



# CANINE CARDIAC DIAGNOSTIC SCHEME

## ABCDs OF MYXOMATOUS MITRAL VALVE DISEASE

UPDATED JANUARY 2021



# A

## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

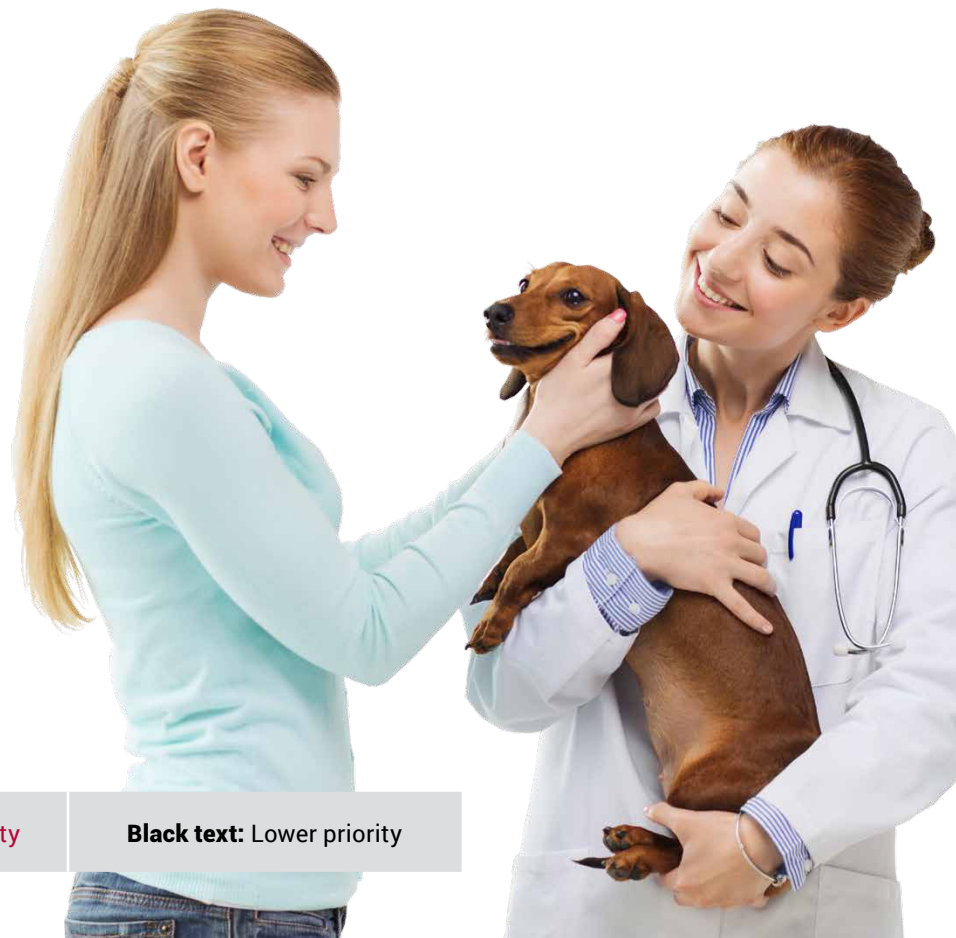
Dogs with no structural disease but at high risk for developing MMVD.

### DIAGNOSTICS

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

### CEG RECOMMENDATIONS

- **No treatment**
- **Client education**
- **Annual re-evaluation**



**KEY:**

**Red text:** High priority

**Black text:** Lower priority



# B

## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

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

### 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 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 B1 from B2.

- Echocardiography is the test of choice to differentiate Stage B1 MMVD from Stage B2 MMVD. Echocardiographic enlargement indicative of Stage B2 includes both LA:Ao  $\geq 1.6$  and LVIDDN  $\geq 1.7$ <sup>1</sup>. Details of diagnostic approach can be found [here](#).
- 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  $\geq$  grade 3/6, radiographic criteria to identify likely Stage B2 dogs includes vertebral heart size (VHS)  $\geq 11.5$  or vertebral left atrial size (VLAS)  $\geq 3$  measured on a lateral radiograph.
- In cases where an echocardiogram cannot be obtained for staging, serial radiography (with consecutive examinations separated by 6 to 12 months) can offer a practical substitute<sup>2</sup>.

#### FOOTNOTES

1. Cornell CC et al. Allometric scaling of M-mode cardiac measurements in normal adult dogs. J Vet Intern Med 2004;18:311-321.
2. 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 two examinations. Values  $\geq 0.1$  VB/month signals a higher risk for developing CHF.

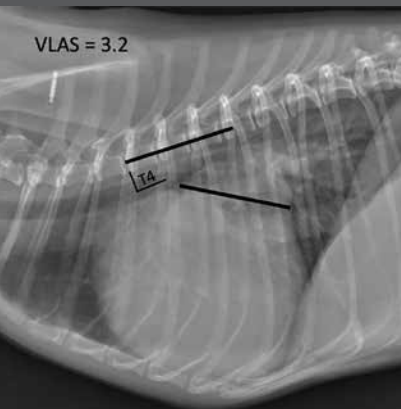
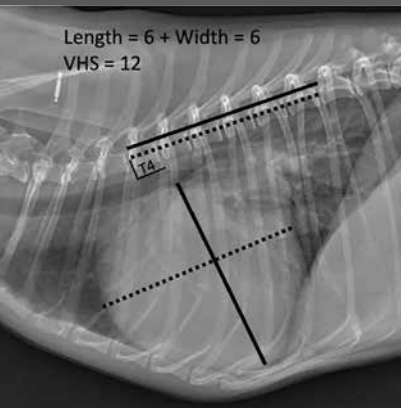
# B

## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

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

### DIAGNOSTICS: STAGE B1 & B2 MMVD

- **Patient history**<sup>3</sup>
- **Cardiac and pulmonary auscultation**<sup>4</sup>
- **Echocardiography**<sup>5,6</sup>
- **Thoracic radiographs**<sup>7,8</sup>
  - **Measure Vertebral Heart Size (VHS)**
  - **Measure Vertebral Left Atrial Size (VLAS)**
- **Blood pressure**
- **Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination.**
- NT-proBNP<sup>9</sup> increases over time are associated with progression of MMVD.
- Clinical lab tests: serum biochemistries, PCV/TS (or CBC) and urinalysis to establish baseline values in older patients.



#### KEY:

**Red text:** High priority

**Black text:** Lower priority

#### FOOTNOTES

3. The history should include: questions about exercise tolerance, resting or sleeping respiratory rate, appetite, interaction with family, suggestive clinical signs (cough, collapse), and overall assessment of quality of life. 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.
4. Left apical systolic heart murmurs are consistent with mitral regurgitation due to MMVD. Echocardiography is strongly recommended if murmur grade is  $\geq 3/6$  to identify Stage B2 dogs.
5. Echocardiography is the diagnostic test of choice to establish the diagnosis of MMVD in dogs.
6. Echocardiographic enlargement indicative of Stage B2 includes  $LA:Ao \geq 1.6$  and  $LV:IDDN \geq 1.7$ ; review flow chart found in [The EPIC Trial: Pimobendan in Preclinical Myxomatous Mitral Valve Disease](#) in Resources page at [cardiaceducationgroup.org](#).
7. 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.
8. See [cardiaceducationgroup.org](#) for more information about radiographs and the Vertebral Heart Size (VHS) and Vertebral Left Atrial Size (VLAS).
9. NT-proBNP testing may help differentiate coughing due to respiratory disease from coughing due to cardiac enlargement. See [NT-proBNP Testing in the Dog](#) in Resources page at [cardiaceducationgroup.org](#).

# B

## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

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

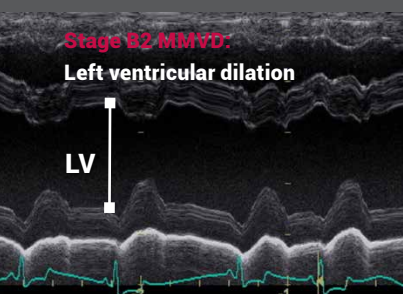
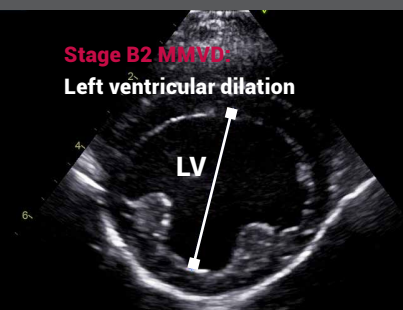
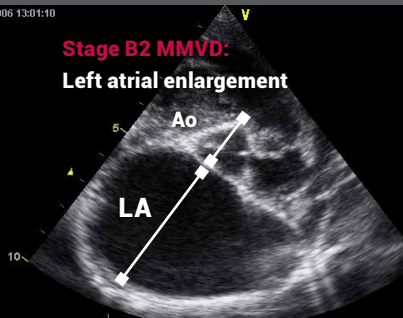
### CEG RECOMMENDATIONS - STAGE B MMVD

#### Stage B2 MMVD Dogs:

- **Pimobendan treatment should be initiated in dogs with B2 MMVD<sup>10</sup>.**
  - See [The EPIC Trial: Pimobendan in Preclinical Myxomatous Mitral Valve Disease](#)
- **Avoidance of high salt dog treats and human food is strongly recommended.**

#### All Stage B MMVD Dogs:

- **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. WSAVA global nutrition committee recommendations for selecting a pet food manufacturer can be found [here](#).**
- **Manage systemic hypertension and concurrent systemic diseases, if present.**
- **Re-evaluation in 6-12 months unless clinical signs develop.**
- **Client education:**
  - **Discuss typical disease progression and signs to watch for.**
    - [Tips for Diagnosing Heart Failure](#)
  - **Counsel/ train owners to monitor resting respiratory rate**
    - [Using Resting Home Respiration Rate](#)
    - Client handout can be provided to aid owners in RRR recording. See [Monitoring Your Pet's Respiratory \(Breathing\) Rate \(Client handout\)](#)
  - **Discuss nutritional information**
    - [Nutritional Management of Heart Disease](#)
    - [Implementing an Optimal Nutrition Plan for Your Cardiovascular Patient](#)
  - **Encourage exercise in B1 MMVD patients as tolerated. Stage B2 patients can exercise as tolerated, avoiding strenuous exercise during periods of high heat or humidity.**



#### KEY:

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#### FOOTNOTES

10. The use of other therapies (ACEi and spironolactone) in Stage B2 MMVD is controversial. Consultation with a cardiologist may be helpful.

# C

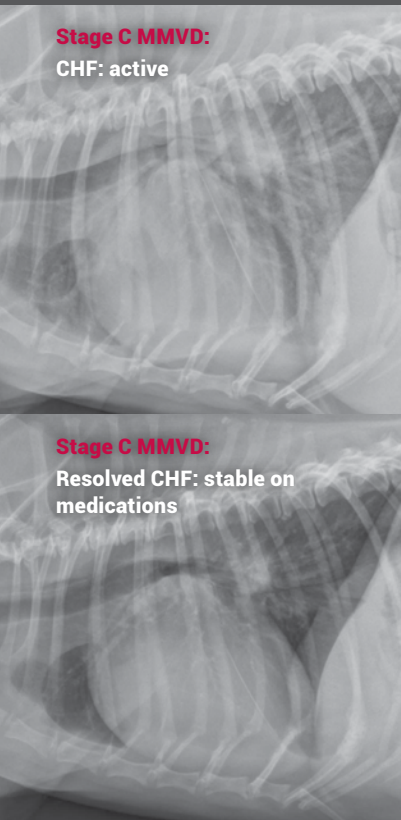
## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

Dogs with past or current clinical signs of heart failure.

Common clinical signs of MMVD with congestive heart failure (CHF) include increased resting or sleeping respiratory rate or effort, cough associated with changes in respiratory rate/effort, abdominal effusion (ascites), exercise intolerance, collapse or syncope<sup>11</sup>.

### DIAGNOSTICS: STAGE C MMVD

- **Patient history**
- **Cardiac and pulmonary auscultation**
- **Thoracic radiographs<sup>12</sup>**
- **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.**
- **Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination.**
- Point of care ultrasound to identify pulmonary infiltrates and cavitory effusions may be helpful but are not a substitute for thoracic radiographs to diagnose the presence of congestive heart failure
- Clinical lab 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 congestive heart failure.
- 24 hour ambulatory electrocardiography (using Holter ECG monitor) for assessment of heart rhythm disturbances or ambulatory event monitor for assessment of syncope.



Stage C MMVD:

CHF: active

Stage C MMVD:

Resolved CHF: stable on medications

#### KEY:

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#### FOOTNOTES

11. 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 symptoms similar to those of

congestive heart failure. These include coughing, tachypnea or symptoms related to airway obstruction. These patients might benefit from additional diagnostic testing, referral to a specialist or therapeutic trials. [Coughing in Dogs: Is It Heart Failure?](#)

12. Confirm cardiomegaly (VHS, VLAS) and pulmonary infiltrates consistent with pulmonary edema.



## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

Dogs with past or current clinical signs of heart failure.

### CEG RECOMMENDATIONS – STAGE C MMVD

#### Initial Therapy of Life Threatening Congestive Heart Failure

- **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 congestive heart failure: furosemide<sup>13</sup>, pimobendan, ACEi, spironolactone.**
- **If atrial fibrillation is present, diltiazem therapy is recommended<sup>14</sup>.**
- **Avoiding high-salt snacks and treats is strongly recommended.** [Nutritional Management of Heart Disease \(Part 1\)](#)
- **Exercise should be limited in acute phase of any episode of congestive heart failure. When pulmonary edema has resolved, gentle exercise is encouraged as tolerated, avoiding prolonged strenuous activity.**
- **Continuation of 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.**

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#### FOOTNOTES

13. Furosemide and pimobendan are typically the first medications to be initiated; ACEi and spironolactone can be added to chronic therapy within the first 1-2 weeks as tolerated.

14. Addition of digoxin to diltiazem therapy may add heart rate control benefit. Relative contraindications for digoxin therapy include: impaired renal function, pre-existing ventricular ectopy or conduction disease of the sinus node or atrioventricular node (AV block).



## D

**STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)**

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

Persistent clinical signs of end-stage MMVD and congestive heart failure despite use of standard doses of recommended medications ([Canine Formulary](#), [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.

**DIAGNOSTICS<sup>15</sup>**

- **Patient history, with special attention to assessment of client compliance and monitoring of clinical signs<sup>16, 17</sup>.**
- **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.**
- **Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination.**
- **Clinical lab 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.

**KEY:****Red text:** High priority**Black text:** Lower priority**FOOTNOTES**

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

16. Assess for medication compliance, check for recent changes in diet, environment and body weight.

17. The presence of some respiratory conditions may complicate assessment of dogs with

heart disease. Collapsing trachea, mainstem bronchial compression due to cardiomegaly, chronic bronchitis or pulmonary hypertension may cause symptoms similar to those of congestive heart failure. These include coughing, tachypnea or symptoms related to airway obstruction. Stage D MMVD patients

with these types of clinical signs may benefit from additional diagnostic testing, referral to a specialist or therapeutic trials.



# D

## STAGES OF MYXOMATOUS MITRAL VALVE DISEASE (MMVD)

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

### CEG RECOMMENDATIONS

- **Standard therapy for congestive heart failure: furosemide, pimobendan, ACEi, spironolactone<sup>18</sup>.**
- **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 [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 congestive heart failure. When pulmonary edema and cavitory effusions have resolved, gentle exercise is encouraged as tolerated, avoiding prolonged strenuous activity.**
- **Continuation of 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 ([Canine Formulary](#)).**



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#### FOOTNOTES

18. Doses of recommended medications can be uptitrated to the high end of the dosing range in patients with difficult to treat heart failure.

## ABOUT THE CARDIAC EDUCATION GROUP (CEG)

Founded in 2009, the Cardiac Education Group is a registered not-for-profit organization of board-certified veterinary cardiologists from both academia and private practice that offers independent recommendations for the evaluation and treatment of canine and feline heart disease. The CEG mission is to improve the lives of dogs and cats with heart disease by providing resources and information in order to promote detection, diagnosis and therapy of heart disease and heart failure with greater accuracy and confidence.

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