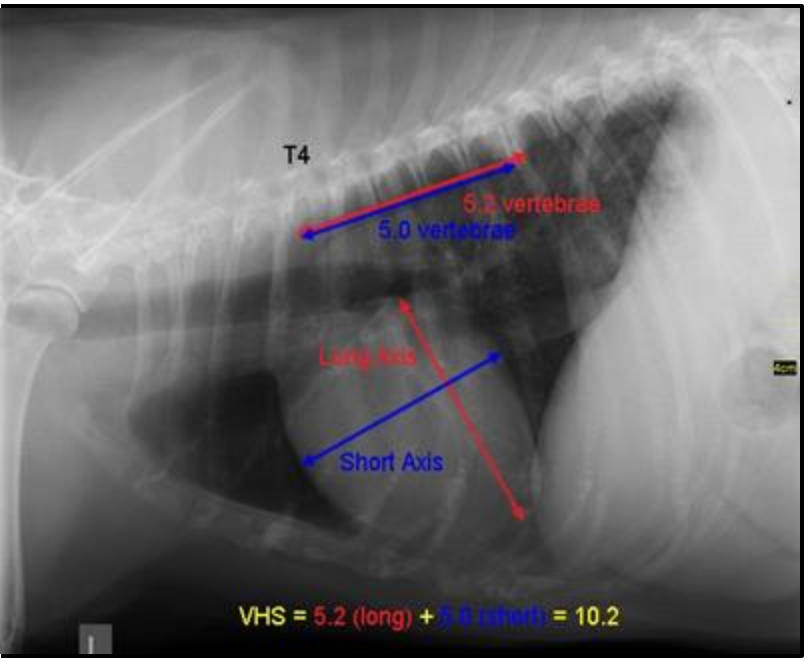
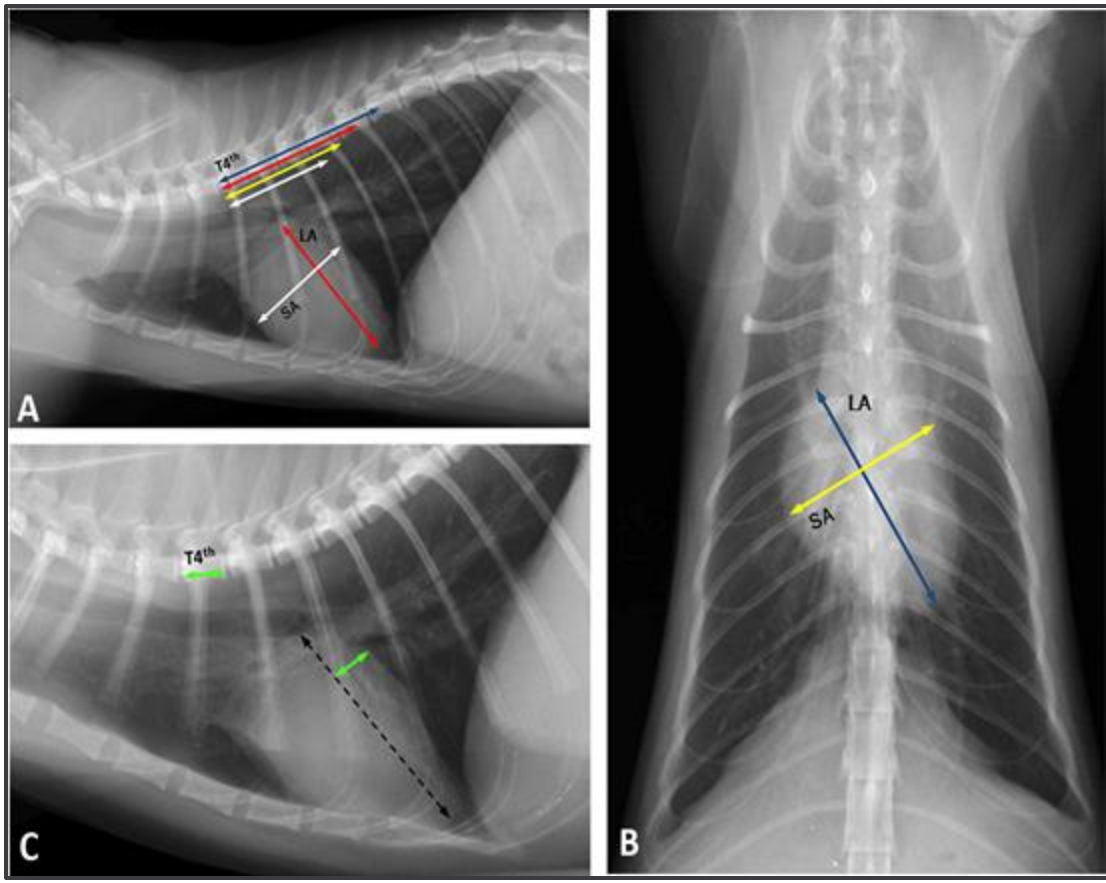
VHS





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Vertebral Heart Score (VHS)

BREED	*NORMAL VHS*
General	8.5-10.7 (9.7-10.3)
Boston	8.9-14.5 (11.7)
Boxer	10.0-13.2 (11.6)
Bulldog	9.3-16.1 (12.7)
Greyhound	9.3-12.0 (10.5)
Labrador Retriever	9.6-12.0 (10.8)
Pomeranian	8.7-12.3 (10.5)
Pug	8.9-12.5 (10.7)
Whippet	10.3-12.3 (11.3)

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VLAS



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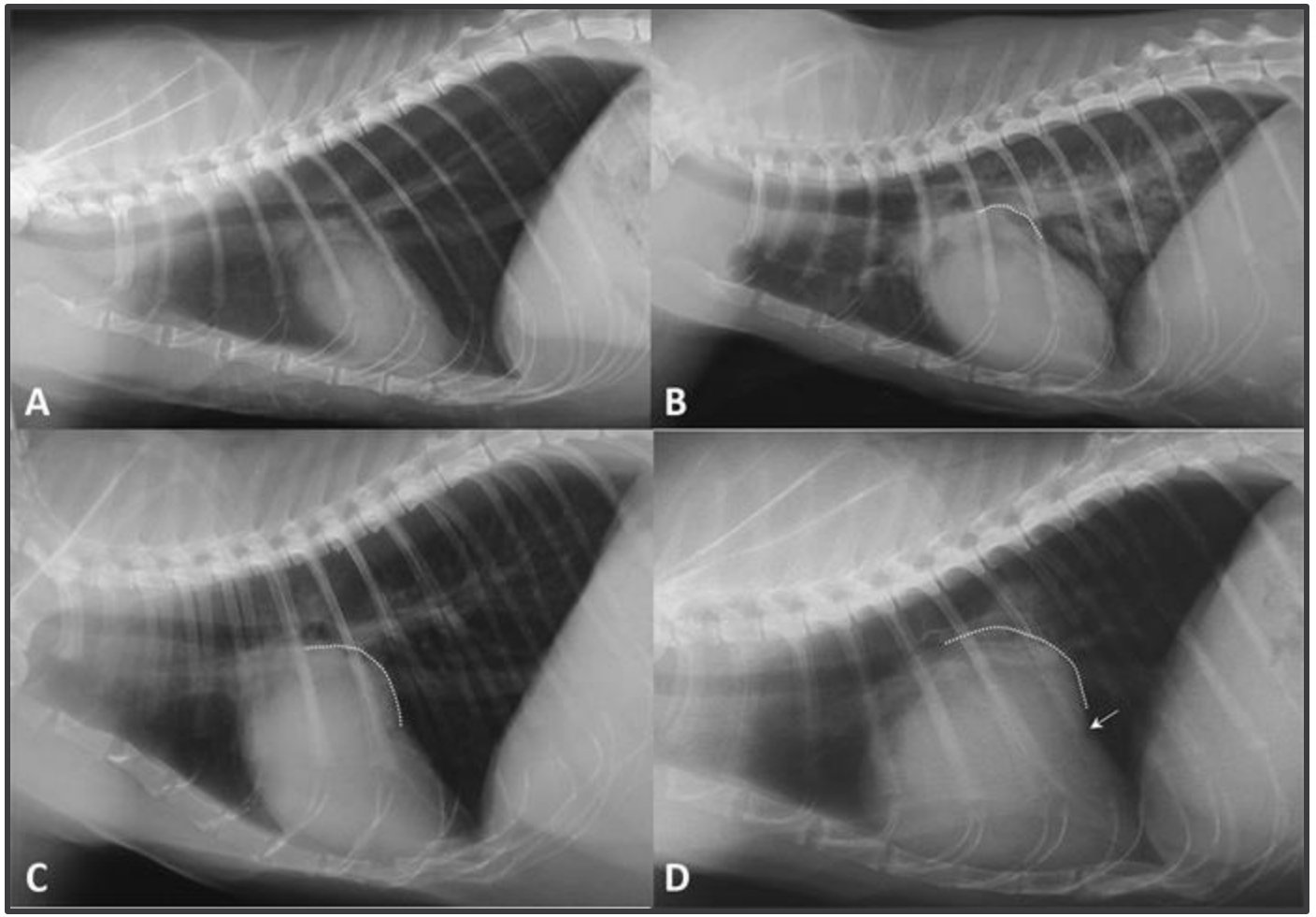
Left Atrial Enlargement in Cats



Pulmonary Patterns

1. **Pulmonary edema**
    a. Interstitial to alveolar patterns
        i. "Patchy"
    b. Perihilar/caudodorsal distribution
        i. caudal LA can also appear "hazy" and lose crisp margins



Pulmonary Patterns

1. **Pulmonary edema**
   a. Interstitial to alveolar patterns
      i. "Patchy"
   b. Perihilar/caudodorsal distribution

2. **Pulmonary vasculature**
   a. Venous dilation



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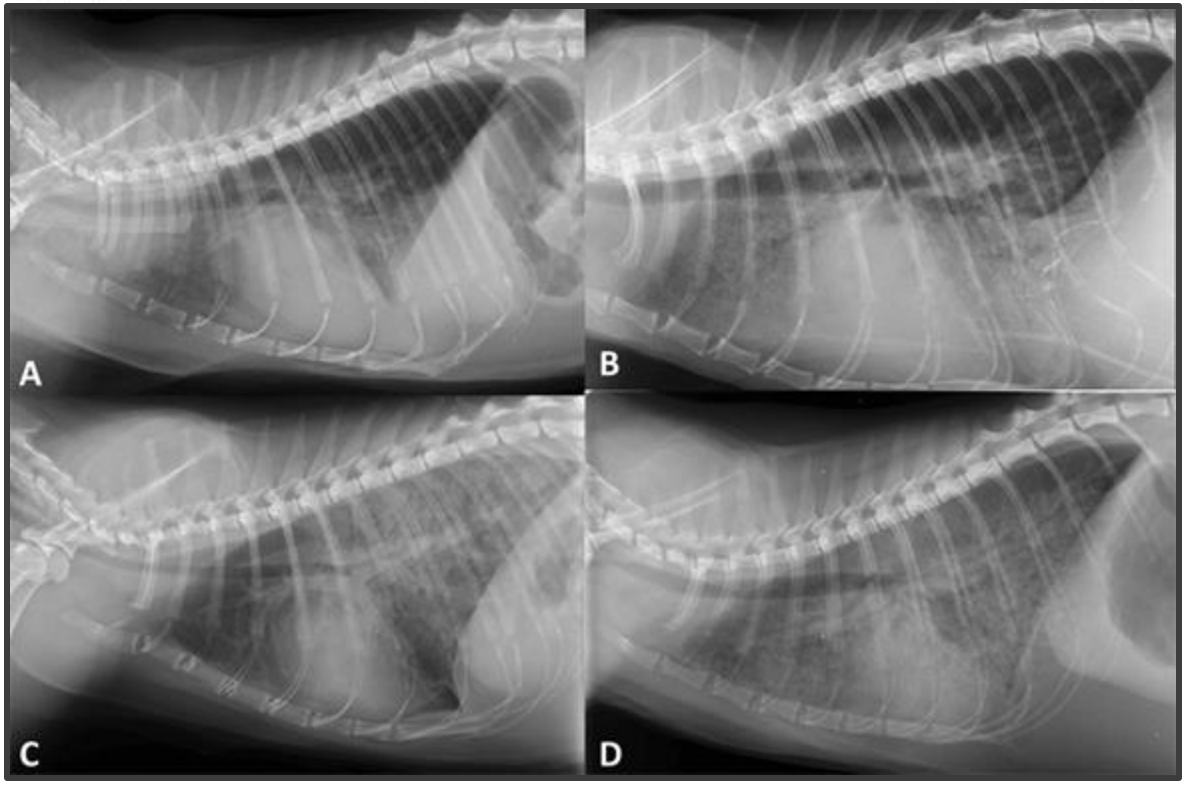
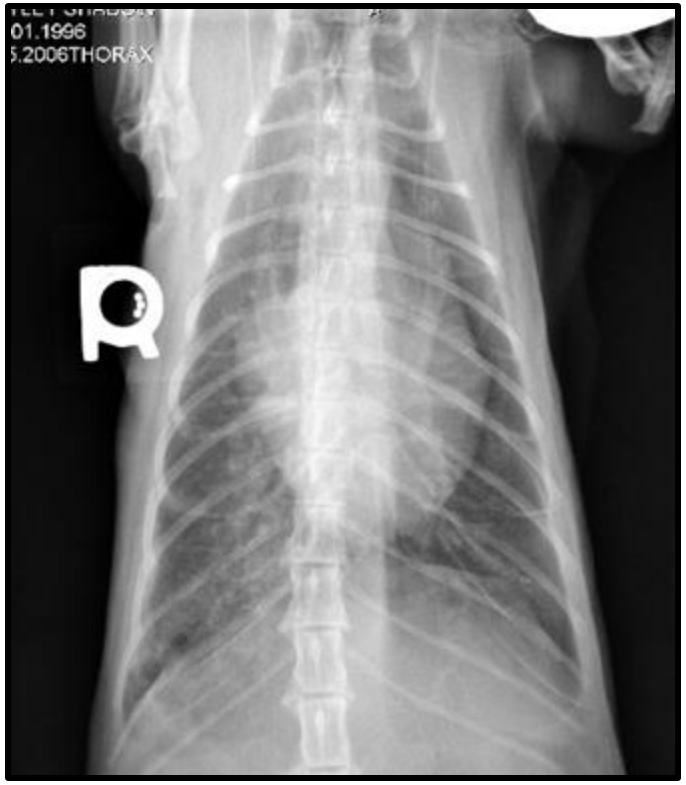
Cats? They do whatever...





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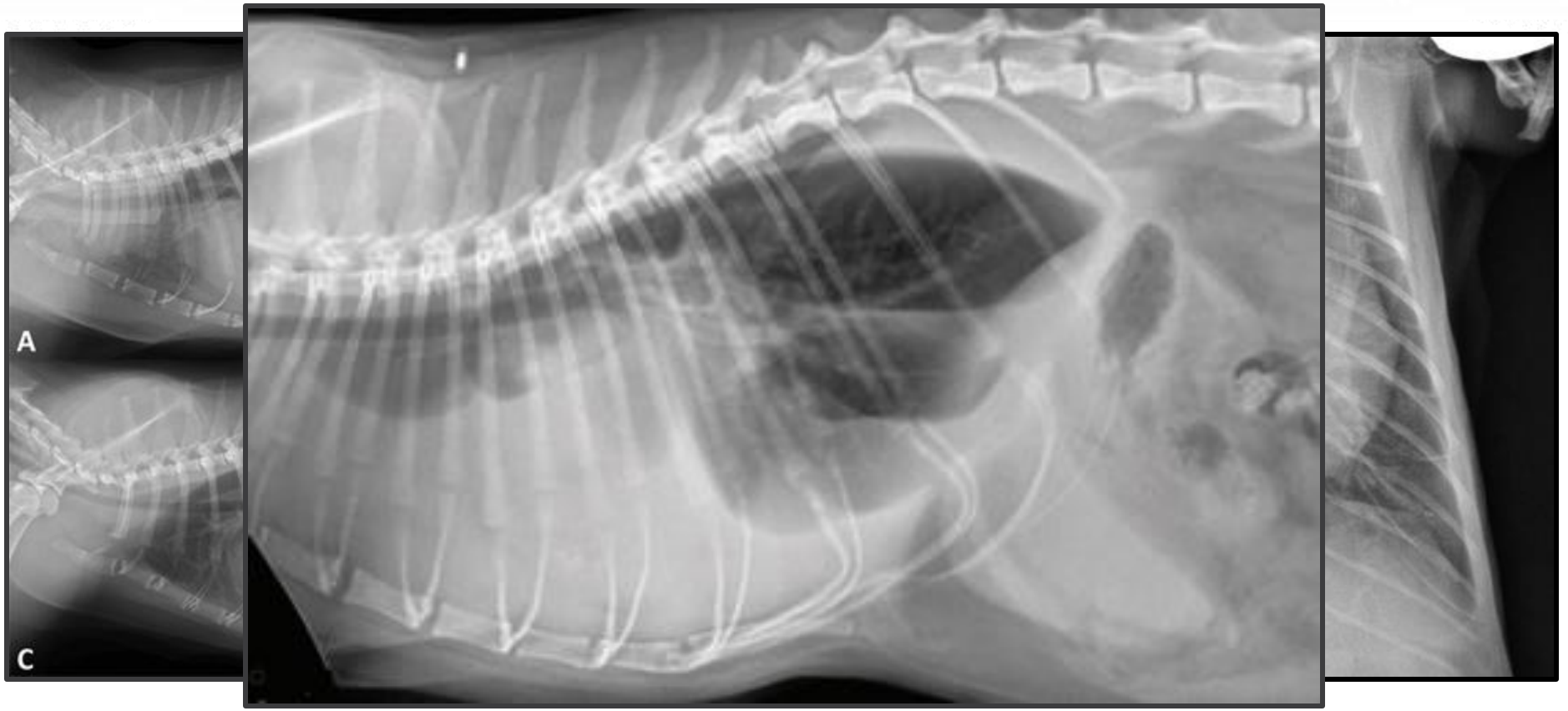

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Triage, stabilization, and treatment!



Case 1: Robin

Signalment:

- 8Y F/S CKCS
- 22# (11kg)



History:

- II/VI systolic murmur last year
- No meds
- Sudden onset of coughing/ inc. RR today
- Single syncopal spell after going upstairs

Case 1: Robin

Physical Examination:

- HR 180, now grade IV/VI murmur
- RR 66 w/abdominal component
- Crackles (R>L in hilar region)
- MM pale/slight cyanosis
- SpO2 93% Room air
- BP 90mmHg systolic (Doppler)
- POCUS (user dependent):
  - Cardiomegaly, B lines in perihilar/CD lung fields



Case 1: Robin

Physical Examination (cont.):

- POCUS (user dependent): Cardiomegaly, B lines in perihilar/CD lung fields



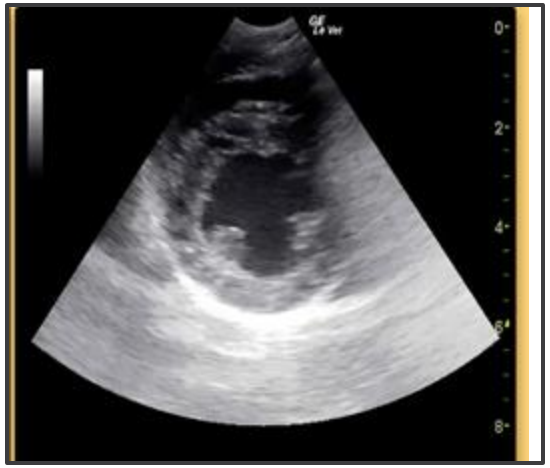






Figure 2—Representative still B-mode LUS images of dogs with respiratory distress showing a single B line (A), > 3 B lines that

Case 1: Robin

Initial Stabilization:

- 2mg/kg IM/IV Lasix (SQ too slow!)
  - *IF very severe or refractory CHF cases, can give 4mg/kg Lasix MAX or CRI*
  - *Remember Lasix ceiling*
- O2 support
  - cage/flow by/tent
  - normal/high flow nasal cannulas
- Anxious/spicy patient? Consider mild sedation
  - butorphanol 0.2mg/kg IM/IV
- +/- IVC



Case 1: Robin

Initial Stabilization (cont.):

- Contact owner for workup of possible CHF
  - 3 view CXR (if stable), baseline labwork
- Don't think they're stable enough to go home?
  - Transfer to ER/hospitalization (if stable enough for transfer)
- *Improved/stabilized after Lasix dose? Rx Lasix and pimobendan. Call CVCA to schedule urgent appt!*

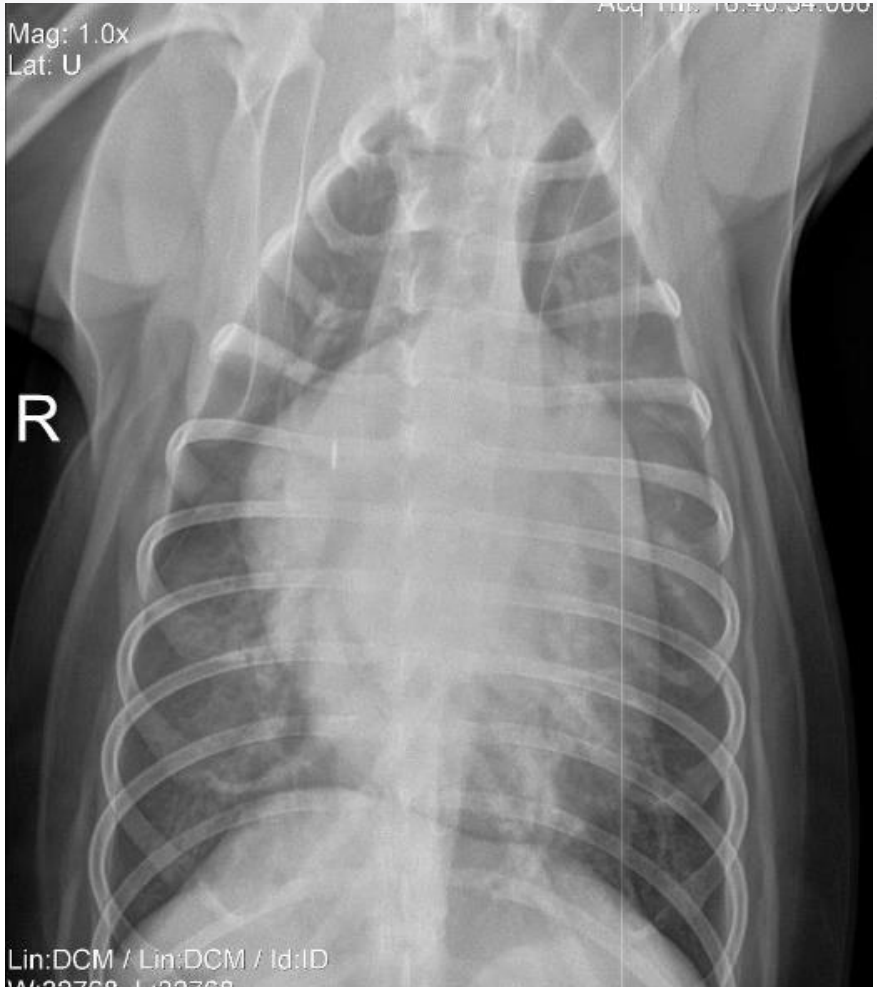


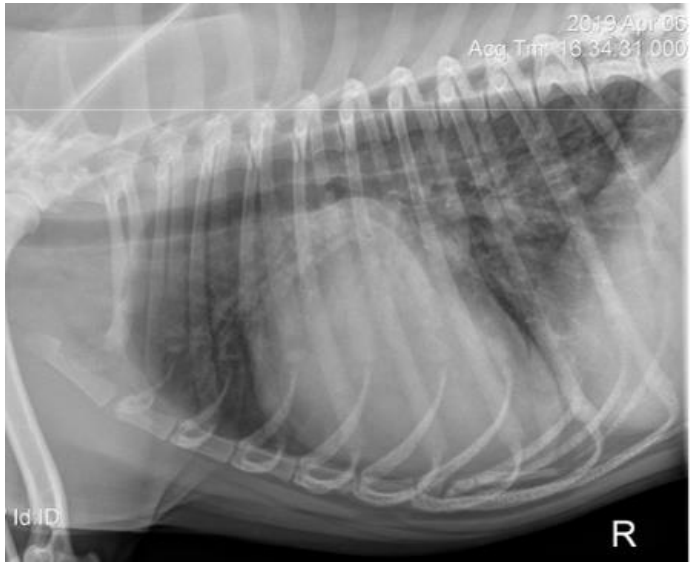


Case 1: Robin

Chest radiographs:

- Cardiomegaly, LAE
- Dilated vasculature
- Unstructured caudodorsal interstitial pattern (R>L)





It's after 5PM, no Echo 'til tomorrow.... PLAN???

- **If stable after 2mg/kg Lasix in hospital**
  - ***Ideal to keep in hospital until next day to have Echo consult***
  - can consider TGH on 2mg/kg Lasix PO TID for 4 days, then BID if improving (can call CVCA to schedule appt during business hours)
  - Pimobendan 0.25-0.3mg/kg PO q12h in all canine CHF cases

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A note on transferring patients

Ideally speak DVM to DVM before initiating transfer to ER or getting an urgent work in with a cardiologist

Please send all history and diagnostics before patient arrives at any facility

This provides seamless care, sets appropriate owner expectations, and helps guide additional diagnostics and treatment.

Short and Long Term Goals

1. **Reduce Congestion**
   a. Lasix - continue 2mg/kg q 2, 4, 6, 8 hr (depending on severity)
   b. If severe CHF - consider Lasix CRI 0.66-1mg/kg/hr MAX 8hr (recheck kidney /lytes values q 8-12h) before restarting pulse therapy
   c. Ceiling effect 12mg/kg/day

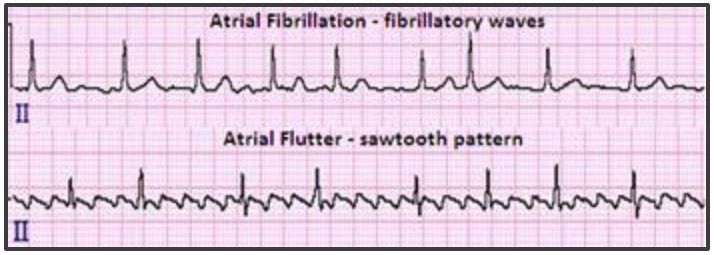


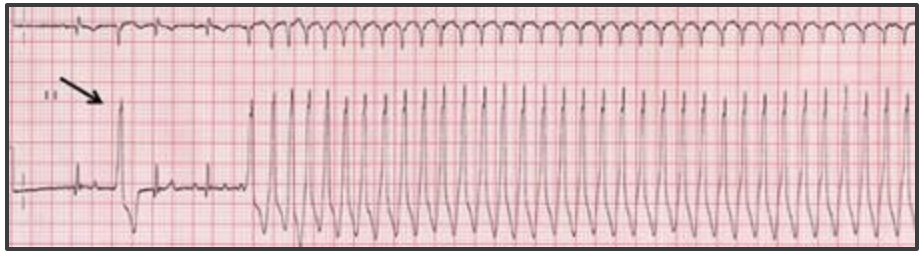
2. **Increase Contractility/Improve BP**
   a. Pimobendan - 0.25 mg/kg PO BID
      i. Can start in obvious DCM/MR CHF cases, call CVCA or withhold if ever unsure of CHF vs. airway disease
      ii. Cats? Not typically necessary in initial stabilization
   b. Dobutamine CRI 5-10 mcg/kg/min
      i. Start if hypotensive (90 mmHg systolic or less)
      ii. CANNOT give in the same line if you have a concurrent Lasix CRI (crystallizes)



Short and Long Term Goals

3. **(if necessary) Normalize HR and Rhythm**
    a. Arrhythmias exacerbate disease
        i. Afib, Ventricular arrhythmias, AV Block
    b. Not sure? Can make copy of strip/video and send to CVCA
        i. In emergency situations:
            1. Ventricular arrhythmias: Lidocaine, mexiletine, consult with CVCA before utilizing sotalol (mild negative inotrope)
            2. Digoxin/diltiazem (PO!)? Would contact cardiologist before giving
                a. Goal is *rate control* (long term survival)
                b. Controlling CHF typically slows HR a little
    c. Beta blockers contraindicated in CHF





Back to Case 1: Robin

Overnight Plan Goals (Specifics):

- O2 support: O2 cage vs. Nasal O2 vs. High flow nasal cannula
  - Monitor RR/RE q1h
- Baseline CXR and Renal Values + electrolytes
  - Monitor renal function and lytes q 24h
- Injectable Lasix 2mg/kg IV/IM q1-2h, then q4-8h
- Pimobendan 0.25-0.3mg/kg PO BID
- Monitor BP q8h (q1h if hypotensive or using pressors)
  - If <90mmHg systolic consider dobutamine CRI
  - ALWAYS offer water, can offer food when less dyspneic
- No IVF (unless pressor/Lasix CRI)
- During q12h exams - can recheck crackles/POCUS
- Individualize therapy accordingly



Long Term Care, Therapies, Monitoring

Robin's all better! TGH Meds??

- **Pimobendan 0.25-0.30mg/kg BID**
  - side effects: GI upset (transient diarrhea), idiosyncratic LE elevations (SUPER rare)
- **Lasix 2mg/kg PO TID for 3 days, then BID**
  - side effects: PU/PD, progressive azotemia

RAAS Inhibition?

- **ACE-i (titrate up to 0.3-0.5mg/kg BID)**
  - balanced vasodilators for afterload reduction
  - side effects: progressive azotemia, GI upset
- **Spironolactone (1-2 mg/kg SID-BID)**
  - aldosterone antagonist and mild diuretic effects
  - side effects: progressive azotemia, GI upset, increased K levels



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Aside #1… Cardalis

Dosing a wee bit different:

- Benazepril 0.25mg/kg SID
- Spironolactone 2mg/kg SID



Benefits:

- Scored tablet
- Yeast based flavor and high palatability
- Once per day dosing
- More convenient for O's



Emerging therapies

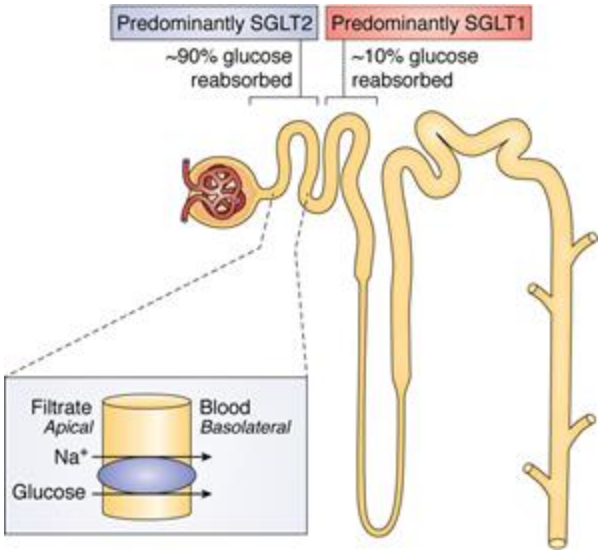
- **Entresto** (sacubitril/valsartan):
  - **Sacubitril** - neutral endopeptidase inhibitor (NEPi)
    - inhibits breakdown of natriuretic peptides (ANP/BNP) - continued diuresis/natriuresis and mitigating maladaptive effects of RAAS activation
  - **Valsartan** - angiotensin receptor blocker (ARB)

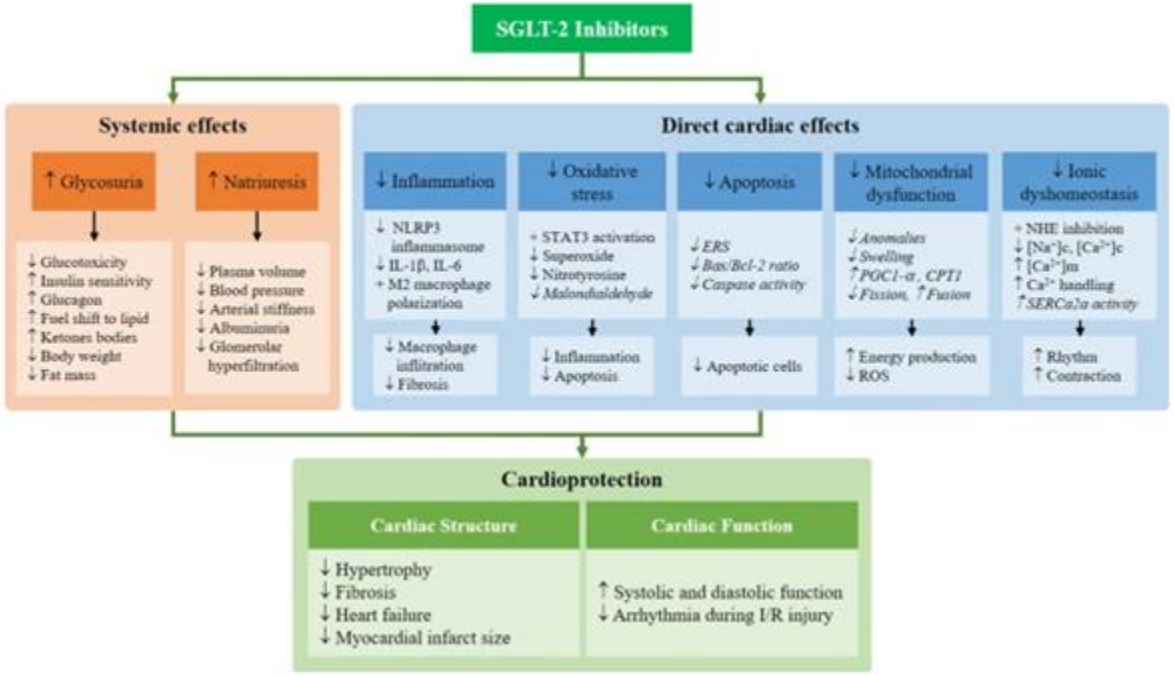
Entresto®
(sacubitril/valsartan) tablets
24/26mg · 49/51mg · 97/103mg



Down the pipeline…

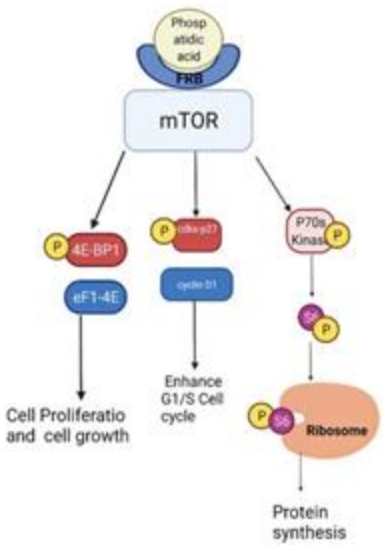
- **Senvelgo** (velagliflozin) and **Bexacat** (bexaglifozin) - SGLT2 inhibitors
  - block glucose and Na+ absorption at the proximal convoluted tubule → diuresis and additional cardioprotective effects

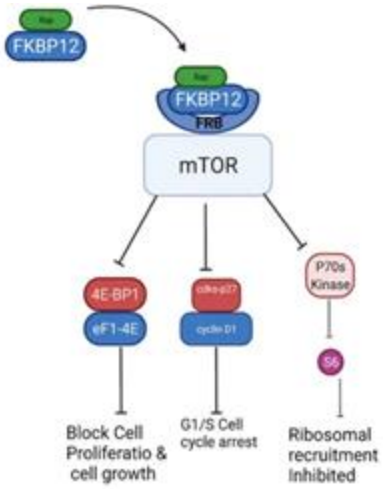




Down the pipeline…

- **Rapamycin** (sirolimus) for cats
  - macrolide compound typically utilized to regulate cell growth/function
    - inhibits the mechanistic target of rapamycin (mTOR - an anchoring protein within a protein complex involved in numerous pathways)
  - *RAPACAT study* - well tolerated in cats, may improve LV wall thickness (additional studies in the works)
  - Not currently recommended for cats with obstructive disease/CHF





Long Term Care, Therapies, Monitoring

Robin's all better!

- **Home Care**
  - Activity - once feeling better, gradually resume to normal activity as pet is able to do
  - Diet - commercial/balanced diet, avoid grain free/high legume diets, avoid salty treats/snacks
- **Monitoring**
  - Coughing or difficulty breathing
  - Getting more tired on walks or when playing
  - Weakness and/or collapse
  - Bloating / swelling of the belly
  - ***RESTING RESPIRATORY RATE:*** The normal breathing rate for a sleeping dog is fewer than 35 breaths per minute. One rise and one fall of the chest is one breath. If you notice that the breathing rate is more than 35, please see your veterinarian. A useful app to monitor breathing rates at rest is BPM Tracker - iPhone (BPM Counter - Android).

Long Term Care, Therapies, Monitoring

Prognosis

- From initial onset of failure: 12-18 months average
  - **This is WITH the use of pimobendan and furosemide**
- Potential complications that could shorten that time:
  - Chordae tendineae tears
  - Bilateral heart disease
  - Arrhythmias
  - CKD
  - Concurrent airway disease
  - Left atrial tear

Other recommendations

- No elective anesthesia (would consider specialty hospital for emergency procedures)

Case 2: Pickles

Signalment:

- 13Y MN DSH
- 11# (5kg)

History:

- Presented to ER for progressively inc. RR/RE and now dyspnea
- Has been on prednisolone for the past 1.5Y to treat suspected IBD/lymphoma
- Had been on Abx for the past week (Convenia and Clavamox) for possible pneumonia



Case 2: Pickles

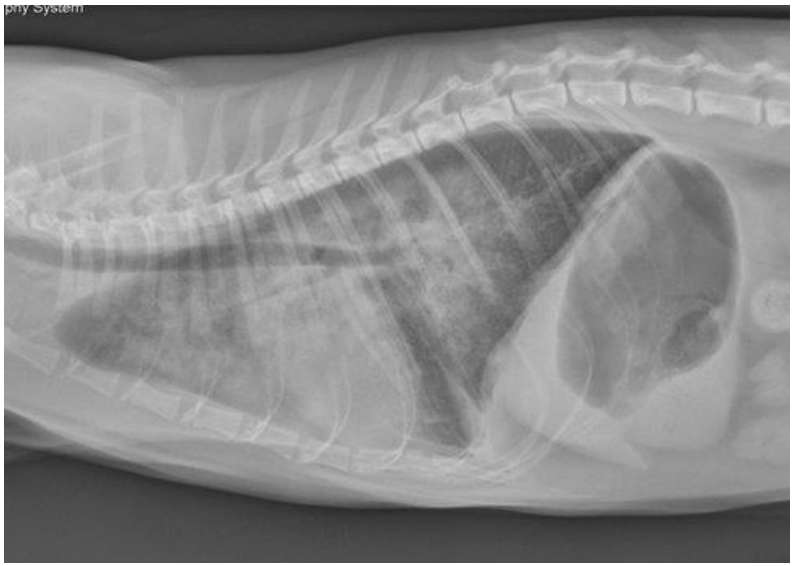


Physical Examination:

- HR 200, new grade III/VI murmur
- RR 66, open mouth breathing
- Crackles everywhere
- BP 110mmHg systolic
- Mm pale pink

- POCUS (user dependent):
  - White out

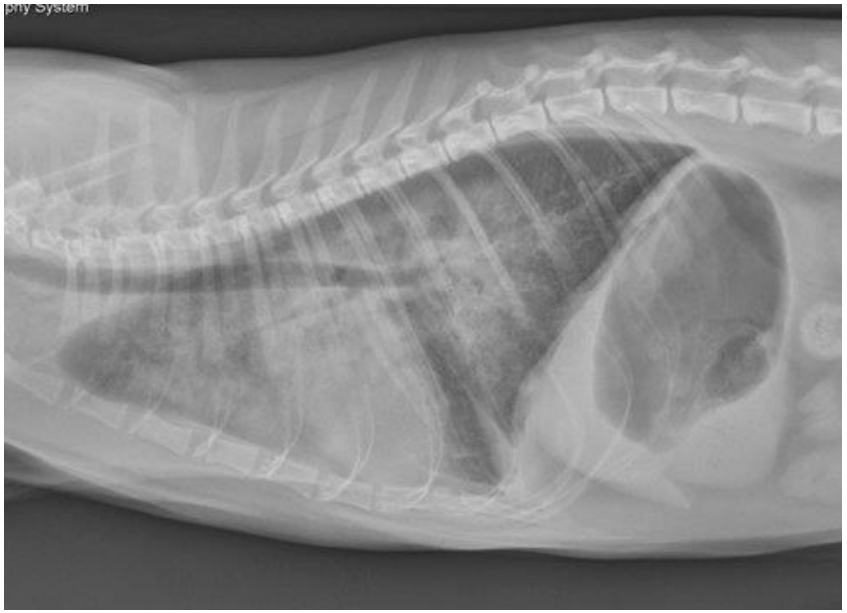
- Thoracic radiographs



Case 2: Pickles

No Echo Available?

- Potentially helpful diagnostics:
  - SNAP BNP / Quantitative NT-proBNP
    - Negative SNAP BNP highly sensitive for ruling out CHF (this cat was +)
    - *Can be falsely positive/elevated in cases of hyperthyroidism, systemic hypertension, renal disease, FIV/FeLV*, neoplasia**
  - Lasix trial/supportive care for CHF
    - 1-2mg/kg IV or IM every 2-4-6 hrs (dependent on RR)
    - Try to get to q8 hrs before discharge



Case 2: Pickles

TGH Tx for CHF Cats:

- Lasix 1-2mg/kg BID-TID
- Antithrombotics
  - Clopidogrel (Plavix) 18.75mg/cat PO SID
    - **VERY BITTER** empty gel capsule
  - Rivaroxaban (Xarelto) 2.5mg/cat PO SID
  - Aspirin? not as effective as other antithrombotics
    - If all else fails: 81mg aspirin: ¼ tablet *twice weekly*
- ACEi?
  - No solid evidence for benefit, but theoretically can be helpful
  - Not ideal for azotemic patients
- Pimobendan?
  - Would wait for echo results or consult with CVCA before utilizing in cats
- Spiro?

Case 2: Pickles

A Note on Aortic Thromboembolisms:

- **Typical History/Presentation**
  - Acute onset hind limb paralysis/yowling
  - May or may not have previous hx of heart murmur/heart disease
  - Hind limbs cold, pale, pulseless
  - May or may not be hypothermic (worse prognosis if temp <99F on presentation)
- **Essential Diagnostics**
  - Doppler BPs on one/both back legs, compare to front/working leg
  - If Doppler BP not available, can do the same with blood glucose levels
  - CXR - looking for signs of cardiac enlargement
  - Echo
- **Treatment**
  - *THIS IS ALWAYS A PAINFUL/UNCOMFORTABLE PROCESS!* Pain meds are a mainstay of therapy
  - Anti-thrombotics (previous slide), can also use Enoxaparin (Lovenox) SQ 1mg/kg q12h
  - Oxygen and manage CHF (if present)
  - Monitor kidney and electrolyte values + reperfusion injury monitoring
  - PT at home
- **Overall Poor Prognosis (average survival time ~3 months)**

Case 3: Pepe

Signalment:

- 15Y MN Chihuahua
- 11# (5kg)



History:

- Presented for progressive coughing, O's can't sleep at night
- Previous hx of a cough, but never this bad

PE:

- Overall unremarkable, but new grade II/VI L heart murmur (not heard before per O's knowledge). Stable. No cough on tracheal palpation. SPICY!

Case 3: Pepe

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Case 3: Pepe

CXR:

- *Subjective* HEART LOOKS HUGE
- VHS: 10 (normal)
  - Mild generalized BI pattern
  - Normal vasculature
  - No CHF or overt collapsing trachea
  - Normal LA
  - Rotated
- Diagnosis: CHF unlikely, tx for airway disease



PLAN:

- Empiric airway therapy
  - Abx
  - Cough suppressant
  - Bronchodilators (theophylline 5-10mg/kg BID)
  - Steroids if normal heart size
- Recommend schedule appt with CVCA for heart murmur (not on urgent basis)



Case 4: Hoss

Signalment:

- 8Y MN Bulldog
- 44# (20kg)



History:

- Presented for progressive lethargy, weakness, abdominal distention
- Also on a grain free diet

PE:

- No overt murmur (but loud stertorous noises), abdominal distention with fluid wave, variable pulses, pale mm

Case 4: Hoss

AFAST:

- Severe peritoneal effusion
- Diagnostic tap - pale yellow, clear to slightly hazy fluid



TFAST:

- BIG right heart
- Subjectively poor heart muscle function

Case 4: Hoss

Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)

Not just in Boxers!

- Identified and characterized in English/American Bulldogs, Bulldog X's
- Can have syncope, arrhythmias, and heart murmurs like ARVC Boxers
  - 2 phenotypes: *Arrhythmogenic* and *Dilated-type*



Case 4: Hoss

Additional Treatments for R CHF (general recommendations):

- **Abdominocentesis/Thoracocentesis (for moderate/severe effusion)**
  - Comfort, increased inspiratory capacity
  - Increased absorption of oral medications



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Aside #2… Update on Grain Free Diets High Pea/Legume or "Pulse" Diets

- Now defining them as *high "pulse" diets*
  - basically high proportions of peas/lentils/chickpeas have been associated with DCM +/- CHF
  - Pit Bulls/Pitty X's may be at increased risk
  - "high proportion" = in top 10 ingredients
  - Time on diet VARIES (months-years)
  - Soybeans and peanuts don't count! See anxiety inducing chart (thank you Dr. Freeman)

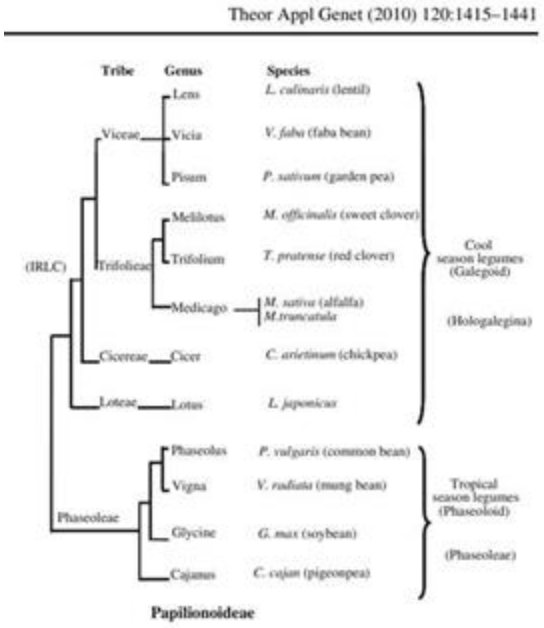


Fig. 1 Phylogenetic relationships: Papilionoideae family. This figure (taken from Choi et al. 2004b) illustrates the phylogenetic relation of chickpea with other legumes. Chickpea and *Medicago* belong to inverted repeat lacking clade (IRLC) of Papilionoideae and constituted the cool season legumes

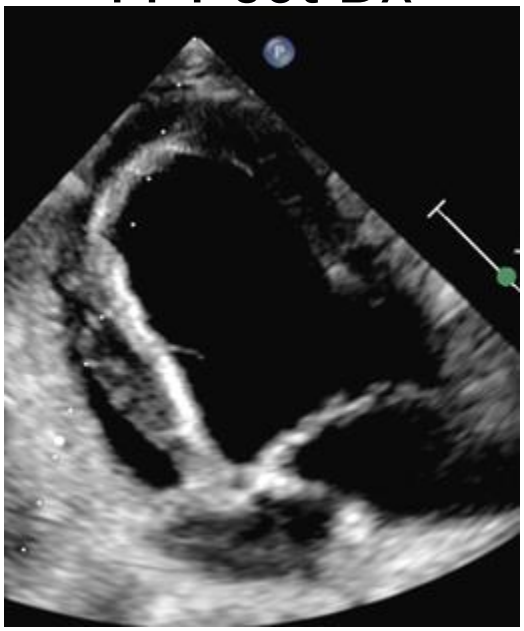
Aside #2… Update on Grain Free Diets
High Pea/Legume or "Pulse" Diets

MAY see reversal/positive remodeling of the heart with cardiac medications + transition to traditional diet (varies…)

Time of Dx



1Y Post Dx



2Y Post Dx



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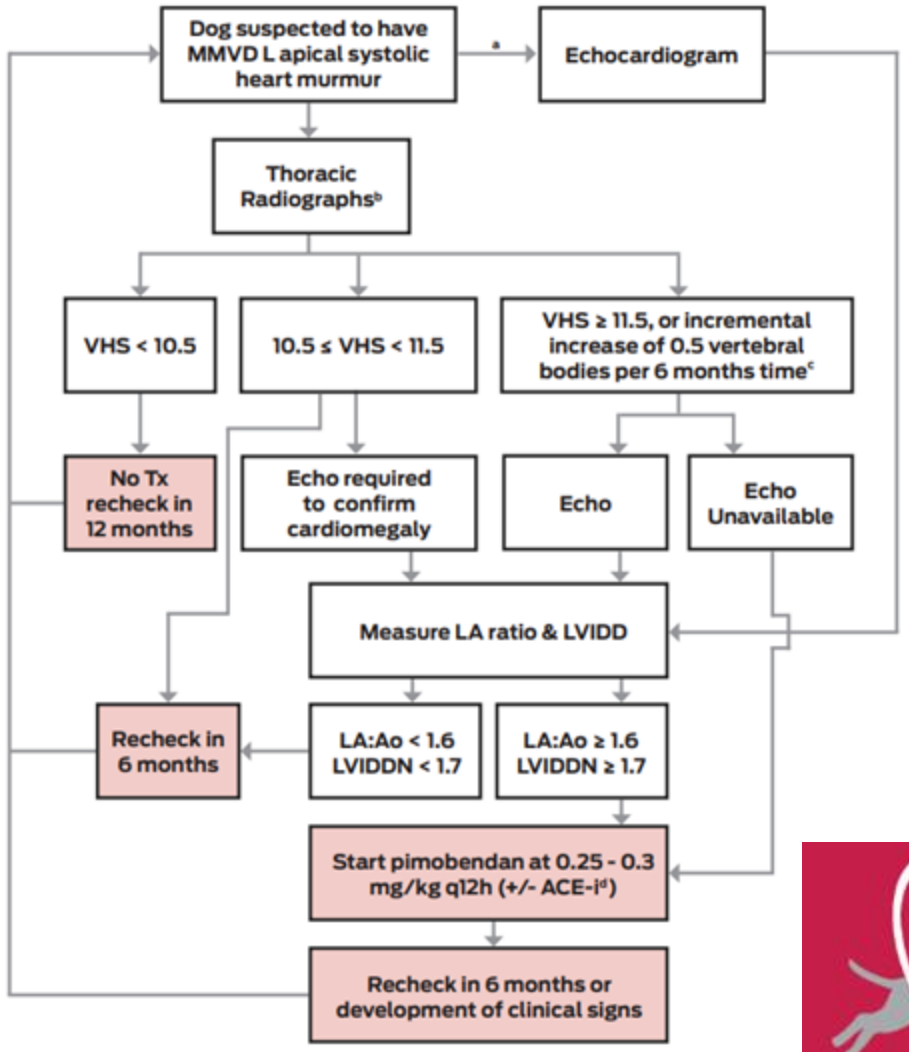
ALGORITHM

CEG Recommendations for Therapy in Preclinical Myxomatous Mitral Valve Disease



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Questions??



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