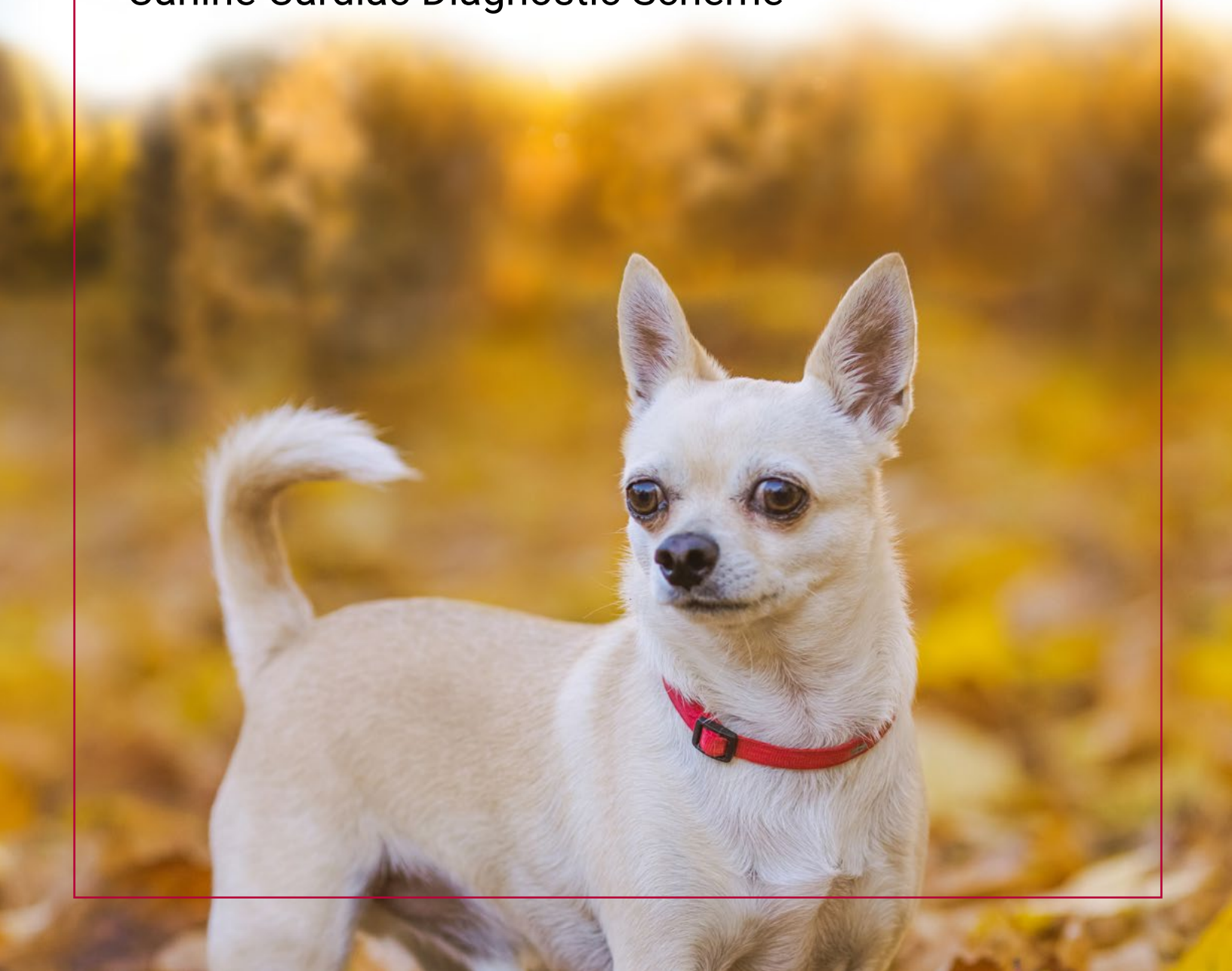
CARDIAC EDUCATION group

ABCDs OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

Canine Cardiac Diagnostic Scheme



STAGE A

Dogs with no structural disease but at high risk for developing MMVD

Red background: High-priority CEG recommendations

Gray background: Lower-priority CEG recommendations

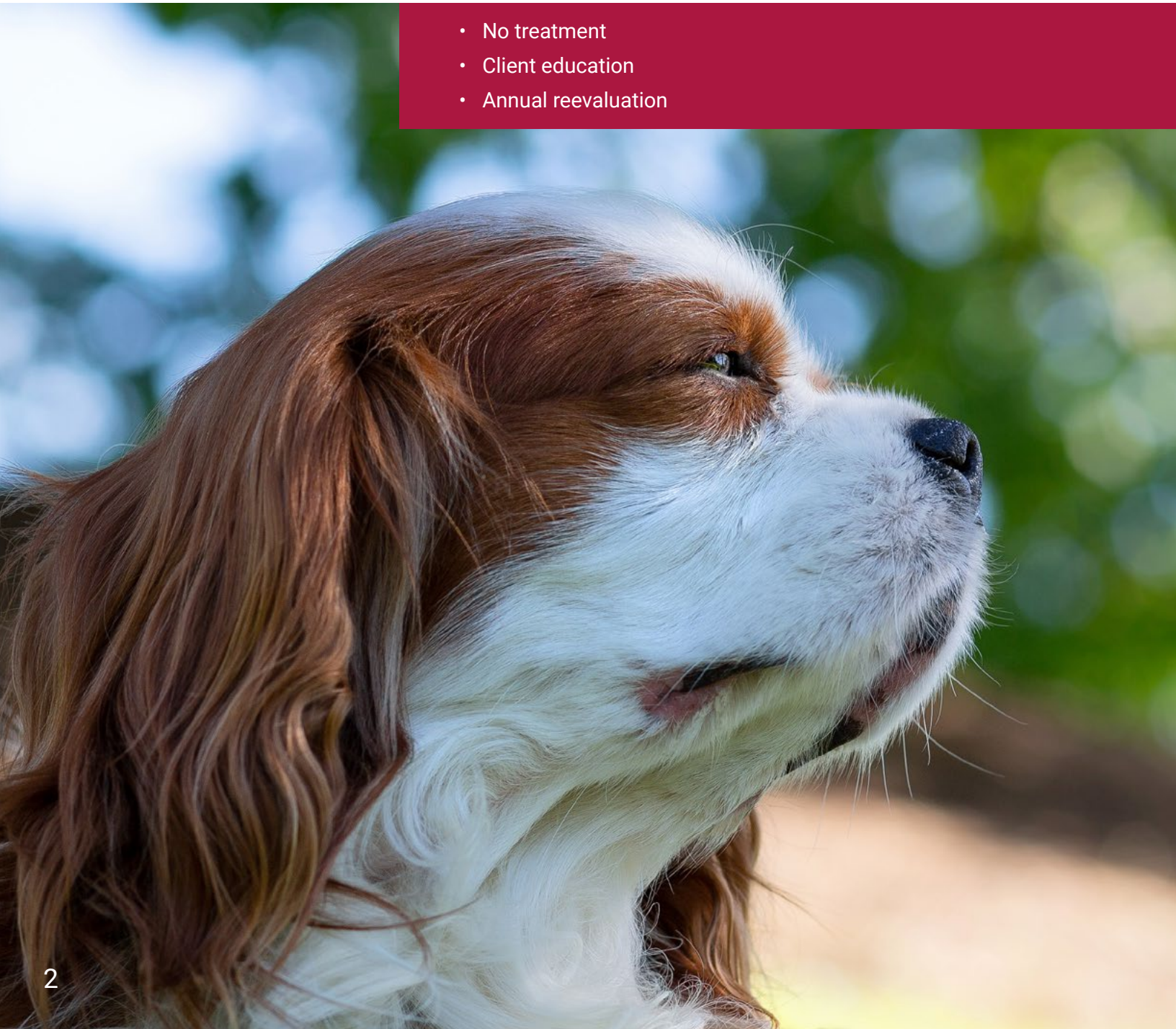
Where this icon appears, mouse over it to see additional information.

CEG Diagnostic Recommendations

- Patient history
- Yearly auscultation
- Screening programs for select breeds

CEG Treatment Recommendations

- No treatment
- Client education
- Annual reevaluation



Defining Stages B1 and B2

Stage B valve disease can be divided into Stage B1 and Stage B2 disease. Dogs with Stage B MMVD have no clinical signs of heart failure. This stage includes:

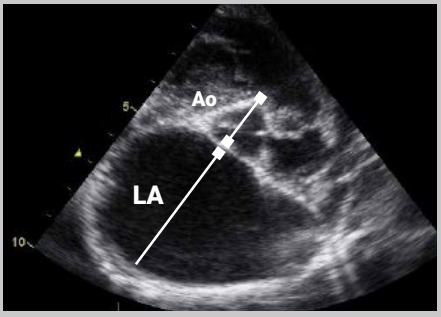
- Stage B1: Dogs with no radiographic or echocardiographic evidence of cardiac remodeling (heart enlargement) or with remodeling that is not severe enough to meet current clinical trial criteria used to determine initiation of treatment
- Stage B2: Dogs with remodeling that is severe enough to support initiation of treatment

Diagnostics are required to differentiate Stage B1 MMVD from Stage B2 MMVD.

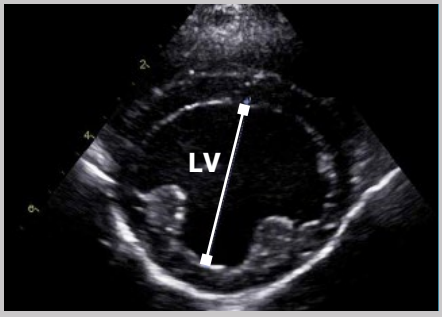
- Echocardiography is the test of choice to differentiate Stage B1 from Stage B2. Echocardiographic enlargement indicative of Stage B2 includes both LA:Ao ≥1.6 and LVIDdN ≥1.7[a]
- If the echocardiographic diagnosis of MMVD has been established previously, a POCUS (point-of-care ultrasound) exam can be used to make LA:Ao and LV measurements
- Radiographic criteria may be used to help identify MMVD patients likely to meet echocardiographic criteria for Stage B2 when echocardiographic examination is not possible
- In dogs with left apical systolic heart murmurs ≥ grade 3/6, radiographic criteria to identify likely Stage B2 dogs include VHS ≥11.5 or VLAS ≥3 measured on a lateral radiograph
- In cases where an echocardiogram cannot be obtained for staging, serial radiography (with consecutive examinations separated by 6-12 months) can offer a practical substitute[1]

[a]Cornell CC, Kittleson MD, Della Torre P, et al. Allometric scaling of M-mode cardiac measurements in normal adult dogs. *J Vet Intern Med*. 2004;18:311-321. doi:10.1111/j.1939-1676.2004.tb02551.x

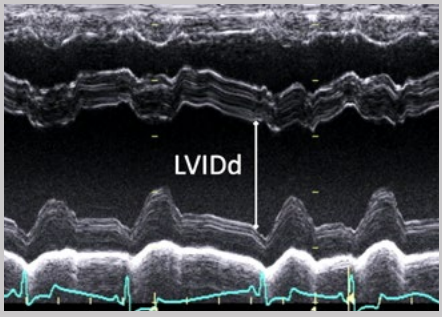
Stage B2 MMVD
Left atrial enlargement



Stage B2 MMVD
Left ventricular dilation



Stage B2 MMVD
Left ventricular dilation

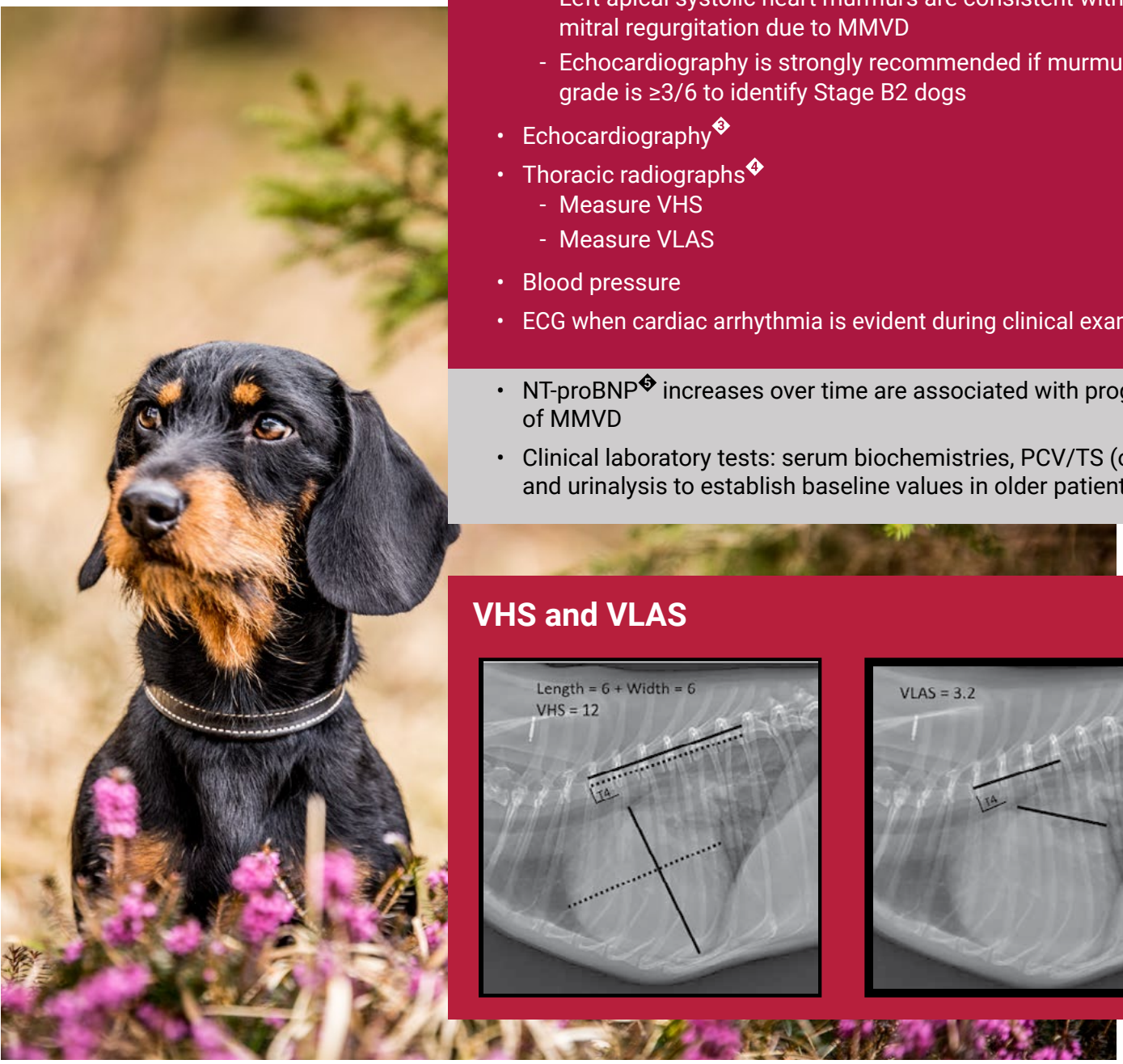


STAGE B

Dogs with structural heart disease that have not yet developed clinical signs of heart failure

CEG Recommendations: Stages B1 and B2

- Patient history
  - Exercise tolerance
  - Resting or sleeping respiratory rate
  - Appetite
  - Interaction with family
  - Suggestive clinical signs (cough, collapse)[2]
  - Overall quality of life
- Cardiac and pulmonary auscultation
  - Left apical systolic heart murmurs are consistent with mitral regurgitation due to MMVD
  - Echocardiography is strongly recommended if murmur grade is ≥3/6 to identify Stage B2 dogs
- Echocardiography[3]
- Thoracic radiographs[4]
  - Measure VHS
  - Measure VLAS
- Blood pressure
- ECG when cardiac arrhythmia is evident during clinical examination



- NT-proBNP[5] increases over time are associated with progression of MMVD
- Clinical laboratory tests: serum biochemistries, PCV/TS (or CBC), and urinalysis to establish baseline values in older patients

VHS and VLAS

Dogs with structural heart disease that have not yet developed clinical signs of heart failure

STAGE B

CEG Recommendations: Stages B1 and B2

- Mild dietary sodium restriction and feeding of a diet with adequate protein and calories for maintaining optimal body condition is recommended. Severe sodium restriction is not recommended. See **WSAVA Global Nutrition Committee: Guidelines on Selecting Pet Foods**
- Manage systemic hypertension and concurrent systemic diseases, if present
- Reevaluation in 6 to 12 months unless clinical signs develop
- Client education
  - Discuss typical disease progression and **signs to watch for**
  - Counsel/train owners to monitor resting respiratory rate
  - Can provide **client handout** to aid owners in monitoring resting respiratory rate
  - Discuss nutritional information
    - ▸ **Nutritional Management of Heart Disease**
    - ▸ **Implementing an Optimal Nutrition Plan for Your Cardiovascular Patient**
  - Encourage exercise in Stage B1 MMVD patients as tolerated. Stage B2 patients can exercise as tolerated, avoiding strenuous exercise during periods of high heat or humidity

CEG Treatment Recommendations: Stage B2 Only

- Pimobendan treatment should be initiated in dogs with Stage B2 MMVD[6]
  - See **The EPIC Trial: Pimobendan in Preclinical Myxomatous Mitral Valve Disease**
- Avoidance of high-salt dog treats and human food is strongly recommended

STAGE C

Dogs with past or current clinical signs of heart failure

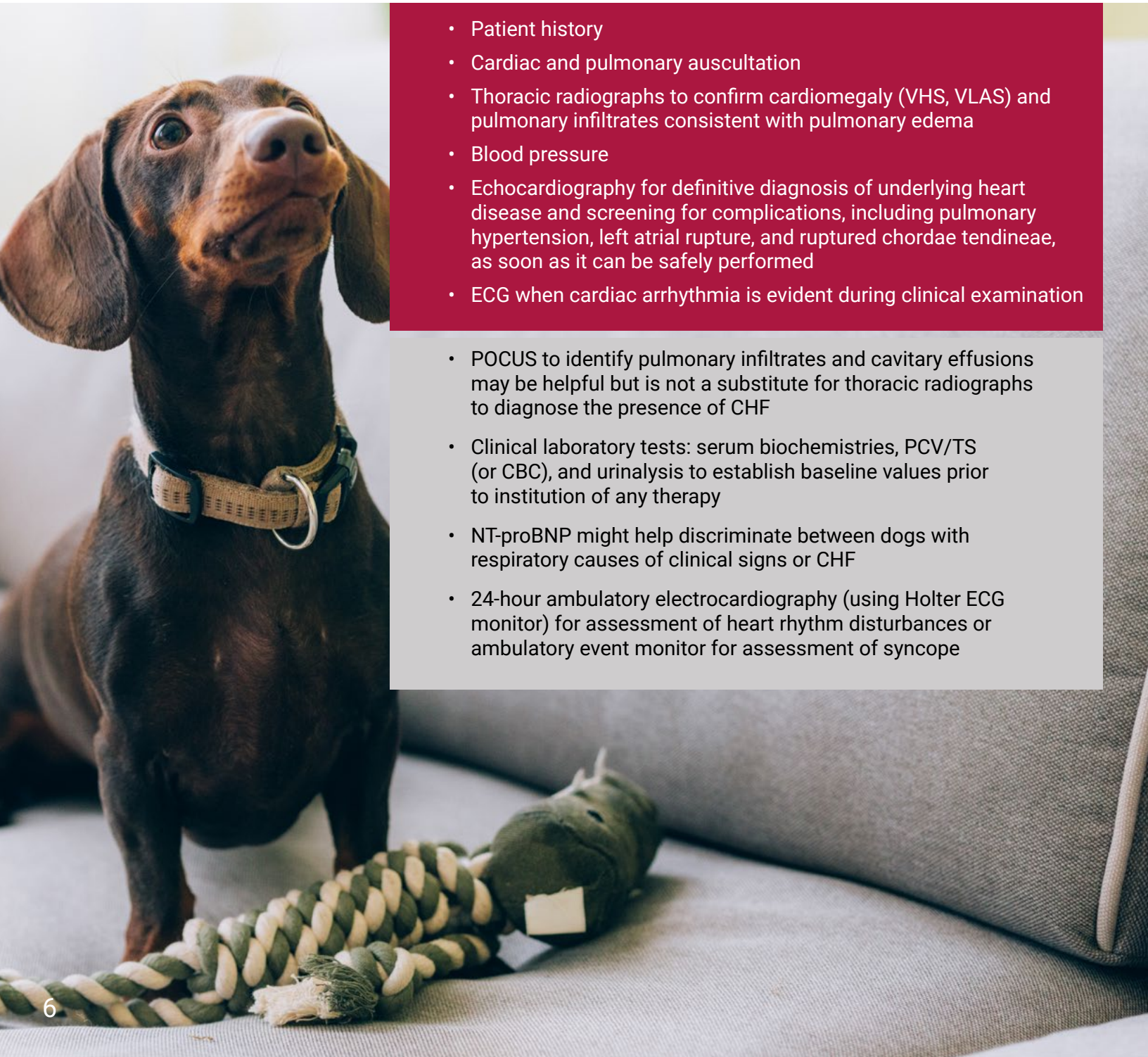
Common Clinical Signs of MMVD With CHF[7]

- Increased resting or sleeping respiratory rate or effort
- Cough associated with changes in respiratory rate/effort
- Abdominal effusion (ascites)
- Exercise intolerance
- Collapse or syncope

CEG Recommendations

- Patient history
- Cardiac and pulmonary auscultation
- Thoracic radiographs to confirm cardiomegaly (VHS, VLAS) and pulmonary infiltrates consistent with pulmonary edema
- Blood pressure
- Echocardiography for definitive diagnosis of underlying heart disease and screening for complications, including pulmonary hypertension, left atrial rupture, and ruptured chordae tendineae, as soon as it can be safely performed
- ECG when cardiac arrhythmia is evident during clinical examination

- POCUS to identify pulmonary infiltrates and cavitary effusions may be helpful but is not a substitute for thoracic radiographs to diagnose the presence of CHF
- Clinical laboratory tests: serum biochemistries, PCV/TS (or CBC), and urinalysis to establish baseline values prior to institution of any therapy
- NT-proBNP might help discriminate between dogs with respiratory causes of clinical signs or CHF
- 24-hour ambulatory electrocardiography (using Holter ECG monitor) for assessment of heart rhythm disturbances or ambulatory event monitor for assessment of syncope



Dogs with past or current clinical signs of heart failure

CEG Recommendations (cont.)

Initial Therapy of Life-Threatening CHF

- Initial treatment of acute CHF should include injectable furosemide, oxygen, and butorphanol sedation if needed
- Administer pimobendan if the patient can tolerate oral medication
- These patients require 24-hour care and may benefit from specialty referral and additional individualized therapy. Stabilize the patient before transport is considered

Therapy of Chronic CHF due to MMVD

- Standard therapy for CHF: furosemide, pimobendan, ACEIs, spironolactone[8]
- If atrial fibrillation is present, diltiazem therapy is recommended[9]
- Avoiding high-salt snacks and treats is strongly recommended (see **Nutritional Management article**)
- Exercise should be limited in acute phase of any episode of CHF. When pulmonary edema has resolved, gentle exercise is encouraged as tolerated, avoiding prolonged strenuous activity
- Continuation or gradual introduction of moderate dietary sodium restriction is recommended if tolerated by the patient. A highly palatable diet with adequate protein and calories will help maintain optimal muscle condition

STAGE D

Dogs with end-stage disease and clinical signs of heart failure refractory to standard therapy

Clinical Signs of Stage D MMVD

Dogs with Stage D MMVD have persistent clinical signs of end-stage MMVD and CHF despite use of standard doses of recommended medications (see **CEG Canine Formulary**, **ACVIM MMVD Consensus Statement**).

Signs may include persistent increased resting or sleeping respiratory rate or effort, cough associated with changes in respiratory rate/effort, abdominal effusion (ascites), poor appetite, weight loss or muscle wasting, exercise intolerance, collapse, or syncope.

CEG Recommendations

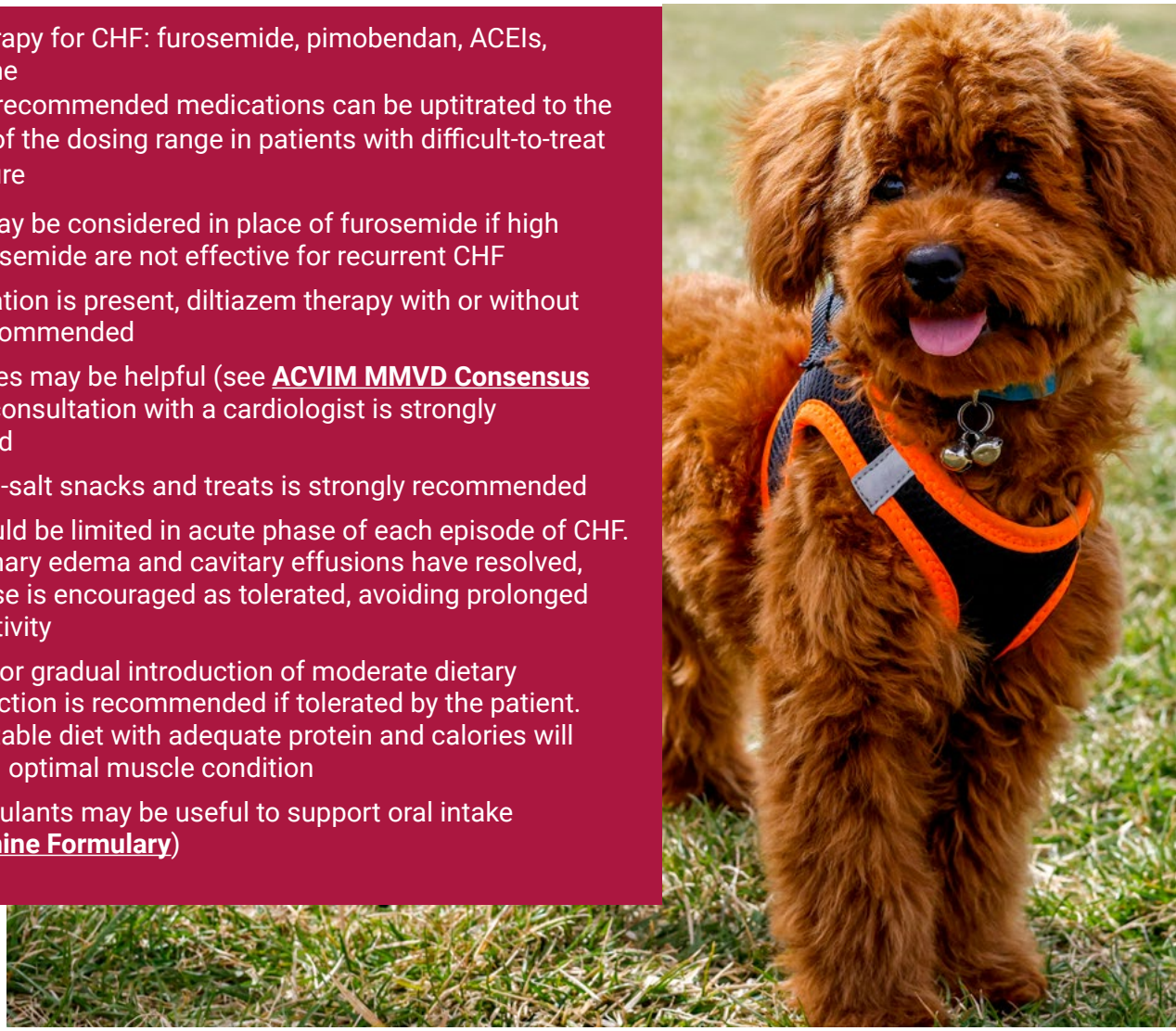
The order of diagnostic tests should be tailored to the patient's current clinical signs.

- Patient history, with special attention to assessment of client compliance and monitoring of clinical signs
  - Assess for medication compliance
  - Check for recent changes in diet, environment, and body weight
- Full physical examination with careful cardiac and pulmonary auscultation
- Careful screening for concurrent systemic disease to identify possible non-cardiac causes of clinical signs
- Thoracic radiographs
- Blood pressure
- Echocardiography for definitive diagnosis of underlying heart disease and screening for complications, including pulmonary hypertension, left atrial rupture, and ruptured chordae tendineae, as soon as it can be safely performed
- ECG when cardiac arrhythmia is evident during clinical examination
- Clinical laboratory tests: serum biochemistries, PCV/TS (or CBC), thyroid assessment if appropriate

- 24-hour ambulatory electrocardiography (using Holter ECG monitor) for assessment of heart rhythm disturbances or ambulatory event monitor for assessment of syncope

CEG Recommendations (cont.)

- Standard therapy for CHF: furosemide, pimobendan, ACEIs, spironolactone
  - Doses of recommended medications can be uptitrated to the high end of the dosing range in patients with difficult-to-treat heart failure
- Torsemide may be considered in place of furosemide if high doses of furosemide are not effective for recurrent CHF
- If atrial fibrillation is present, diltiazem therapy with or without digoxin is recommended
- Other therapies may be helpful (see **ACVIM MMVD Consensus Statement**); consultation with a cardiologist is strongly recommended
- Avoiding high-salt snacks and treats is strongly recommended
- Exercise should be limited in acute phase of each episode of CHF. When pulmonary edema and cavitary effusions have resolved, gentle exercise is encouraged as tolerated, avoiding prolonged strenuous activity
- Continuation or gradual introduction of moderate dietary sodium restriction is recommended if tolerated by the patient. A highly palatable diet with adequate protein and calories will help maintain optimal muscle condition
- Appetite stimulants may be useful to support oral intake (see **CEG Canine Formulary**)



Clinical Resources

ACVIM Consensus Guidelines for the Diagnosis and Treatment of Myxomatous Mitral Valve Disease in Dogs

CEG Circulations: Coughing in Dogs: Is It Heart Failure?

CEG Circulations: Nutritional Management of Heart Disease (Part 1)

CEG Circulations: Implementing an Optimal Nutrition Plan for Your Cardiovascular Patient (Part 2)

CEG Circulations: NT-proBNP Testing in the Dog

CEG Circulations: Tips for Diagnosing Heart Failure; Using Resting Home Respiration Rate

CEG Client Handout: Monitoring Your Pet's Respiratory (Breathing) Rate

CEG Formulary: Cardiac Medications for Dogs

CEG Practice Pointers: Evaluating Radiographic Heart Size Using VHS and VLAS

CEG Recommendations: The EPIC Trial: Pimobendan in Preclinical Myxomatous Mitral Valve Disease

WSAVA Global Nutrition Committee: Guidelines on Selecting Pet Foods

Endnotes

1. Both VHS and VLAS are measured using the same (right) projection for each exam. A VHS rate of change ("velocity") is calculated as the change in VHS in vertebral bodies (VB) divided by the number of months between the 2 examinations. Values ≥0.1 VB/month signal a higher risk for developing CHF.
2. Hacking, unproductive cough without respiratory distress may be a sign of clinically significant cardiomegaly in dogs with MMVD. Evaluation for the presence of Stage B2 is recommended.
3. Echocardiography is the diagnostic test of choice to establish the diagnosis of MMVD in dogs. Echocardiographic enlargement indicative of Stage B2 includes LA:Ao ≥1.6 and LVIDdN ≥1.7. For more information, see the flowchart in **The EPIC Trial: Pimobendan in Preclinical Myxomatous Mitral Valve Disease**.
4. Thoracic radiographs may be helpful as part of the diagnostic evaluation of dogs with possible MMVD. If echocardiography is not available, radiographic measurements of VHS and VLAS may help identify dogs likely to meet Stage B2 echocardiographic criteria. A second opinion from a radiologist or cardiologist may be helpful. For more information, see **Evaluating Radiographic Heart Size Using VHS and VLAS**.
5. NT-proBNP testing may help differentiate coughing due to respiratory disease from coughing due to cardiac enlargement. For more information, see **NT-proBNP Testing in the Dog**.
6. The use of other therapies (ACEI and spironolactone) in Stage B2 MMVD is controversial. Consultation with a cardiologist may be helpful.
7. The presence of some respiratory conditions may complicate classification of dogs with heart disease. This is especially problematic in distinguishing Stage B2 from Stage C dogs. Collapsing trachea, mainstem bronchial compression due to left atrial enlargement, chronic bronchitis, or pulmonary hypertension may cause clinical signs similar to those of CHF. These include coughing, tachypnea, or signs related to airway obstruction. Patients with these types of clinical signs, including Stage D patients, might benefit from additional diagnostic testing, referral to a specialist, or therapeutic trials. For more information, see **Coughing in Dogs: Is It Heart Failure?**
8. Furosemide and pimobendan are typically the first medications to be initiated; ACEI and spironolactone can be added to chronic therapy within the first 1 to 2 weeks as tolerated.
9. Addition of digoxin to diltiazem therapy may add heart rate control benefit. Relative contraindications for digoxin therapy include impaired renal function, preexisting ventricular ectopy, or conduction disease of the sinus node or atrioventricular node (AV block).

Abbreviations

ACEI, angiotensin-converting enzyme inhibitor; **ACVIM**, American College of Veterinary Internal Medicine; **CBC**, complete blood count; **CEG**, Cardiac Education Group; **CHF**, congestive heart failure; **ECG**, electrocardiogram; **LA**, left atrium; **LA:Ao**, left atrial-to-aortic root ratio; **LV**, left ventricle; **LVIDd**, left ventricular internal diameter in diastole; **LVIDdN**, left ventricular internal diameter in diastole normalized for body weight; **MMVD**, myxomatous mitral valve disease; **NT-proBNP**, N-terminal pro-B-type natriuretic peptide; **PCV/TS**, packed cell volume/total solids; **POCUS**, point-of-care ultrasound; **VHS**, vertebral heart score; **VLAS**, vertebral left atrial size; **WSAVA**, World Small Animal Veterinary Association.