Poisoning the heart?

Anaesthesia from the cardiologist's point of view

Jo Harris BVSc DVC MRCVS
RCVS Recognised Specialist in Veterinary Cardiology

HeartVets Cardiology Consultancy Service
Referral clinics throughout SW and S. Wales
Online ECG/Radiograph Reporting and
Holter Monitoring Service

jo@heartvets.co.uk   **www.heartvets.co.uk**

1

2

Anaesthetising the Cardiac Patient: Goals

- Anaesthetise or sedate the patient SAFELY

- Assess physical status

- Identify potential problems

- Make a diagnosis if underlying cardiac disease is suspected

- Stabilise with appropriate therapy

- Use appropriate drug protocols

- Use adjunctive analgesia techniques

HeartVets

3

ASA Physical Status Classification System

Established in 1963 for assessing the fitness of cases before surgery:

1. Healthy patient.
2. Mild systemic disease.
3. Severe systemic disease
4. Severe systemic disease that is a constant threat to life
5. A moribund patient who is not expected to survive without the operation.

(6. A declared brain-dead patient whose organs are being removed for donor purposes)

HeartVets

4

2/3/20

Identify potential problems

- Why are we sedating or anaesthetizing?
  - Routine neutering
  - Healthy animal needing claw clip or dematt
  - Geriatric patient presented for dental
  - Acute systemic disease requiring surgery (haemoabdomen, GDV)

- How will this affect our patient?
  - Healthy
  - Anxious/aggressive
  - Hypovolaemic/ hypotensive/ sepsis / pyrexic
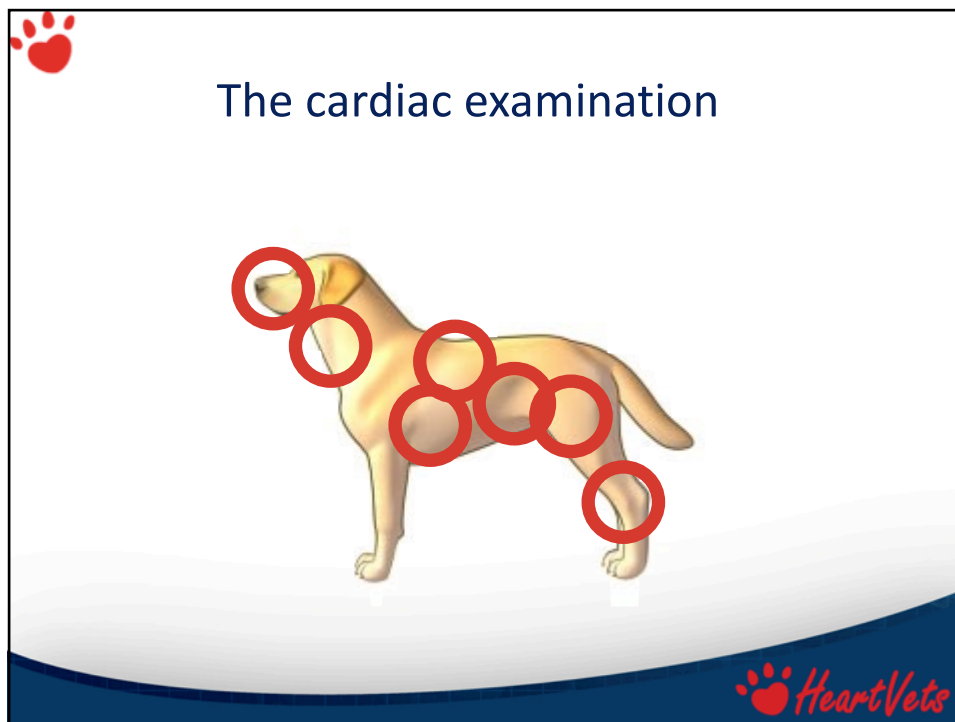
- Generate problem list

HeartVets

5

Do a full clinical examination

- So how do we examine the cardiovascular system?

  - One of the few systems that can be evaluated externally

  - Clinical examination tells us much about the heart

  - Systematic approach gives us really useful information

HeartVets

6

The cardiac examination

7

Membrane colour

- Tells you about peripheral perfusion
- Well… maybe it does
- Affected by lots of non-cardiac things
- Not to be relied upon
  - Blue or White - pay attention
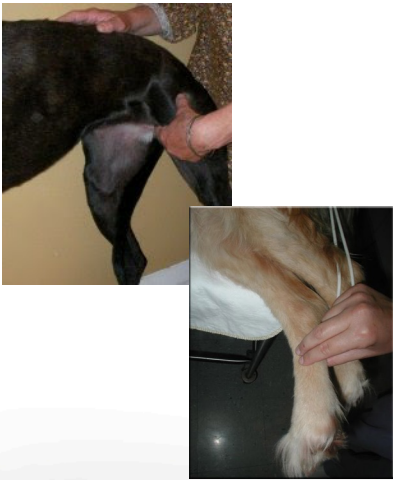 - Pink - means little

8

Capillary Refill Time

9

Pulse quality

- Pulse quality tells you about flow to that artery
- The more distal you go, the more distal the flow you are assessing
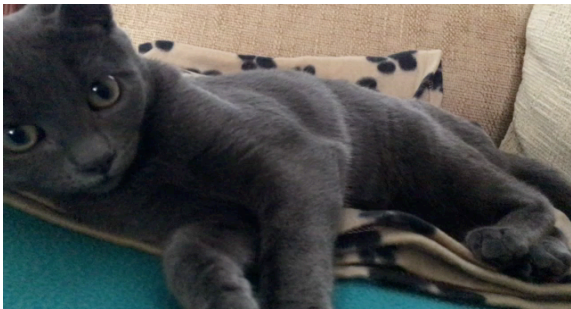- Femoral for measuring pulse rate
- Tarsal/carpal for assessing perfusion

10

Respiratory rate and pattern

- Count RR
- Assess respiratory effort

11

Jugulars and abdomens

12

Jugulars and abdomens
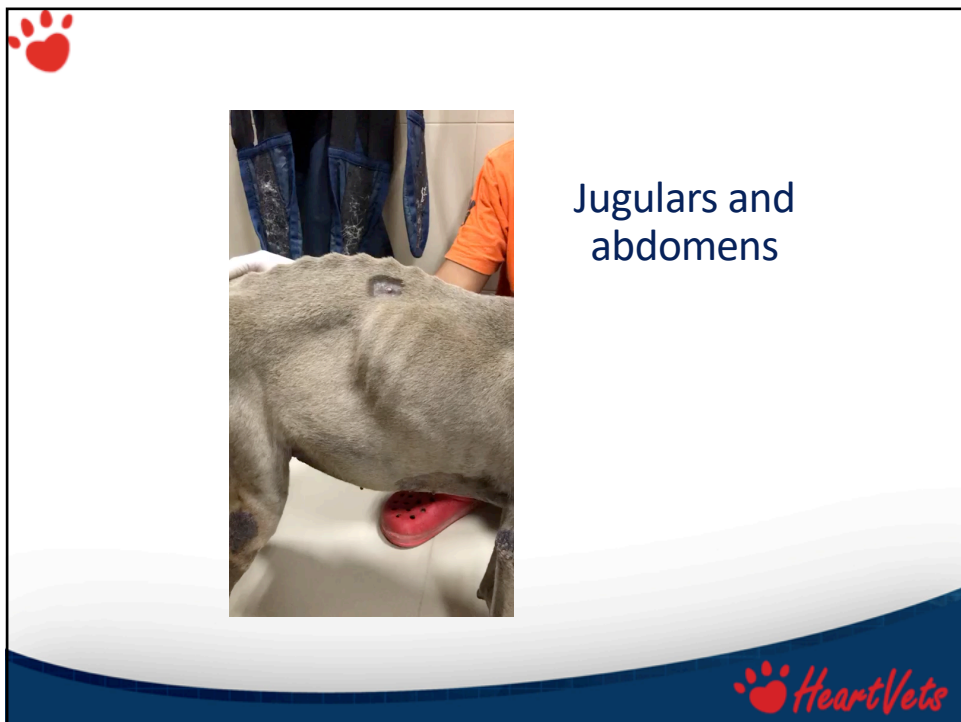

13

Jugulars and abdomens

14

Jugulars and abdomens
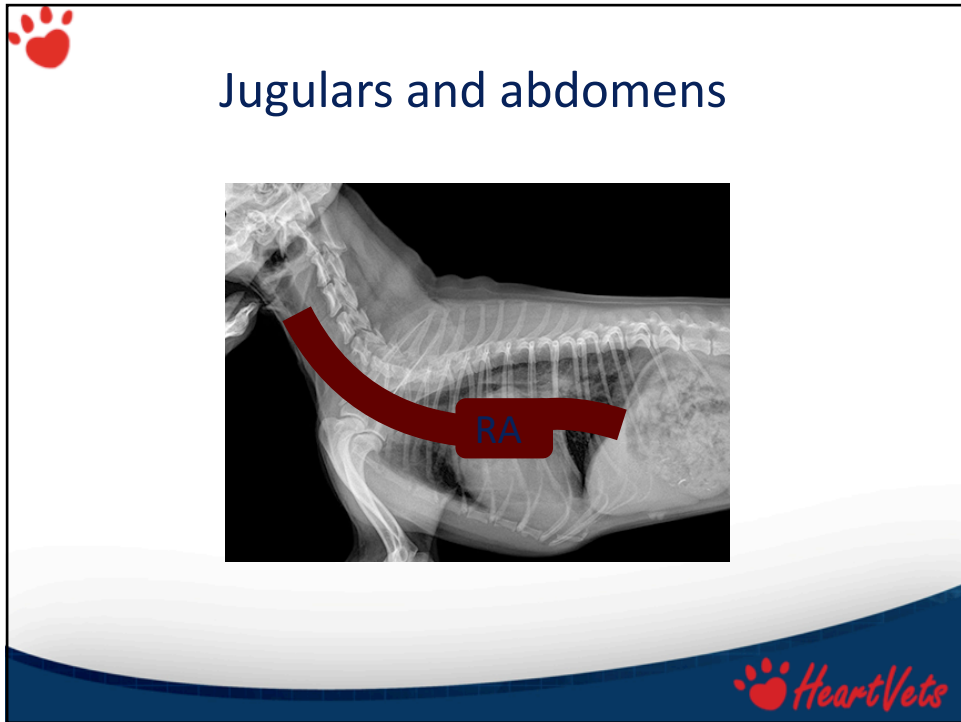
15

Heart murmurs

- A murmur is any other noise we hear (apart from a gallop sound)
- Can be quiet or loud
- Can be present some of the time or all of the time
  - Systolic
  - Diastolic
  - Continuous

16

Q: So what is a murmur?

A: Turbulent flow

17

A murmur is NOT a diagnosis

Three main causes:

1. "Normal" flow (e.g. ejection murmurs in athletic breeds)

2. Turbulence across a valve
   - Leaking or narrowed

3. Turbulence across a hole/defect
   - "Hole in the heart" - VSD, ASD
   - Extra blood vessel - PDA

18

Top Tip

Use your hands before you use your ears:

"Palpate before you auscultate"

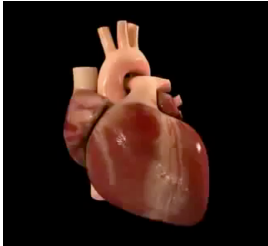Use the palms of your hands, not your fingertips

Feel both sides

Feel carefully

19

The heart beat

- We can feel the heartbeat easily in most animals
  = "apical impulse"
- This is the "thump" created as the heart squeezes against the chest wall
- One "thump" per heart beat
- Strong heart beats = stronger apical impulse
  - Big heart
  - High sympathetic tone (adrenaline)
  - Long pause after premature beat ("palpitations")

20

Top Tip

Use a medical instrument, not a child's toy

21

How loud is it?

- We can "grade" the murmur
  - 1 to 6
- Or to describe what we hear:
  - Soft
  - Moderate - same as the heart sounds
  - Loud - louder than the heart sounds
  - Thrilling (palpable)

22

Thrills

- A "thrill" is a murmur so loud, you can feel it
- Significant vibration caused by turbulent flow
- <u>Always important</u>
- <u>Always need investigation</u>
- Usually means bad heart disease (some exceptions)
- **Never ignore (or miss!) a thrill**

23

Make a diagnosis then make a plan

- A heart murmur IS NOT a diagnosis
- Heart murmur: turbulent flow within the heart
- Gallop sound: abnormal cardiac filling (or occasionally a split S2 heart sound)
- Arrhythmia: run an ECG
- Check jugular veins for distension/ pulsation
- Check pulse quality

24

Make a diagnosis
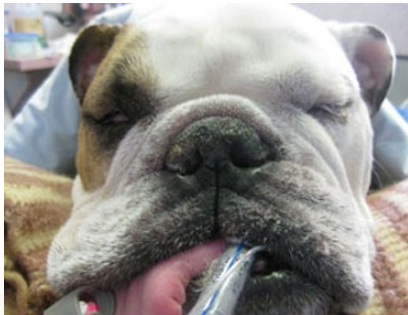
- Perform an echo or refer if a heart murmur is present or you suspect CHF
- May be able to diagnose and stage disease with a basic echo in-house (e.g. DMVD)
- A heart murmur investigation needs a Doppler exam to get a **diagnosis**
- If there is an arrhythmia **run an ECG**
- **The diagnosis tells us the risk involved**

25

Anaesthetising the Cardiac Patient: Case Examples

26

Case 1. Molly

- 10yo FN CKCS
- Heart murmur (3/6, L Apex)
- HR 120, regular rhythm, RR 12
- Exercise tolerance good
- Needs a dental

HeartVets

27

Case 1: What do you do next?

1. Just get on with the GA, no change in protocol
2. Carry on with GA but make some protocol changes
3. Perform full cardiac investigation (echo, ECG, rads, bloods)
4. Perform echo only
5. Tell the owner it is too dangerous to proceed

HeartVets
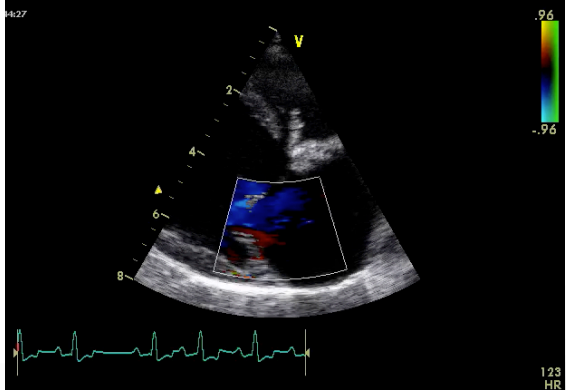
28

Molly

Make a diagnosis

- Echo = DMVD
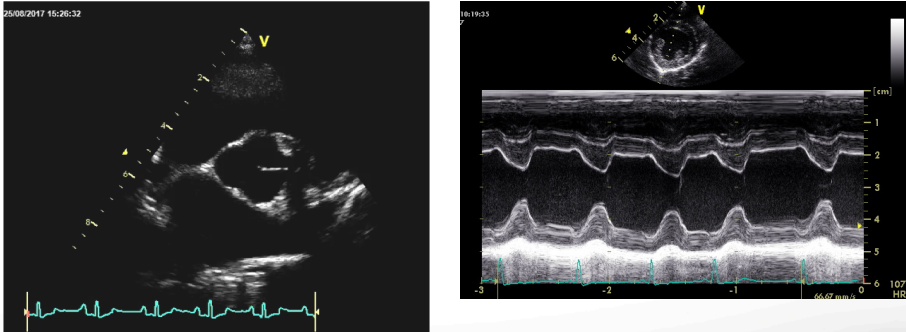
29

Molly

Evaluate disease severity

- No LAE or LV dilation, no clinical signs (ACVIM stage B1)

- ASA Category 2/5

30

Molly GA Protocol

- Standard premed: ACP (0.01mg/kg), methadone (0.25mg/kg) (some vasodilation is helpful)

- **Alfaxan** induction (or propofol)

- Maintenance isoflurane or sevoflurane

- Dental nerve blocks

- Consider ketamine for top-up analgesia (1mg/kg IV)

- IVFT (with some caution)

31

Case 2. Molly – 2yrs later!

- 12yo FN CKCS

- Long-standing murmur (5/6, LHA)

- **HR 170, irregular rhythm**, RR 25

- Exercise tolerance unchanged

- MCT, needs surgery

32

Molly

Make a diagnosis

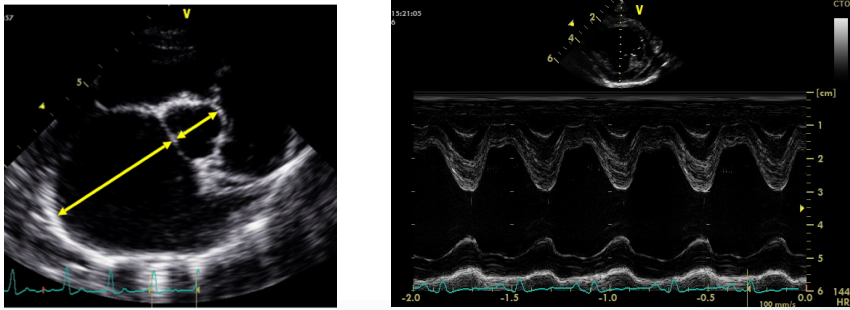- ECG – sinus rhythm with occasional isolated SVPCs

- Echo: degenerative mitral valve disease
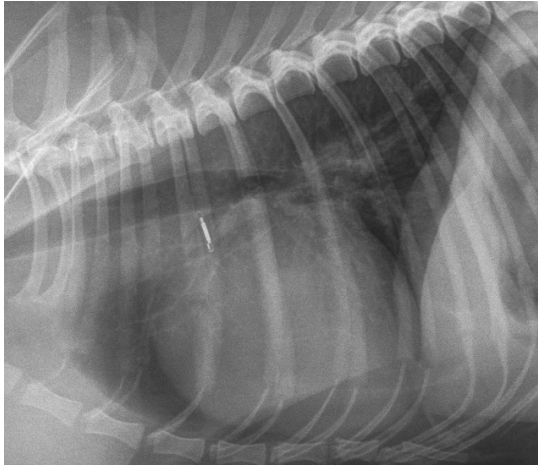
33

Molly

Evaluate disease severity

- LAE & LV dilation

34

Molly

– No evidence of CHF (ACVIM stage B2)
– ASA Category 3/5

HeartVets

35

What do you do next?

1. Just get on with the GA, no change in protocol
2. Reduce the ACP
3. Use different induction and maintenance agents
4. Put her on IVFT
5. Tell the owner it is too dangerous

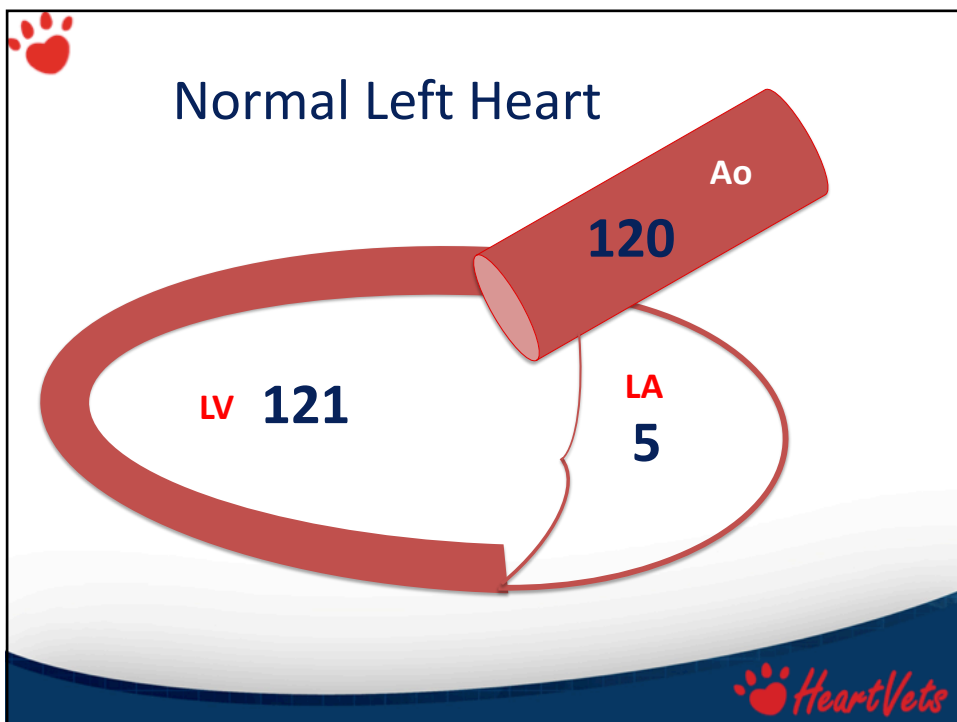*HeartVets*

36

Molly

DMVD Pathophysiology

DMVD ➔ Reduced CO ➔ RAAS

RAAS = vasoconstriction and fluid retention
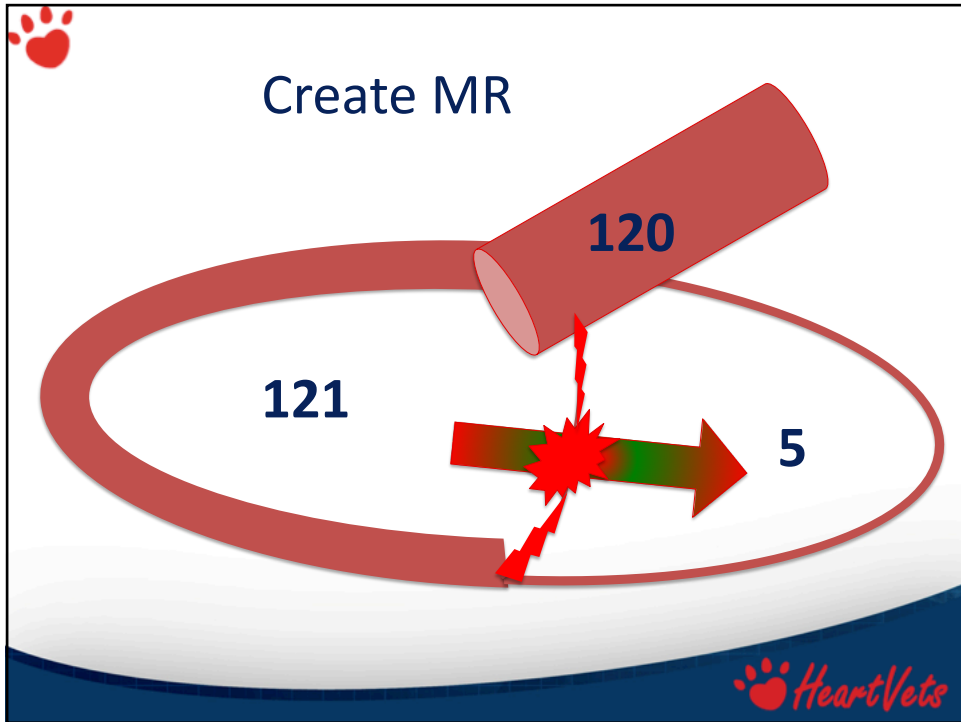
- Start pimobendan

- Don't be afraid to anaesthetize

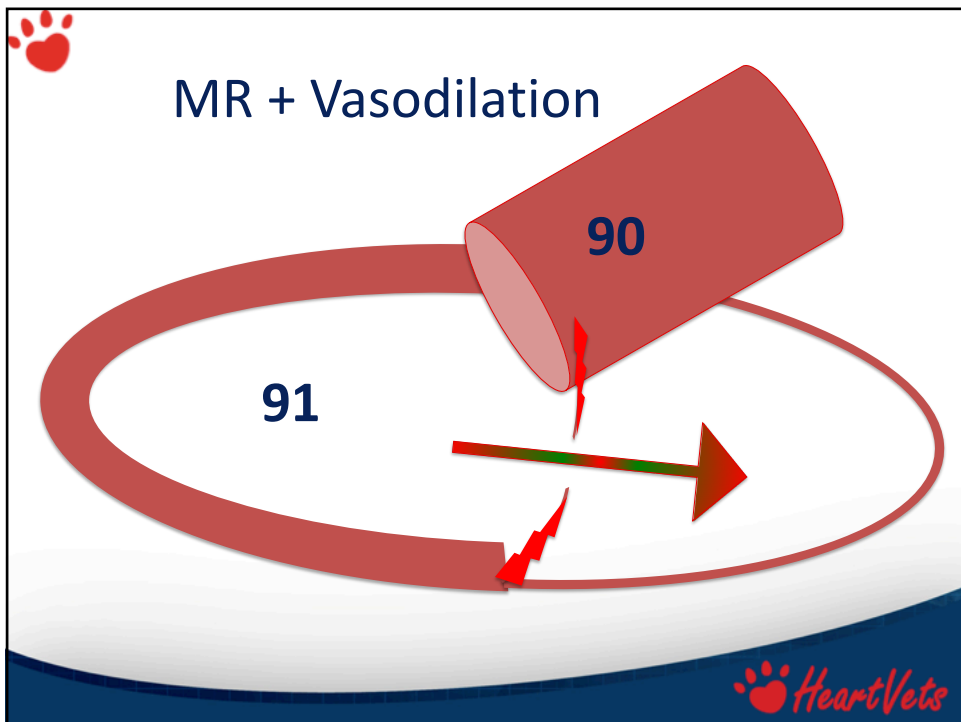- Choose drugs wisely – some vasodilation is a good thing (basis of ACEi)

HeartVets

37

Normal Left Heart

Ao

120

LV 121

LA
5

HeartVets

38

39

40

MR + Vasodilation

- Does it work?
- In theory, yes…

- It is unlikely to do harm in this case

- Don't be scared to anaesthetise uncomplicated MR cases

41

Polly GA Protocol

- Premed: **lo ACP (0.005mg/kg),** methadone 0.25mg/kg IV (diluted) or IM
- Alfaxalone or propofol induction
- Maintenance iso or sevo – control vasodilation
- Dental nerve blocks
- Avoid overloading with IVFT (stay at 3ml/kg/hr - AAHA)
- ?Ketamine for top-up analgesia – prob avoid unless desperate – low dose

42

Dental nerve blocks
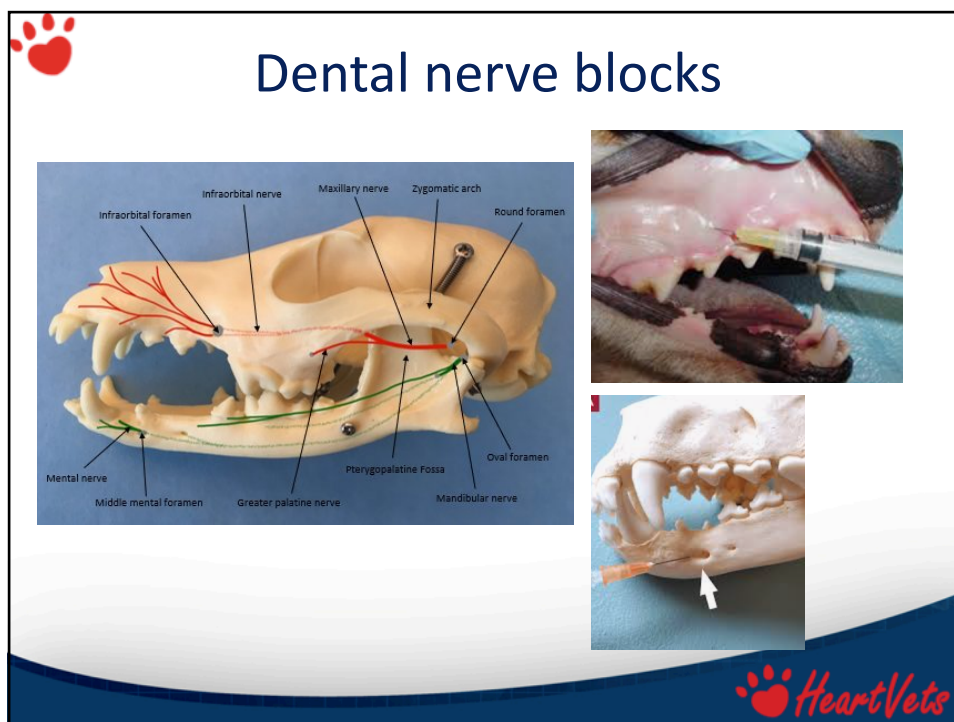
43

Case 2. Molly 6m on…

- 12.5yo FN CKCS
- Long-standing murmur (5/6, LHA)
- HR 150, regular rhythm, RR 20

- In CHF, on standard meds
- Needs second MCT surgery

44

What test do you do next?

1. BP ideally – consider vasodilation
2. Echo – ideally (check filling pressures and for PHT)
3. Chest rads – ideally – control of CHF
4. Bloods – ideally – renal status, anaemia, electrolytes
5. ECG – no arrhythmia heard so less important (but would want to monitor)
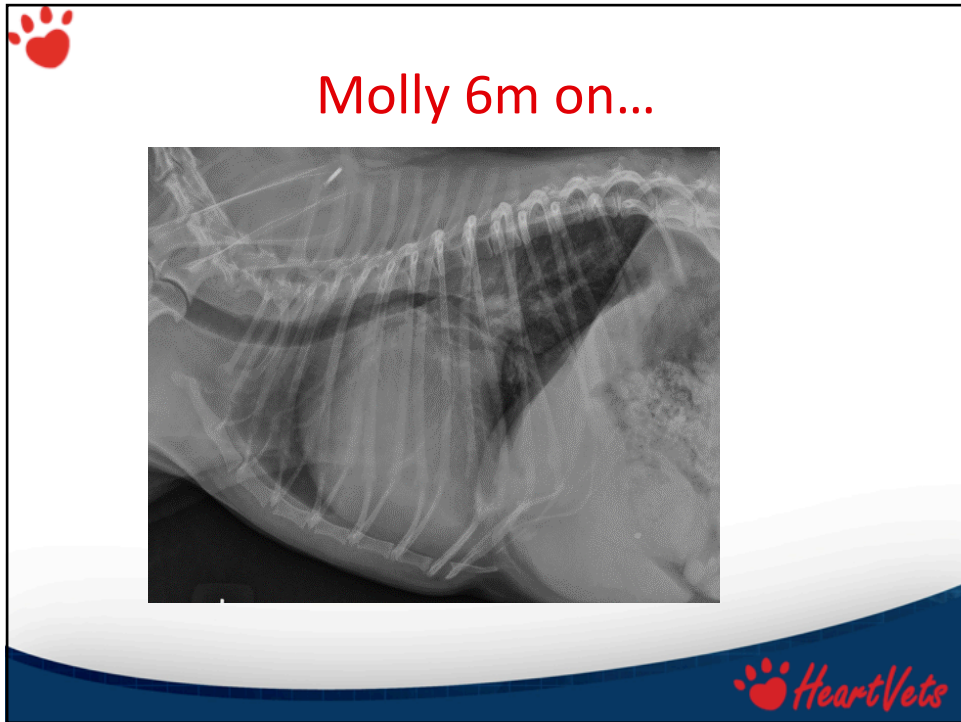
HeartVets

45

Molly 6m on…

Diagnosis = DMVD & CHF (ACVIM stage C DMVD)

Evaluate disease severity
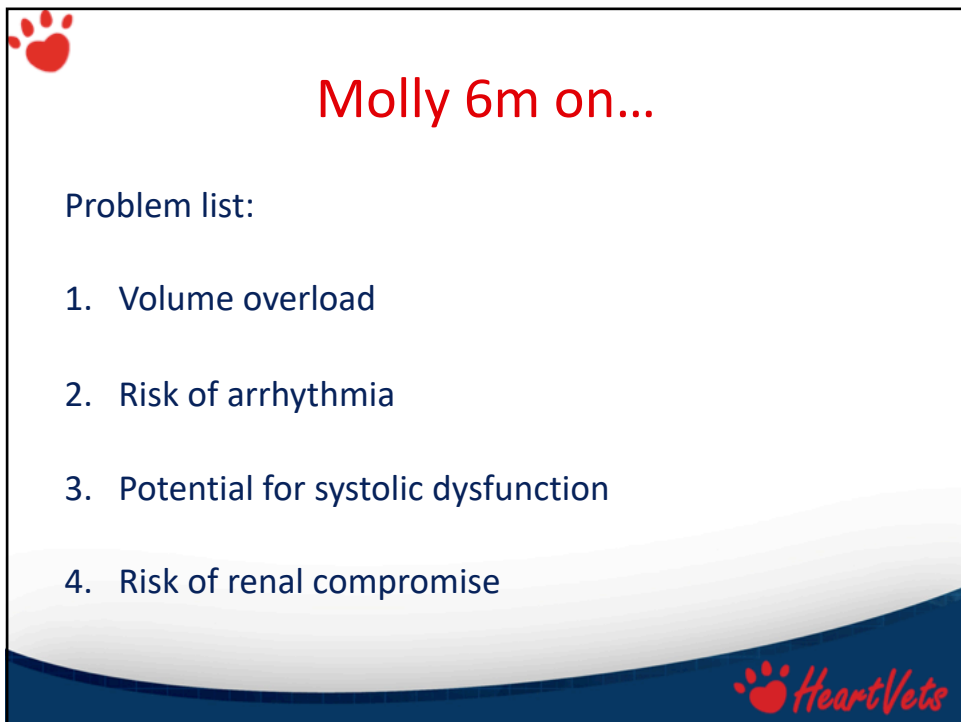
– Rads: CHF controlled (ie rads clear)

– Echo: systolic function preserved, no PHT

– ASA Category: 3/5

HeartVets

46

Molly 6m on...

47

Molly 6m on...

Problem list:

1. Volume overload

2. Risk of arrhythmia

3. Potential for systolic dysfunction

4. Risk of renal compromise

48

Molly GA Protocol

- Opioid only premed (methadone 0.25mg/kg), make sure had furosemide that morning

- Co-induce with alfaxalone and midazolam (0.5-1mg/kg alfax, then midazolam, then rest of alfaxalone)

- Pre-oxygenate (at least 5mins)

- Be prepared to treat arrhythmia:
  - lidocaine for VT
  - atropine for bradycardia IF SEVERE (last resort) - half dose IM
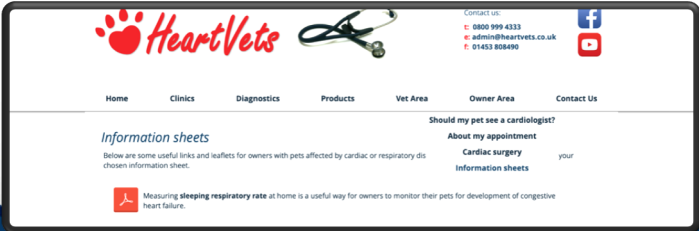 - consider glycopyrrolate 10-20mcg/kg IM if available (less tachycardia)

HeartVets

49

Molly GA Protocol

- Avoid overloading with IVFT (stay at 3ml/kg/hr - AAHA)

- Watch for hypotension (IV pimo, dobutamine)

- Hospitalise post-op to monitor RR

- Educate owner to measure SRR after discharge

HeartVets

50

Case 3. Reuben

- 8yo ME Cocker Spaniel
- Soft systolic murmur
- HR 220, irregular rhythm
- Soft cough, exercise intolerance, dyspnoea for last few days
- Tripped down stairs, # leg

51

What do you do next?

1. Just get on with the GA, no change in protocol
2. Carry on with GA but make some protocol changes
3. Perform full cardiac investigation (echo, ECG, rads, bloods)
4. Perform echo only
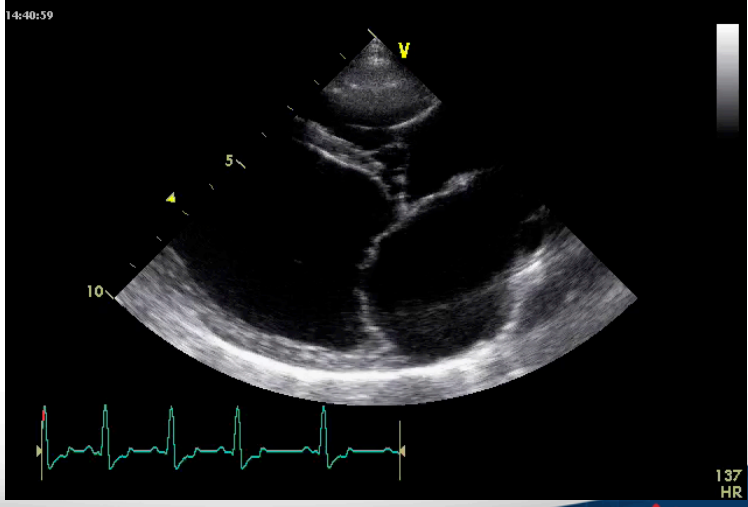5. Tell the owner it is too dangerous

52

What do you do next?

1. Just get on with the GA, no change in protocol
2. Carry on with GA but make some protocol changes
3. **Perform full cardiac investigation (echo, ECG, rads, bloods)**
4. Perform echo only
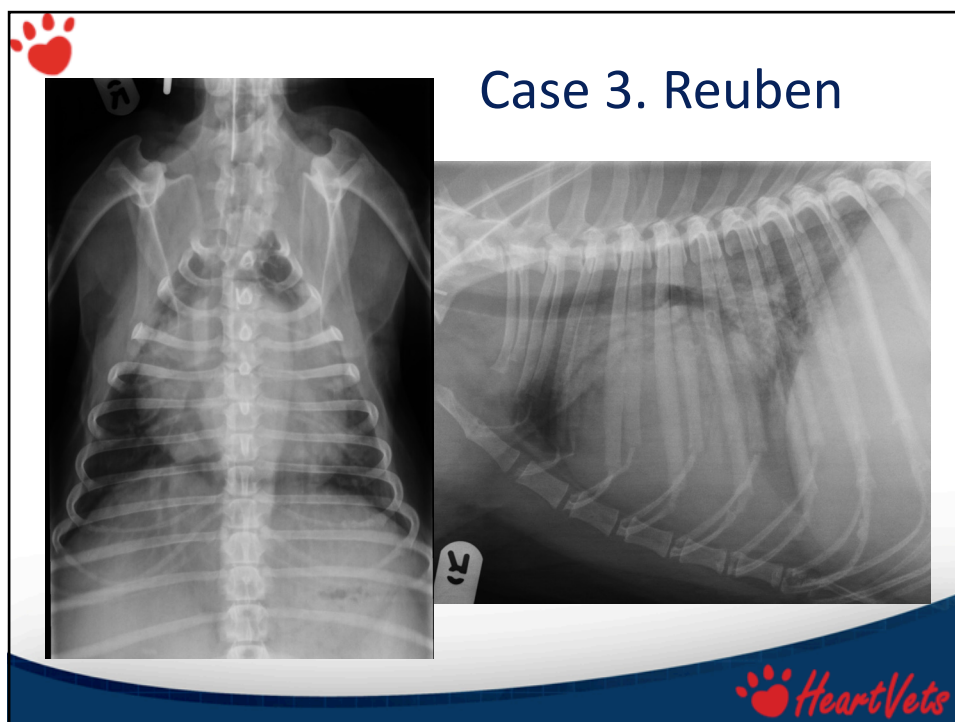5. Tell the owner it is too dangerous

53

Case 3. Reuben

54

Case 3. Reuben

55

Case 3. Reuben

ECG:

- Irregular RR intervals
- Absent P waves
- Baseline fibrillation

Atrial fibrillation

56

Reuben

<u>Make a diagnosis</u>

– Echo = DCM

<u>Evaluate disease severity</u>

– Severe cardiac dysfunction, LA enlargement

– Rads confirm CHF

– ECG confirms atrial fibrillation (dec CO)

– ASA Category 4/5

57

Reuben

- Need to stabilise prior to GA
- Dogs don't usually die of a broken leg
- Many dogs die of a broken heart

1. Control the CHF
2. Control the systolic dysfunction
3. Control the heart rate if needed

58

2/3/20

Reuben – 3d on

- Now stable on standard CHF meds (frusemide, pimobendan, ACEi/Spironolactone, digoxin)
  - HR 160, regular rhythm, SRR 25-30
- ASA Risk Category 3/5
- Proceed to GA…

HeartVets

59

Reuben – GA Plan

Problems:

1. Systolic dysfunction

2. Volume load (CHF)

3. Arrhythmia

4. ?Diastolic dysfunction (HR dependent)

HeartVets

60

Reuben – GA Plan

Problems

1. Systolic dysfunction
   - Positive inotrope – IV pimobendan (dobutamine)
2. Volume load (CHF)
   - Diuresis, avoid XS IVFT
3. Arrhythmia
   - ECG monitoring
   - Be ready to treat tachyarrhythmia if required (lidocaine)

HeartVets

61

Reuben – GA Protocol

- No ACP (hypotension). Make sure he had frusemide dose this morning.
- Premed: methadone 0.3-0.4mg/kg Iv (diluted) or IM
- Alfaxalone induction or co-induce with mizadolam
- Avoid volume overload – care with IVFT (3ml/kg/hr max)
- Inhalational anaesthesia: Iso/Sevo
- local/regional anaesthesia

HeartVets

62

Additional analgesia

- Fentanyl CRI (3mcg/kg/hr) – take 10ml out of 100ml NaCl. Add 10ml fentanyl (Fentadon) -> **0.6ml/kg/hr**

- NO ketamine

- Don't use methadone CRI – accumulates in fat

- NO N_2O.

63

Say NO to N_2O!

- sympathetic stimulant – arrhythmia!

- Greenhouse gas! 1l/min for an hour of GA = driving 348miles.

- Lasts 110years in the atmosphere.

64

Reuben – GA Protocol

- Monitor BP carefully (invasively if poss)
- ECG monitoring
- Pulse oximetry
- Be ready for problems
- Plan surgery before the op
  - Have a plan in mind
  - Get all kit ready
  - Be as quick as possible

HeartVets

65

Case 4. Sparky

- 5yo MN DSH
- Long-standing murmur (3/6, sternal)
- HR 150, regular rhythm, RR 20
- Stitch-up

HeartVets

66

What do you do next?

1. Just get on with the GA, no change in protocol
2. Carry on with GA but make some protocol changes
3. Perform NT-proBNP SNAP test
4. Perform an echo
5. Tell the owner it is too dangerous

HeartVets

67

Scary facts

- 20-40% of cats with heart murmurs have underlying heart disease (HCM) – increases with age

- Cats with no murmur can have **worse heart disease**! (but rare in young cats)

- 90% of ventricular arrhythmias are associated with structural heart disease in cats

- In one study 50% of cats presenting in CHF had an **identifiable event in the 1-2 weeks previously** of either GA, corticosteroid tx or IVFT

HeartVets

68

IDEXX proBNP SNAP test

- Great **screening test** (not a diagnostic test)
- cut-off 108-122pmol/l so based upon earlier proBNP assay studies should screen effectively.
- 146 asymptomatic cats with heart murmur, gallop sound, arrhythmia, or cardiomegaly.
- **NPV 94%**, PPV 64% (population prevalence of HCM was 24%)
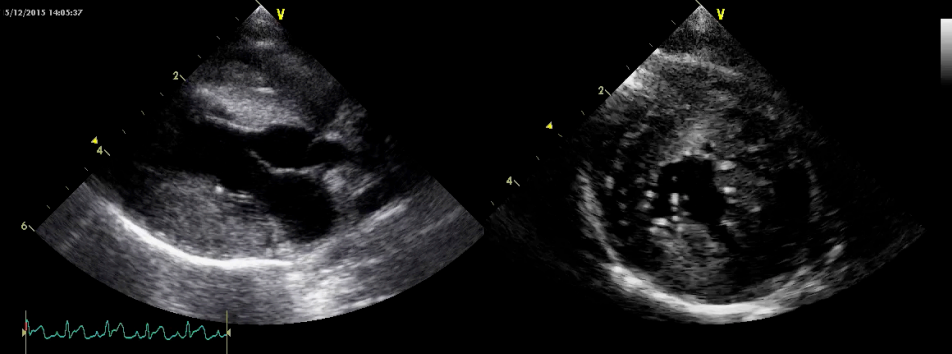- Sensitivity/ Specificity of 88.6% / 81.3%

Machen et al 2014: J Vet Cardiol 16, 245-255

69

Sparky: Echocardiography

- Diagnostic test

70

Sparky

Make a diagnosis

- Echo: HCM, moderate dynamic LV outflow tract obstruction

Evaluate disease severity

- No LAE, mild LVH, no clinical signs

- Low risk of CHF (if careful)

- ASA Risk Category 2/5

HeartVets

71

Sparky GA Protocol

- Premed: No ACP

- methadone (or buprenorphine, but better just for post-op analgesia

- **Propofol** or alfaxan induction

- Maintenance iso or sevo

- Regional analgesia/anaesthesia

- CARE with IVFT (diastolic failure in HCM = stiff heart)

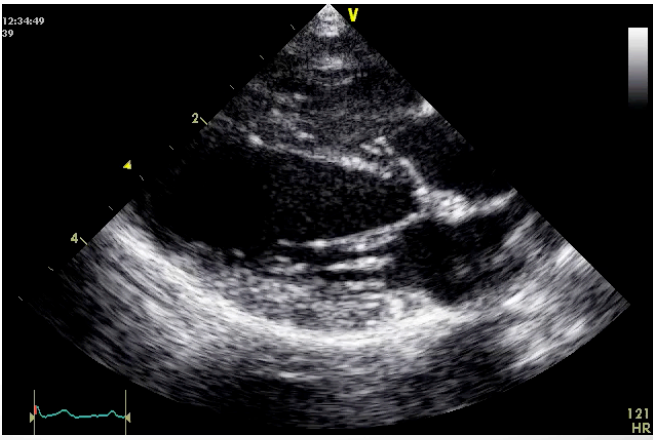*HeartVets*

72

Alpha-2 agonists?

- The anaesthetist's say: "alpha-2's are great for cats"

- Human studies suggest lower heart rate = improved diastolic filling and coronary artery flow

- One study in cats showed inc LV diameter and inc BP following dexmedetomidine + butorphanol – this is my experience too

- This all sounds great… in a normal heart

73

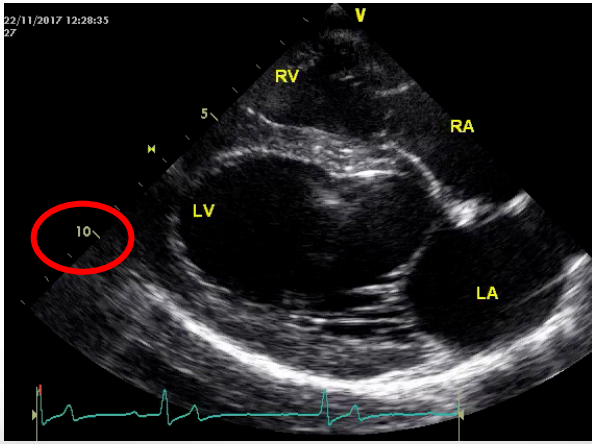# Normal cat echo

74

Case study: 3yo FN Feline deeply sedated with "triple combination"

75

Anxious/ aggressive cats

- Gabapentin min. 1h before leaving home
- Put in a kennel for 15min minimum before handling (ISFM guidelines)
- Butorphanol IM 0.4mg/kg
- Alfaxalone IM 1-2mg/kg IM (+/- midazolam and butorphanol)

76

Case 5 - Basil

- 6 month old ME French Bulldog
- Presented for castration
- Loud harsh left cranial pansystolic murmur with a palpable thrill
- Poor exercise tolerance (owner thinks this is "normal" for Frenchies though)

HeartVets

77

Case 5 - Basil

- What do you do next?
- This dog needs an echo!
- We see a lot of cases referred for congenital heart disease that were detected **during or after** routine neutering
- Do a thorough clinical exam pre-GA
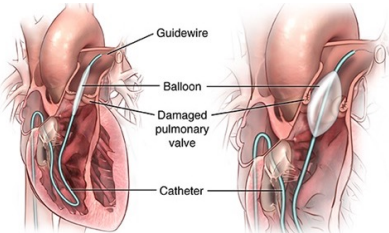- DON'T IGNORE THEM! Get a definitive diagnosis – PDA vs PS vs VSD

HeartVets

78

Case 5 - Basil
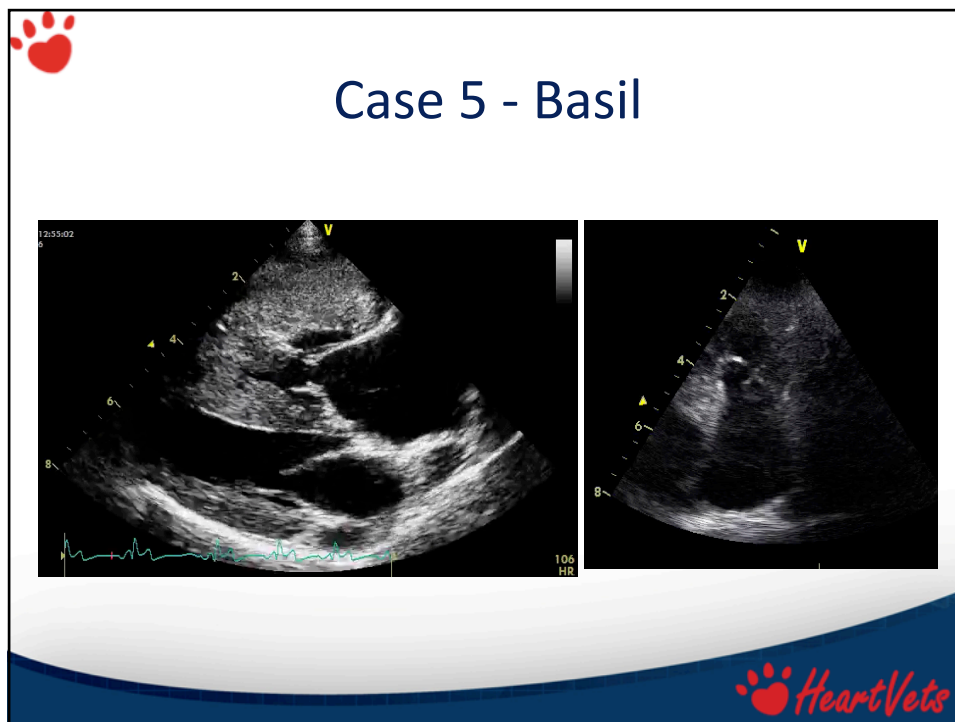
79

Pulmonary valvuloplasty = keyhole valve surgery

In severe PS pulmonary balloon valvuloplasty shown to be beneficial:
- 80% of symptomatic dogs became asymptomatic
- 50% lower risk of sudden death

80

Summary

- Don't necessarily be afraid to anaesthetize cardiac patients
- Assess their physical status
- Assess the risk of the procedure
- Make a diagnosis and stage severity
- Adapt GA protocol accordingly
- Know your limits!

HeartVets

81

KEEP CALM AND ASK QUESTIONS

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

www.heartvets.co.uk/cpd-events

HeartVets

82