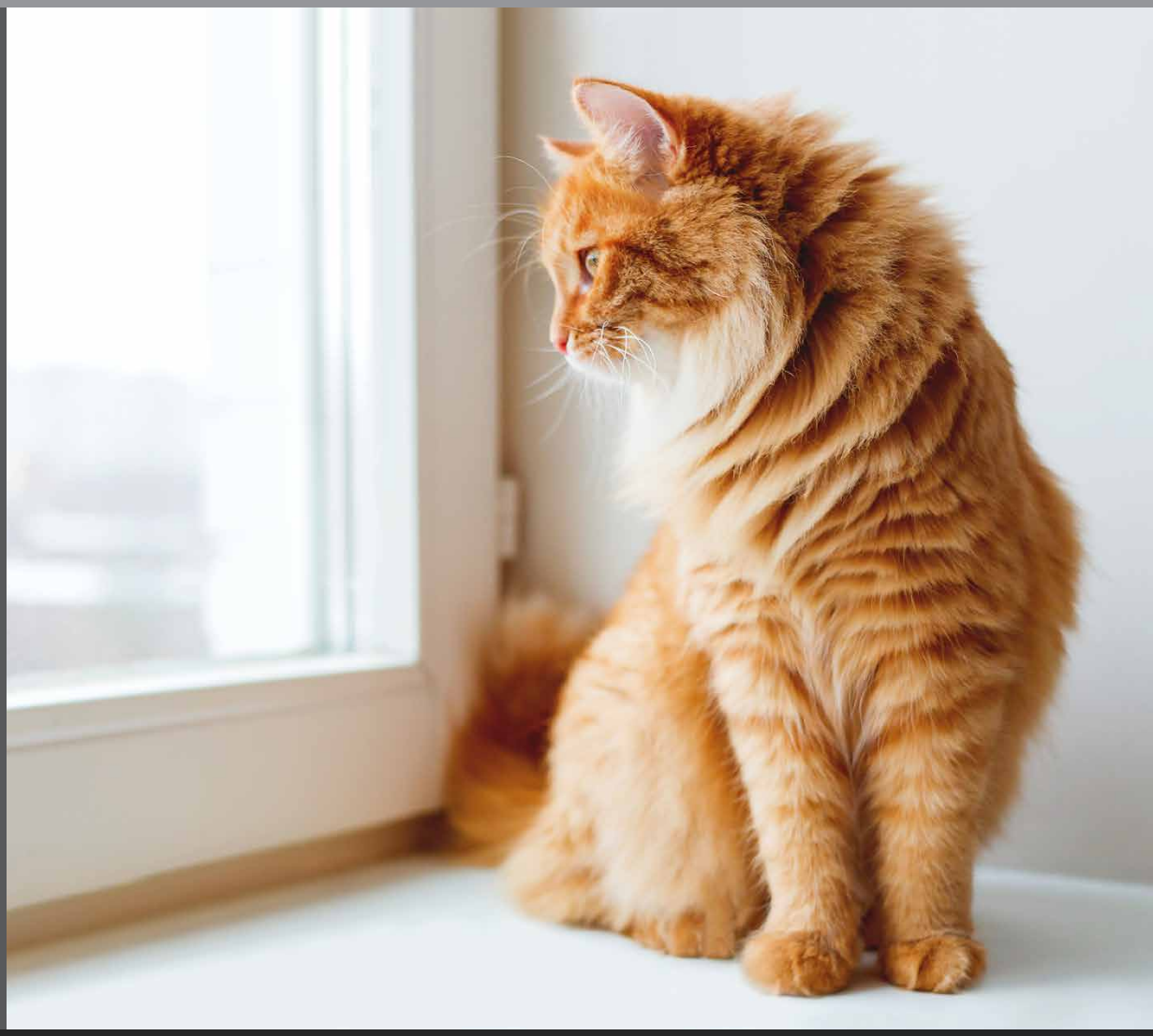
CARDIAC EDUCATION group



FELINE CARDIAC DIAGNOSTIC SCHEME

ABCDs OF FELINE CARDIOMYOPATHY

UPDATED APRIL 2021

A

CARDIOMYOPATHY STAGES

Cats that are predisposed to cardiomyopathy[1] but currently have no clinical evidence of myocardial disease.

DIAGNOSTICS

- **Patient history**
- **Yearly auscultation[2]**
- **Screening echocardiography for predisposed breeds**
- **Genetic tests are available for Main Coon and Ragdoll breeds**
- **Elevated NT-proBNP concentrations may identify cats that may benefit from further diagnostic evaluation.** See NT-proBNP Testing in Cats.

CEG RECOMMENDATIONS

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

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

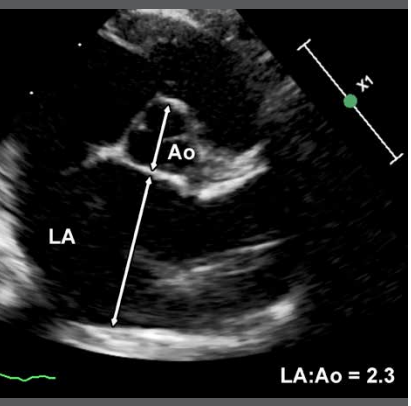
FOOTNOTES

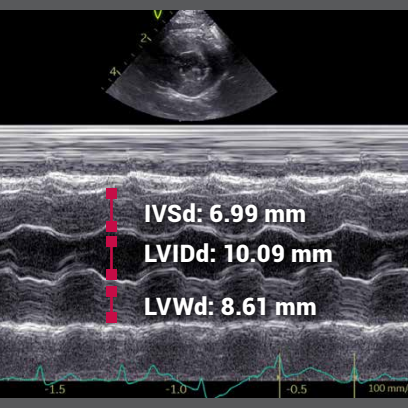
1. Predisposed breeds include Maine Coon, Ragdoll, British Shorthair, Persian, Bengal, Sphynx, Norwegian Forest cat, and Birman breeds. Additional "at risk" breeds are likely to be identified and additional breed-specific genetic testing may become available in future years.
2. The absence of a heart murmur does not exclude the possibility of preclinical cardiomyopathy.

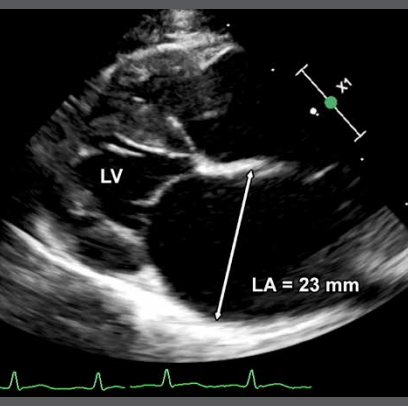
B

CARDIOMYOPATHY STAGES

Cats with suspected cardiomyopathy that do not have clinical signs[3]







Stage B cats are divided into Stage B1 or B2 based on risk of imminent congestive heart failure (CHF) or aortic thromboembolism (ATE).

- **B1:** low risk of imminent CHF or ATE based primarily on minimal left atrial (LA) enlargement.
- **B2:** increased risk of imminent CHF or ATE based on more severe LA enlargement (for example, LA diameter ≥ 20 mm on long axis, LA:Ao ≥ 1.8) or presence of other risk factors[4].

DIAGNOSTICS: STAGE B1 & B2

- **Patient history**
- **Cardiac and pulmonary auscultation[5]**
- **Echocardiography[6] [7]**
- **Blood pressure**
- **Resting serum thyroxine concentration (cats ≥ 6 years of age)**
- NT-proBNP[8]
- Thoracic radiographs[9]
- Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination
- Clinical lab tests: serum biochemistries, PCV/TS (or CBC) and urinalysis (prior to initiating any therapy in B2 patients)

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

FOOTNOTES

3. Cardiomyopathy may be suspected when a murmur, gallop or arrhythmia is detected on physical examination.
4. Other risk factors: presence of arrhythmia, extreme LV hypertrophy, spontaneous echo contrast/thrombus, regional wall motion abnormalities, LV systolic dysfunction
5. Abnormal auscultation findings indicate that further evaluation is warranted, but are not diagnostic for cardiomyopathy. Conversely, some cats with cardiomyopathy may have normal auscultation findings.
6. Echocardiographic findings allow diagnosis of specific type of cardiomyopathy, including hypertrophic cardiomyopathy (HCM), restrictive cardiomyopathy (RCM), dilated cardiomyopathy (DCM) or non-specific cardiomyopathic phenotypes as well as degree of severity of changes. See ACVIM Feline CM Consensus Statement.
7. Point-of-Care (POC) exams may be used to document degree of LA enlargement and/or presence of spontaneous echo contrast or intracardiac thrombus in cats without clinical signs.
8. Abnormal SNAP® NT-proBNP or Cardiopet NT-proBNP quantitative results (Idexx Laboratories, Inc.) are an indication for echocardiography. See NT-proBNP Testing in Cats.
9. Radiographic findings are not diagnostic for cardiomyopathy but may be used to track progressive cardiomegaly or document evidence of respiratory disease, and may be used as baseline information for B2 cats.

B

CARDIOMYOPATHY STAGES

Cats with suspected cardiomyopathy that do not have clinical signs

CEG RECOMMENDATIONS - B1 & B2

- **No specific dietary changes or exercise restrictions at this stage**
- **Manage systemic hypertension if present**
- **Manage hyperthyroidism if present**

Stage B1

- No treatment[10, 11]

Stage B2

- **Echocardiographic identification of cardiomyopathic phenotype and severity of anatomic changes including degree of LA enlargement is recommended.**
- **Thromboprophylactic therapy[12] recommended when risk factors for ATE are present, primarily moderate to severe LA enlargement (for example, LA diameter ≥ 20 mm on long axis, LA:Ao ≥ 1.8)[13] or other identified risk factors.**
- Owner monitoring of resting or sleeping respiratory rate strongly recommended (See Monitoring Your Pet's Respiratory (Breathing) Rate).
- Treat ventricular tachycardia or frequent ventricular ectopy[14] or atrial fibrillation[15] when present; consider consultation with a cardiologist.
- Additional therapies[16] are controversial in Stage B2 disease. Consultation with a cardiologist may be helpful.

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

FOOTNOTES

10. Atenolol therapy for preclinical cats with dynamic left ventricular outflow obstruction is controversial. Consultation with a cardiologist may be helpful.
11. Beta-blocker therapy (e.g. atenolol or sotalol) most often first choice for therapy of ventricular ectopy.
12. Clopidogrel recommended. Feline Formulary.
13. Other risk factors for ATE include spontaneous echo contrast ("smoke"), visible intracardiac thrombus, left atrial (LA) decreased systolic function (LA FS% </=20%) or low LA appendage velocities.
14. Beta-blocker therapy (e.g. atenolol or sotalol) most often first choice for therapy of ventricular ectopy.
15. Diltiazem recommended.
16. For example, ACEi or spironolactone.

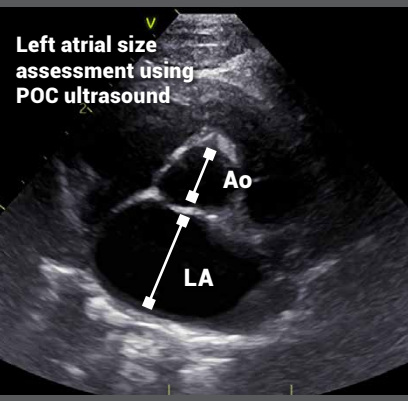
C

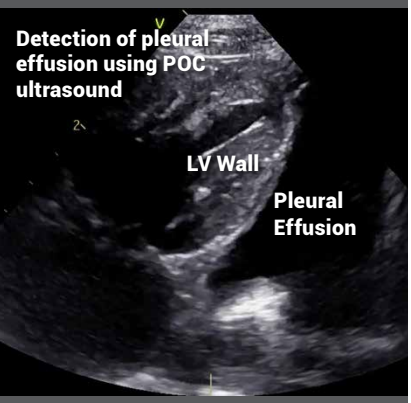
CARDIOMYOPATHY STAGES

Cats with past or current clinical signs[17] of congestive heart failure or aortic thromboembolism.

DIAGNOSTICS

- **Patient history**
- **Cardiac and pulmonary auscultation**
- **Echocardiography for definitive diagnosis of underlying structural heart disease; this test may need to be delayed until the patient is clinically stable.**
- **Thoracic radiographs[18] or POC[19] ultrasound to identify pulmonary edema, left atrial enlargement or pleural effusion**
- Cageside SNAP® NT-proBNP might help discriminate respiratory disease causes of acute clinical signs versus congestive heart failure[20] in cats with respiratory distress.[21]
- Blood pressure
- Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination.
- Clinical lab tests:
  - Serum biochemistries, PCV/TS (or CBC) and urinalysis (prior to initiating any therapy and to monitor for renal and electrolyte abnormalities after therapy).
  - Thyroid testing can be submitted if current thyroid status is not known (cats ≥ 6 years of age).





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

FOOTNOTES

17. Clinical signs may include general signs of illness (e.g. hiding, inappetence), congestive heart failure signs (e.g. tachypnea, respiratory distress, hypothermia), signs of arrhythmia (e.g. syncope) and/or signs of aortic thromboembolism (e.g. paresis, paralysis).
18. Thoracic radiographs may be too stressful to be completed in severely dyspneic patients. Emergency thoracocentesis should be performed to stabilize patients with severe pleural effusion.
19. Point-of-Care (POC) ultrasound may be used to document cardiac disease as the cause of dyspnea by identifying left atrial enlargement in the presence of pleural effusion or pulmonary B-lines that may indicate pulmonary edema.
20. NT-proBNP assessment can be performed using a blood sample or a pleural effusion sample that has been diluted 1:1 with saline.
21. "Normal" SNAP NT-proBNP results make congestive heart failure UNLIKELY to be the cause of the patient's respiratory distress. A strong "Abnormal" result SUPPORTS a diagnosis of congestive heart failure. A weak "Abnormal" result should be interpreted with caution.

C

CARDIOMYOPATHY STAGES

Cats with past or current clinical signs of congestive heart failure or aortic thromboembolism.

CEG RECOMMENDATIONS

- **Standard Treatment:**
  - **Acute CHF[22]: Oxygen supplementation, furosemide, anxiolysis, thoracocentesis if needed, supportive care[23]**
  - **Chronic CHF[22,24]: Furosemide, ACEi, clopidogrel if indicated by echocardiographic findings:**
    - **Most patients: furosemide, clopidogrel[25]**
    - **Renin-angiotensin-aldosterone system blockade recommended (ACEi and spironolactone) if tolerated. [26]**
  - **ATE: analgesia[27], anticoagulant therapy[28], supportive care (including CHF therapy if needed)**
  - Treat ventricular arrhythmias or atrial fibrillation as outlined for B2
  - Owner assessment of cat's home sleeping respiratory rate recommended to monitor for recurrence of CHF. (See Monitoring Your Pet's Respiratory (Breathing) Rate)

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

FOOTNOTES

22. If systolic dysfunction is present, pimobendan or dobutamine therapy may be helpful.
23. Injectable butorphanol (IM) recommended for anxiolysis, supportive care includes access to water and access to gentle warming for hypothermic patients.
24. Although furosemide is almost always needed to control chronic CHF in cats, addition of other medications should be based on patient tolerance.
25. If clopidogrel is not tolerated, factor Xa inhibitors (apixaban, rivaroxaban) may be considered. Consultation with a cardiologist is recommended.
26. May cause facial pruritis in some cats.
27. Potent opioid-based analgesics (such as fentanyl, hydromorphone or methadone) are recommended for pain control. Concurrent use of butorphanol with these medications may reduce analgesic efficacy.
28. Immediate commencement of low molecular weight heparin or unfractionated heparin injections or oral dosing of factor Xa inhibitor (e.g. apixaban, rivaroxaban) is recommended. (Feline Formulary)

D

HEART FAILURE STAGES

Cats with end-stage disease with clinical signs of CHF refractory to standard therapy or repeated thromboembolic events.

DIAGNOSTICS

- **Patient history**
- **Cardiac and pulmonary auscultation**
- **Thoracic radiographs[29] or POC[30] ultrasound to identify pleural effusion or pulmonary edema**
- **Echocardiography for definitive diagnosis of underlying structural heart disease[31].**
- **Blood pressure**
- **Clinical lab tests: serum biochemistries, PCV/TS (or CBC) and urinalysis (prior to initiating any therapy and to monitor for renal and electrolyte abnormalities after therapy). Thyroid status should be reassessed in Stage D patients.**
- NT-proBNP might help discriminate between cats with respiratory causes of clinical signs or congestive heart failure[32].
- Electrocardiogram (ECG) when cardiac arrhythmia is evident during clinical examination.

CEG RECOMMENDATIONS

- **Standard Treatment: Furosemide, pimobendan, ACEi & spironolactone**
- **Clopidogrel[33] if indicated by echocardiographic findings**
- Torsemide may be considered in place of furosemide if high doses of furosemide not effective for recurrent CHF
- Atrial fibrillation – diltiazem therapy
- Ventricular arrhythmias – sotalol therapy
- Other therapies may be helpful; consultation with a cardiologist is strongly recommended.
- Dietary changes – avoid excessive sodium intake and maintain adequate protein and caloric intake. Dietary intake is prioritized over sodium restriction.
- Appetite stimulants may be useful.

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

FOOTNOTES

29. Thoracic radiographs may be too stressful to be completed in severely dyspneic patients. Emergency thoracocentesis may be required to stabilize patients with severe pleural effusion.
30. Point-of-Care (POC) ultrasound may be used to document cardiac disease as the cause of dyspnea by identifying LA enlargement, to identify pleural effusion and to identify pulmonary B-lines that may indicate pulmonary edema.
31. Echocardiography may need to be delayed until patient is stabilized.
32. NT-proBNP assessment can be performed using a blood sample or a pleural effusion sample that has been diluted 1:1 with saline.
33. If clopidogrel is not tolerated, factor Xa inhibitors (apixaban, rivaroxaban) may be considered. Consultation with a cardiologist is recommended.

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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