

Cardiology Emergencies: CHF, Collapse, Cardiac arrhythmia

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HeartVets Cardiology Consultancy Service

Referral clinics throughout SW and S. Wales

Online ECG/Radiograph Reporting and

Holter Monitoring Service

www.heartvets.co.uk



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What is Heart Failure?

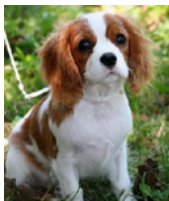
= **Clinical syndrome** caused by heart dysfunction.

- **Low output (forward) heart failure:** pumping ability is compromised and can't meet body's needs. **Weakness/collapse**
- **Congestive (backward) heart failure:** inc venous pressure -> fluid accumulates in the lungs/body cavity. **Breathless**



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What causes CHF?



- Severe MR
- Reduced CO, severe LA enlargement

DMVD



- Severe LV systolic function
- Poor CO
- Elevated LVEDP
- LA enlargement

DCM



- Severe LV diastolic function
- Poor LV filling
- Elevated LVEDP
- LA enlargement

HCM



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It takes severe, overwhelming disease to cause CHF

- Mild heart disease **does not** result in heart failure
- Heart failure only occurs when severe, overwhelming heart disease is present.
- The animal is distressed, SNS is activated -> tachycardia, loss of sinus arrhythmia
- Tachypnoeic/dyspnoeic
- The left atrium needs to be enlarged (usually..)
- Cardiomegaly, pulmonary venous congestion and interstitial/alveolar pattern on thoracic rads



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Clinical findings consistent with congestive heart failure - dogs

- Tachycardia (>120bpm)
- loss of sinus arrhythmia
- **Tachypnoeic/** dyspnoeic (SRR >30 br/min)
- Cough MAY be present (rapidly progressive)
- Loud murmur in small breed dogs (DMVD)
- Large breed dogs may have soft murmur +/- gallop sound
- Arrhythmia MAY be present



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What about cough?

- Coughing is the hallmark sign of chronic bronchitis
- Tachypnea/dyspnoea are the hallmarks of PO
- Dogs with pulmonary oedema can cough **BUT primary lung/airway disease is very common**
- Frusemide is a bronchodilator
- Dogs with chronic bronchitis **often improve on furosemide** with reduced or resolved coughing.
- This is not evidence that the dog has LCHF



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Clinical Examination: Lung sounds



Crackles of CHF are
soft and fine

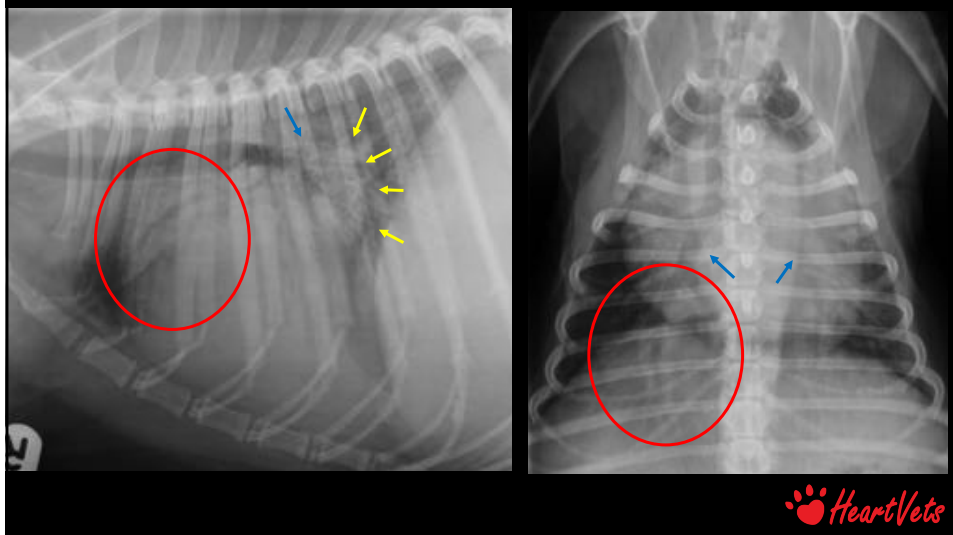


Coarse crackles = lung disease



8

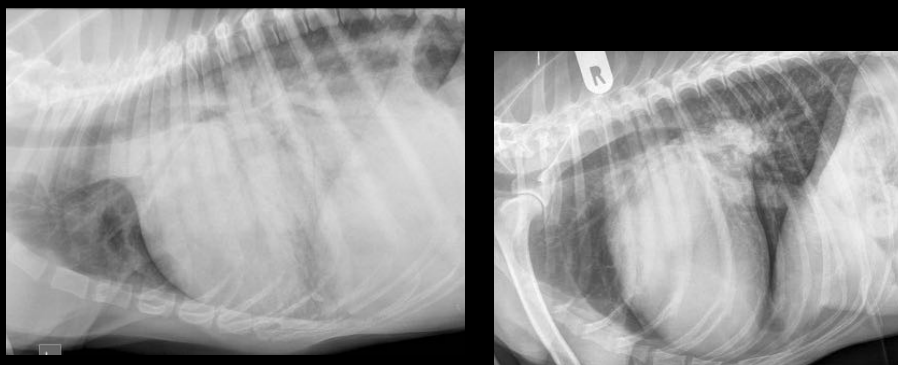
Radiographic CHF



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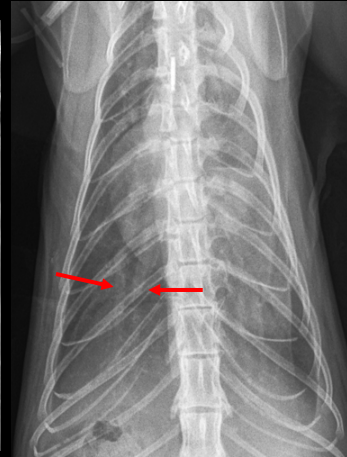
Pulmonary oedema



HeartVets

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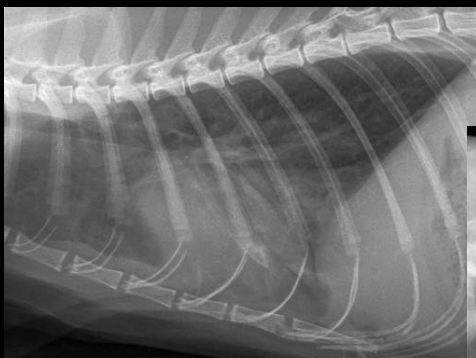
Feline CHF



 HeartVets

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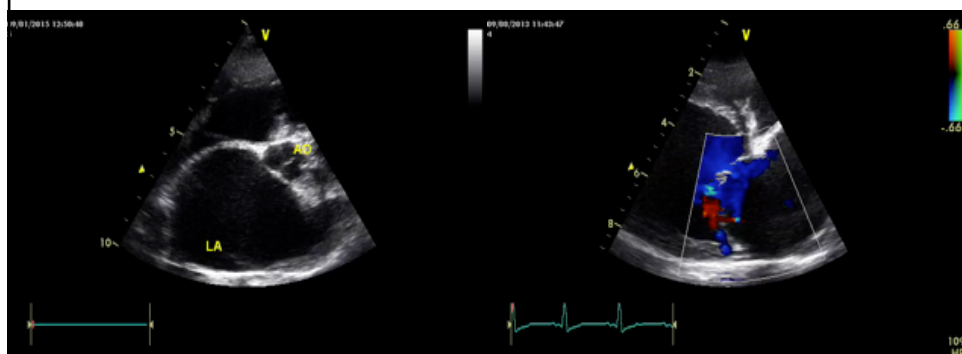
Feline CHF



 HeartVets

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Echocardiography

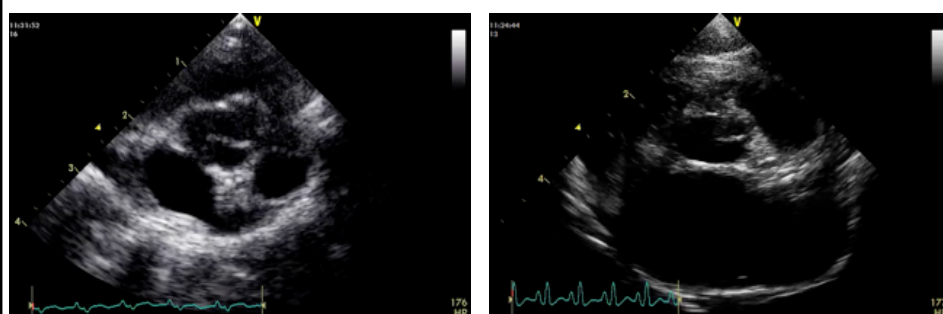


- Echo: left atrial enlargement, underlying disease
- It does NOT tell us whether there is pulmonary oedema



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Echocardiography



- In cats LA enlargement and dyspnoea = likely CHF
- Poor LA function - beware thrombo-embolic consequences
- Beware the acute MI in cats - "flash" oedema



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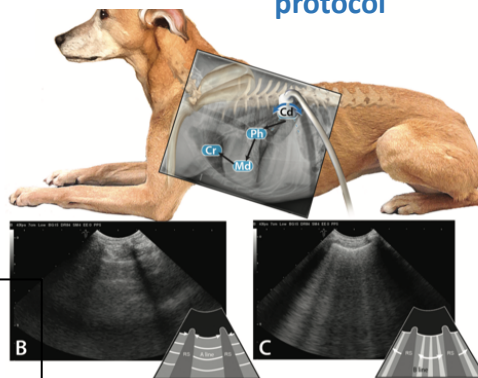
Lung Ultrasound

Accuracy of point-of-care lung ultrasonography for the diagnosis of cardiogenic pulmonary edema in dogs and cats with acute dyspnea

"VetBLUE protocol"

JAVMA • Vol 250 • No. 6 • March 15, 2017

Jessica L. Ward DVM
Gregory R. Lisciandro DVM
Bruce W. Keene DVM, MSc
Sandra P. Tou DVM
Teresa C. DeFrancesco DVM



Sensitivity 84%
Specificity 74%
Similar to thoracic radiography



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Clinical findings consistent with congestive heart failure - cats

- Heart rate: variable
- Heart murmur: variable
- Gallop sound: maybe
- Arrhythmia: possibly
- Cough: don't rule it out

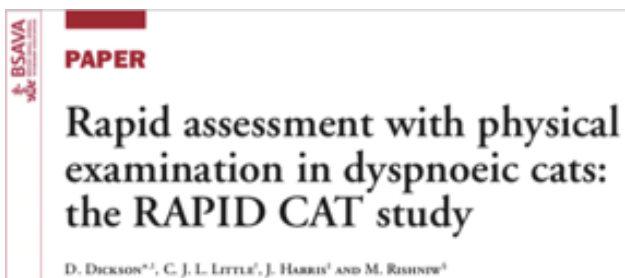


This is the problem with cats!



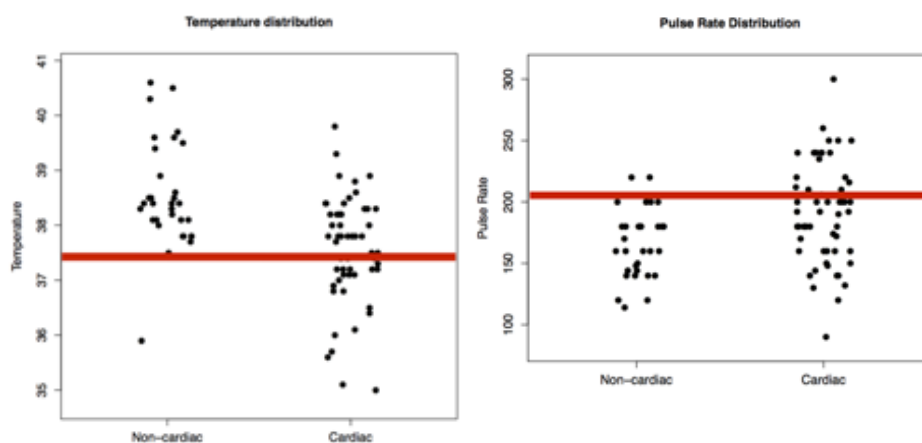
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Diagnosis of CHF in cats



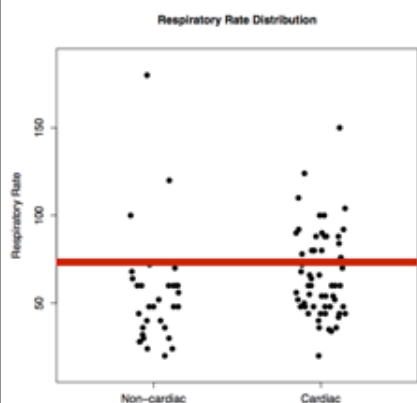
17

Diagnosis of CHF in cats



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Diagnosis of CHF in cats



Gallop

$T < 37.5^{\circ}\text{C}$

$P > 200$

$R > 75$

Highly specific,
but not sensitive
for acute cardiac
dyspnoea in cats

When combine findings,

PPV = 91% for presence of **cardiac dyspnoea**
(Spec of 84% and Sens of 83%)



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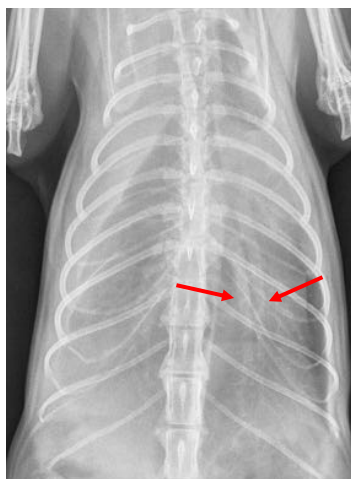
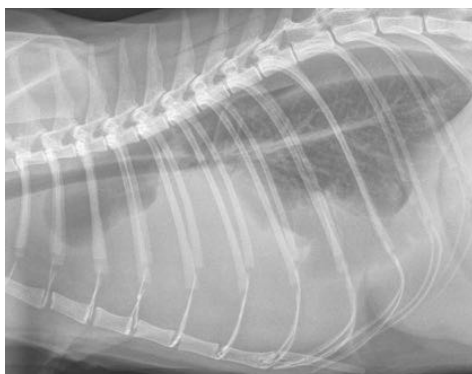
IDEXX proBNP SNAP test

- Test for presence of “LV stretch”
- Reasonably useful in the clinical situation to differentiate cardiac from non-cardiac dyspnoea
 - Takes 20-30 mins to get an answer
 - Doesn't differentiate between Pleural Effusion and Pulmonary Oedema
 - Doesn't differentiate between pyothorax and asthma
- More useful (I think) to decide if a cat with a murmur needs an echo



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CHF in cats – pleural effusion

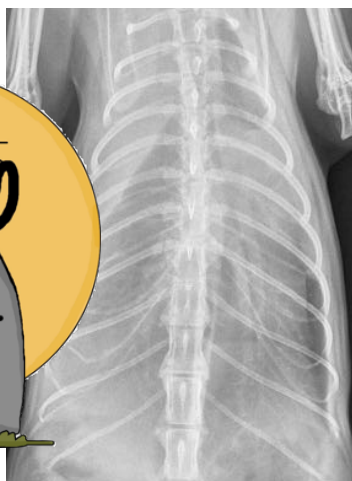
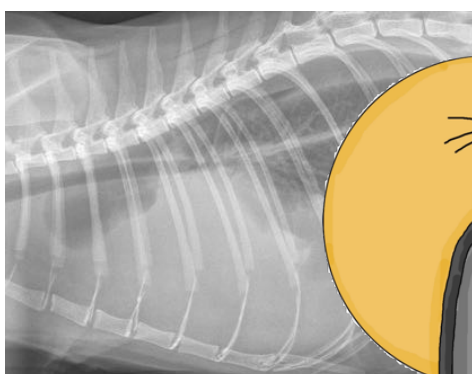


- Thoracocentesis if required to relieve dyspnoea
- Note the pulmonary vessels if still visible



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CHF in cats – pleural effusion

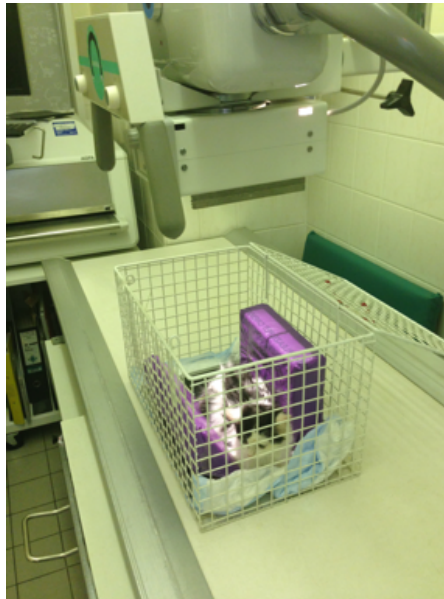


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- Note the pulmonary vessels if still visible

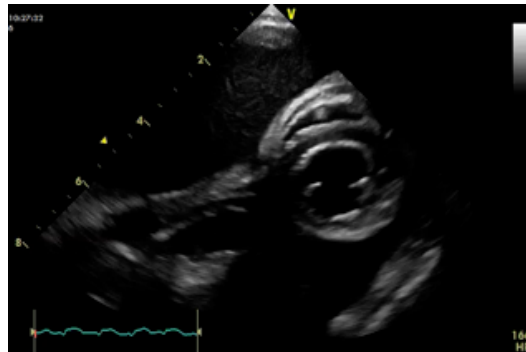


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CHF in cats



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Pleural effusion:
Ultrasound

- Fluid surrounds heart AND other structures -> see membranes and other tissue waving in the fluid
- The pericardium can still usually be seen – bright white line at edge of myocardium
- Pleural AND pericardial effusion may be present in CHF



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Pleural effusion vs Pericardial effusion



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Thoracocentesis

- Catheter (IV, butterfly, thoracic) or needle
- 3-way tap
- Extension tubing
- 10-20ml syringe (60ml if large dog)
- Plain & EDTA sample pots, slides, culture swab
- Dish/bowl
- Extra sedative (Alfaxan)
- Gloves, drape, surgical prep



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Thoracocentesis

- Best spot to drain: US
- Local anaesthesia (Ethyalm, lidocaine)
- Gently advance needle into thorax with negative pressure
- Stop as soon as aspirate fluid
- Advance catheter fully into thorax (aim ventrally)
- Gently aspirate fluid (not too hard- blocks)
- Use first syringe for samples
- Use three-way tap to speed drainage and reduce movement of catheter



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Treatment of CHF

Acute CHF:

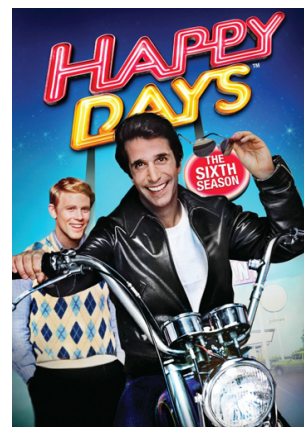
Frusemide

Oxygen

Nitroprusside (ie Vasodilation)

Z = Sedation

- Quiet environment
- Avoid stress



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Acute CHF

Furosemide:

- 2mg/kg IM or IV (1-2mg/kg cats)
- Hourly until RR decreases <40br/min
(or 1mg/kg q 1-2 h in cats)
- Then q. 6-12h
- Monitor renal parameters/ electrolytes
- May be more effective as a CRI: 0.66-1mg/kg/h after initial bolus)



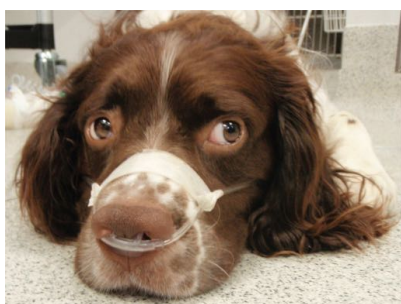
Expert consensus in humans, dogs and cats that loop diuretics are efficacious for CHF



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Acute CHF

Oxygen:



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Acute CHF

Vasodilation:



¼ - ½ inch cutaneously q 6h

¼ - ½ 5mg patch cutaneously

- Nitroprusside/ hydralazine (with experience)
- Consider **amlodipine** (dogs)
- Monitor BP – CARE hypotension
- DON'T USE if suspect severe LVOTO in cats (loud murmur)



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Acute CHF

Sedation:

- Mild sedation to reduce anxiety if required
- Butorphanol
- 0.2-0.25mg/kg IM



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Inotropic support – with myocardial failure

- **Pimobendan** intravenously (dogs) –
0.15mg/kg as a single dose (2ml/10kg
or 1 x 5ml bottle/25kg)
- Dobutamine 1-10mcg/kg/min CRI (start low) –
only if experienced
- Digoxin – if desperate! 1-2 x doses at twice
calculated maintenance dose



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Summary

- CHF is a clinical syndrome which requires careful management
- Make sure the diagnosis is correct!
- Trial therapy is OK but STOP if not working
- There are clear guidelines based on good level evidence for management of CHF in dogs
- There is little EBM re CHF in cats but similar principles apply
- Ultrasound for pleural effusion in cats - thoracocentesis
- Treat each case according to suspected underlying disease



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Approach to the collapsed patient

Cardiac collapse in dogs is due to severe forward failure:

- Myocardial failure (DCM)
- Severe diastolic failure causing poor filling (HCM)
- Cardiac compression/ constriction (pericardial disease, neoplasia)
- Arrhythmia (tachyarrhythmia, bradyarrhythmia)

In cats it may be due to

- Severe dynamic LV outflow obstruction (HCM) – on exertion
- Arrhythmia: SVT/VT as a consequence of HCM/DLVOTO/MI
- Bradyarrhythmia: hi grade AV blocks (intermittent)
- Arterial thrombo-embolic event – non-ambulatory



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Approach to the collapsed patient

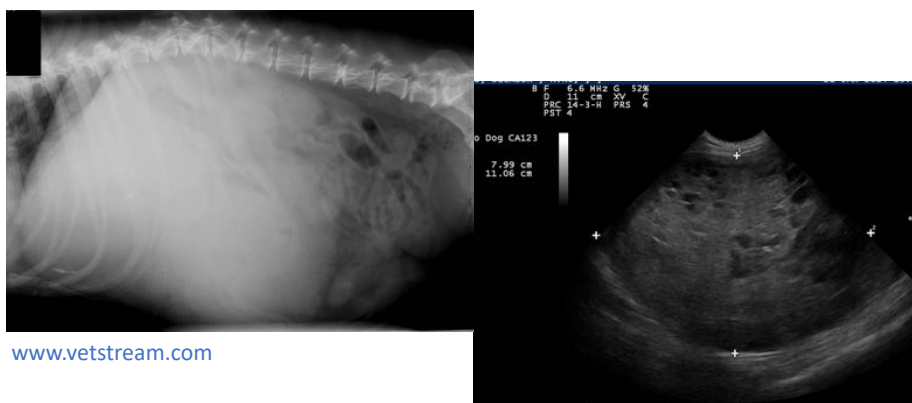
- Check mucous membrane colour
- Is the patient dyspnoeic? Is there respiratory stridor/stertor?
- Check peripheral perfusion – limb temperature, peripheral pulses (cold limbs in cats -> ATE)
- Check femoral pulses and feel apical impulse arrhythmia - pulse deficits, weak/variable pulses in DCM or PE, absent or weak pulses in cats -> ATE)
- Auscultate: heart rate, loudness of heart sounds, presence/absence of murmur/gallop sound/arrhythmia
- Connect ECG – arrhythmia needs a **rhythm diagnosis**
- **Rectal temperature** (low in dyspnoeic cats: be suspicious of CHF)



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Approach to the collapsed patient

If pale and tachycardic remember this may be acute hypovolaemia –
check the abdomen!



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Pericardial effusion

- Collapse is due to poor output (the heart is compressed and can't fill)
 -> poor pulses, variable pulse quality, tachycardia
- Ascites: R-CHF is due to inc RA pressure **Check the jugular veins**



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Jugulars and abdomens:

Hepatojugular reflux test



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Pericardial effusion

Transudates

- Hypoproteinaemia
- Congestive heart failure
- Peritoneopericardial diaphragmatic hernia

Haemorrhage (non-clotting)

- **Idiopathic**
- **Neoplasia**
- Cardiac rupture (LA tear)
- Trauma

Chylous effusion

- Idiopathic pericarditis
- Neoplasia

Exudative

- Infectious pericarditis (trauma)
- Sterile
 - Idiopathic, uraemia, FIP



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Pericardial effusion

Idiopathic

- Effusion develops over days to weeks
- Large volume of effusion
- Ascites is more common

Neoplastic

- Effusion develops rapidly
- Smaller volumes of effusion occurs
- Collapse is more common

Table 3. Presenting signs and clinical findings in 143 cases of pericardial effusion

Sign	Number of cases (%)
Muffled heart sounds	106 (74)
Weakness, lethargy	105 (73)
Ascites	97 (68)
Exercise intolerance	82 (57)
Weak pulse	51 (36)
Pallor	44 (31)
Dyspnoea	40 (28)
Colic	33 (23)
Coughing	33 (23)
Vomiting, diarrhoea	23 (16)
Polydipsia	17 (12)

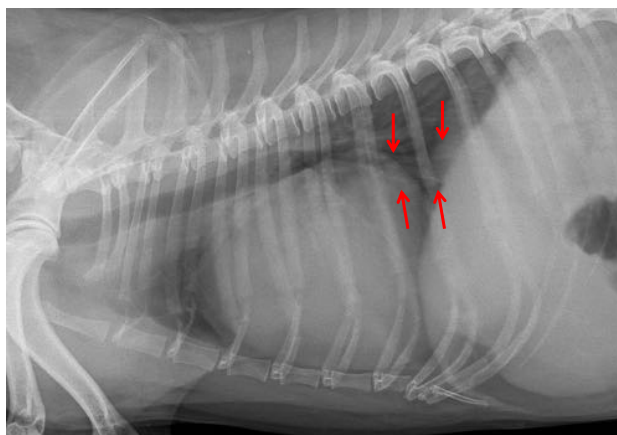
Stafford Johnson, Martin et al (2004)
JSAP



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Pericardial effusion

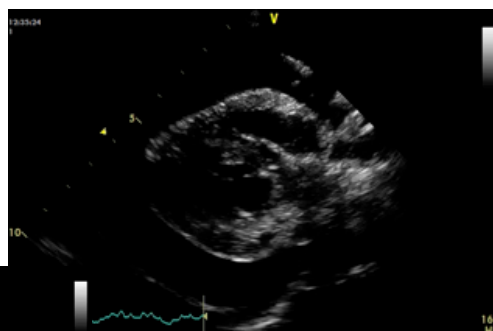
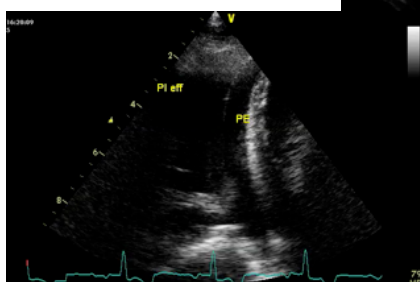
- Large, globoid cardiac silhouette (unless acute)
- Sharp borders
- No LA enlargement
- Wide caudal vena cava
- hepatomegaly
- +/- pleural effusion



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Pericardial effusion: echo

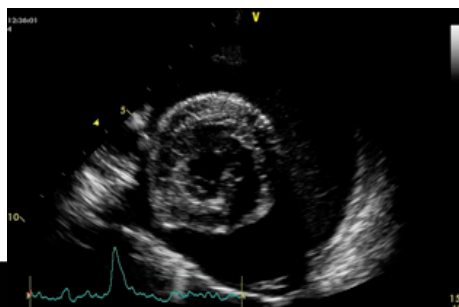
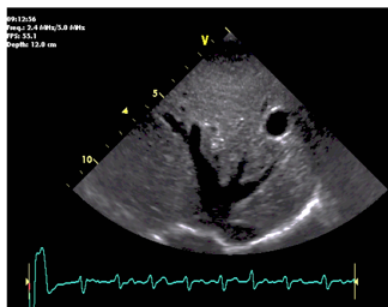
- Black (anechoic) space around heart
- RA/RV collapses (tamponade)
- Often have pleural effusion too
- Congested hepatic veins



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Pericardial effusion: echo

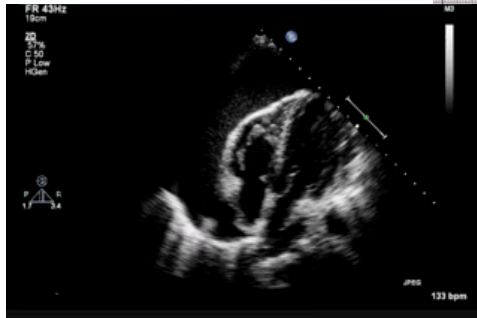
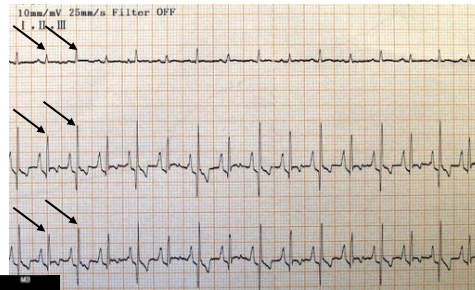
- Black (anechoic) space around heart
- RA/RV collapses (tamponade)
- Often have pleural effusion too
- Congested hepatic veins



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Pericardial effusion: ECG

- Small amplitude of QRS
 $< 1\text{mV}$ in 50%
- Electrical alternans
 • 1/3 rd of cases



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PE: Cardiac mass vs idiopathic

A retrospective study of clinical findings, treatment and outcome in 143 dogs with pericardial effusion

M. STAFFORD-JOHNSON, M. MARTIN,
 S. BEVIS* AND M. J. DIX*

Journal of Small Animal Practice (2004)
 45, 545-552

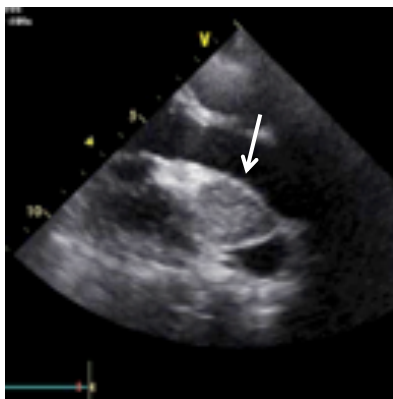
- MST 1068d for echo-negative (no mass)
- MST 26d for echo positive (cardiac mass)
- Dogs presenting with collapse and no ascites had significantly shorter survival times

-> look for cardiac mass on ultrasound before draining (easier to see)

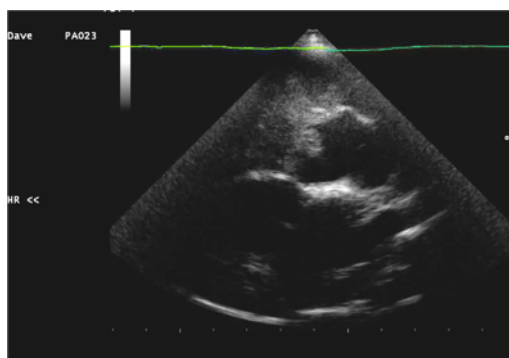


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Pericardial effusion: neoplasia



Aortic body mass



RA haemangiosarcoma



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Pericardiocentesis

- Catheter (large IV, pericardiocentesis kit)
- 3-way tap or needle free valve/clip
- Extension tubing
- 20ml syringe (60ml if large dog)
- Plain & EDTA sample pots, slides, culture swab
- Dish/bowl
- Extra sedative (Alfaxan)
- Gloves, drape, surgical prep



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Pericardiocentesis

- IV catheter: 14-16g
- Ideally cut 2-3 holes near tip

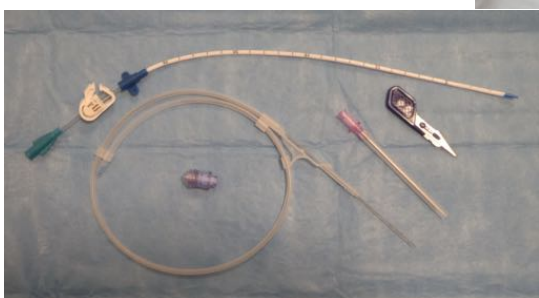


Image courtesy of Mike Martin

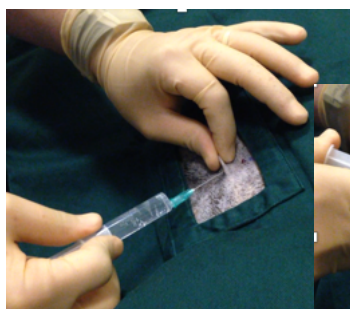
- Infusion concepts
"Martin"
pericardiocentesis kit
- Seldinger technique



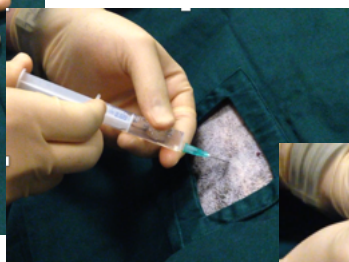
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Pericardiocentesis

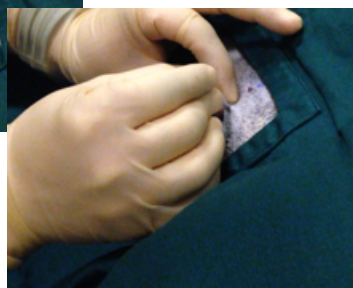
Patient in R lat recumbency, not completely flat



1. Lidocaine infiltration:
skin bleb
chest wall



2. Stab incision
through skin



Images courtesy of Mike Martin



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Pericardiocentesis

3. Insert needle with gentle negative pressure until bloody fluid fills syringe (clear pleural effusion may come first)

- Can do US guided
- Or measure depth and hold needle at that depth

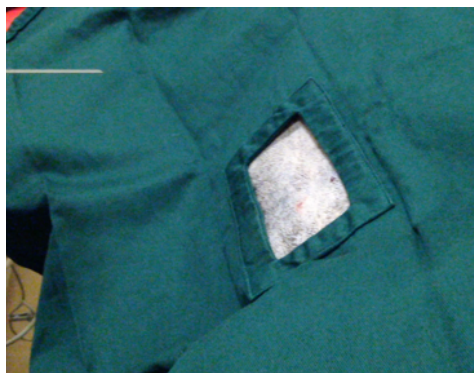


Image courtesy of Mike Martin



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Pericardiocentesis

4. Insert guide wire and remove needle



Images courtesy of Mike Martin



5. Thread catheter over and into pericardial space. Hold guide wire as advancing!



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Pericardiocentesis

6. Drain fluid – relieve tamponade

- Skin glue and place primapore
- Strict rest for a few days
- No medication
- Send fluid samples for cytology



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Collapse: Arrhythmia

- Sustained rate of >250-300bpm or <30bpm to be haemodynamically significant

Tachyarrhythmias:

- Supraventricular tachycardia (SVT)
- Ventricular tachycardia (VT)

Bradyarrhythmias:

- Sinus arrest
- High grade 2nd degree or 3rd degree AV block (usually intermittent collapse)
- Atrial standstill
- (Consider high grade 2nd degree AVB in cats with “seizures”)



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Arrhythmia: SVT

- **SVT** = runs of SVPCs – NARROW COMPLEX rhythm.
- May be atrial tachycardia or macro re-entry circuits involving the AVN or an accessory pathway (young Labradors)



- Persistent high rate -> dec ventricular filling
- myocardial dysfunction/failure (TICM)



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Arrhythmia: SVT

When to worry?

- Heart rate of 180-200bpm seems fast but is not unstable and can be due to white coat effect – sinus tachycardia
- If unsure **run an ECG**
- If it is **too fast to** count it is likely to be significant > 240bpm
- Persistent SVT in dogs is usually >300bpm and causes weakness rather than syncope
- Only req tx if persistent or frequent

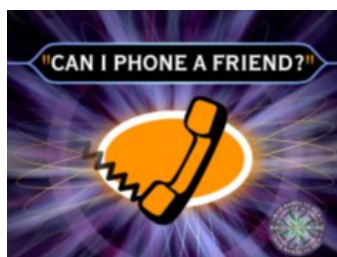
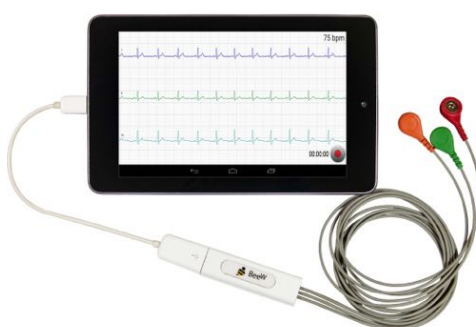


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Arrhythmia: SVT

Persistent SVT:

- Consider patient signalment, history
- ? Likely underlying myocardial dysfunction/ CHF



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Arrhythmia: SVT

Persistent SVT: Dogs

- Vagal manoeuvre
- Establish IV access, start IVFT (care if advanced cardiac disease/ CHF)
- Diltiazem – IV cautiously or oral Hypercard 1-2 mg/kg.
- One lidocaine IV bolus (esp if suspect AP)
- Beta-blocker if not available (care in myocardial dysfunction/CHF).
- Repeat vagal manoeuvre
- Try other drugs:
 - Sotalol
- Repeat vagal manoeuvre
- Monitor BP, ECG



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Arrhythmia: SVT

Persistent SVT: Cats

- Uncommon – ask for help!
- Typically associated with underlying cardiomyopathy – HCM or ARVC so CARE re CHF.
- Vagal manoeuvre
- Diltiazem – orally
- Quiet environment, monitor RR
- Try other drugs: atenolol (if not breathless)
- Repeat vagal manoeuvre
- Monitor BP, ECG



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Ventricular arrhythmias

- Mostly underlying cardiomyopathy (DCM, ARVC)
- Occasionally PE, myocarditis, cardiac neoplasia
- Acute myocardial damage/infarction (rare)
 - Snakebite
 - Pulmonary neoplasia
 - Coagulable state (PLN, HAC), DIC
- Consider non-cardiac disease (abdomen)



Need an ECG diagnosis in any tachyarrhythmia



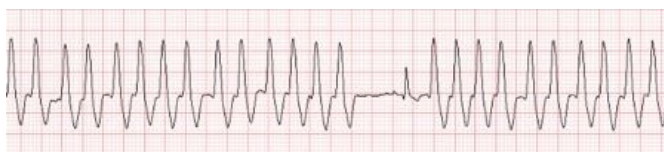
60

Ventricular arrhythmias



This doesn't make dogs collapse
the underlying disease
does – check abdomen

Accelerated idioventricular rhythm



Ventricular tachycardia – fast and potentially unstable



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Ventricular arrhythmia

General guidelines on when to treat:

- Check it is truly ventricular and not SVT/AF with aberrant conduction (vagal manoeuvre may help)
- RATE – rapid VT (>200bpm)
- Multiform (polymorphic)
- Close coupling of VPCs in couplets/triplets (R-on-T)



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Ventricular arrhythmia



Treatment of sustained VT: Dogs

- IV lidocaine boluses (NOT with adrenaline) 2mg/kg. lasts 10-15min. CARE: toxicity (3 boluses max then CRI)
- Check serum electrolytes, supplement K⁺ if low
- Lidocaine CRI if needed
- Monitor BP and ECG
- Consider oral sotalol/atenolol/mexiletine



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Ventricular arrhythmia

Treatment of sustained VT: Cats

- Uncommon, usually underlying HCM with **myocardial ischaemia/infarct**
- Beta-blocker (atenolol) or sotalol PO
- Quiet environment, supportive care
- Monitor RR/ echo to check LA size
- Low dose IV lidocaine boluses (NOT with adrenaline) 0.25-0.5mg/kg – CARE with toxicity
- Check serum electrolytes, supplement K⁺ if low
- Monitor BP and ECG



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Longer term therapy

- In arrhythmia cases this really depends on underlying disease (including non-cardiac disease)
- Accurate diagnosis and staging of disease needed
- Very little EBM regarding anti-arrhythmics; individual case-by-case basis
- Remember to follow up and monitor efficacy of therapy/ check for pro-arrhythmic effects.



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Bradyarrhythmias

General principles

- clinical signs vs incidental finding – usually not an acute emergency but can be acute frequent collapse / lethargy
- Underlying disease (e.g. hyperkalaemia, high vagal tone, hypothyroidism, Addisons)
- Consider atropine response to reveal true bradyarrhythmia (or run around in car park!) – if patient is able
- Heart rate is usually <60bpm, often nearer 40bpm
- 3rd degree AV block and atrial standstill are VERY REGULAR – no RSA



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Bradyarrhythmias

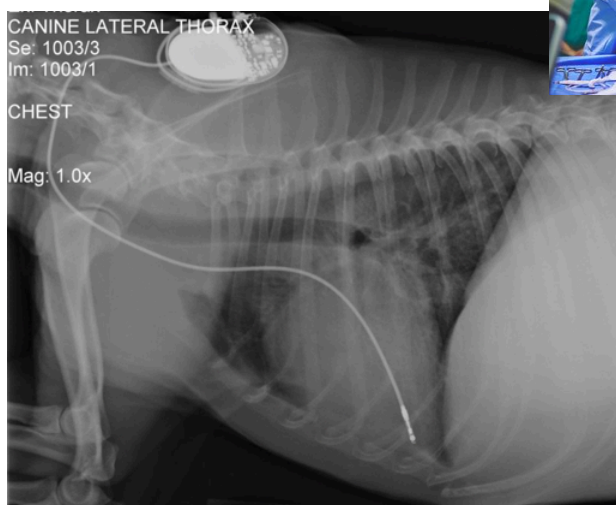
Bradyarrhythmia therapy

- Ultimately pacemaker implantation is required for symptomatic/ progressive disease: 3DAVB, atrial standstill, sick sinus syndrome
- Risk of sudden death
- Medical therapy may palliate clinical signs but often short lived
 - Theophylline
 - Pimobendan
 - terbutaline



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Bradyarrhythmias



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A copy of the slides will be available as a download from our website:

www.heartvets.co.uk/cpd-events

