

# CEG FORMULARY:

## Cardiac Medications for Cats



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MEDICATION [Drug Class]	PREPARATIONS	TYPICAL DOSAGE	ADMINISTRATION NOTES & POTENTIAL ADVERSE EFFECTS
<b>Amlodipine*</b> [arterial dilator]	Tablets: 2.5, 5, 10 mg	PO: 0.625-1.25 mg <b>per cat</b> , q12-24h	<ul style="list-style-type: none"><li>• Generally start at lower range and uptitrate dose to desired BP</li><li>• Initial dose is typically q24h</li><li>• Hypotension, RAAS activation, gingival hyperplasia</li></ul>
<b>Apixaban</b> [factor Xa inhibitor - antithrombotic]	Tablets: 2.5, 5 mg	PO: 0.625 mg to 1.25 mg <b>per cat</b> , q12h	<ul style="list-style-type: none"><li>• Higher dosages are often used for the first 3 to 7 days for animals with active thrombosis, then lowered to a maintenance dosage for chronic preventative therapy</li></ul>
<b>Aspirin</b> [NSAID/antithrombotic]	Tablet: 81 mg	PO: 1-2 mg/kg, q24h  Alternative: PO: ¼ of an 81 mg tablet, <b>per cat</b> , q3 days (or twice a week)	<ul style="list-style-type: none"><li>• May cause GI signs especially with higher doses</li></ul>
<b>Atenolol*</b> [beta-blocker]	Tablets: 25, 50, 100 mg	PO: 1.0-2.5 mg/kg, q12h Alternative: PO: 6.25-12.5 mg <b>per cat</b> , q12h	<ul style="list-style-type: none"><li>• For HR control in CM: The target HR in hospital is ≈160 bpm</li><li>• Initiation should not be considered when active CHF is present</li><li>• Cats without CHF can tolerate higher initial and target doses</li><li>• Abrupt discontinuation should be avoided, gradual down-titration is recommended</li><li>• Myocardial depression, bradycardia (sinus and AVB), hypotension</li></ul>
<b>Benazepril*</b> [ACEI]	Tablets: 5, 10, 20, 40 mg	PO: 0.25-0.5 mg/kg, q12h or 0.5 mg/kg, q24h	<ul style="list-style-type: none"><li>• Generally start at lower range and increase to maximal dosage with monitoring of renal function and serum potassium and BP</li><li>• Contraindications: dehydration, hyponatremia</li><li>• Hyperkalemia, azotemia, acute renal failure</li></ul>
<b>Buprenorphine</b> [opioid/analgesic]	For injection: 0.3 mg/ml	Parenteral: 5-10µg/kg IV/IM/SC PO (buccal mucosa): 0.2-0.3 mls of injectable preparation <b>per cat</b>	<ul style="list-style-type: none"><li>• Oral administration at home can be used for emergency treatment of pain associated with acute ATE</li></ul>
<b>Butorphanol</b> [opioid/analgesic/ anxiolytic]	For injection: 2 mg/ml or 10 mg/ml concentrations	Parenteral: 0.1-0.4 mg/kg, IV/ IM/SC	<ul style="list-style-type: none"><li>• Effects range from "antianxiety" to heavy sedation depending on dose</li><li>• Can be safely used in dyspneic cats to help reduce stress and facilitate diagnostics</li><li>• Typical dose for anxiolysis in acute heart failure is 0.1-0.2 mg/kg, IM repeated in 30-60 min if needed</li></ul>

<p><b>Cilostazol</b> [phosphodiesterase III inhibitor]</p>	<p>Tablets: 50 mg, 100 mg</p>	<p>PO: 10 mg/kg, q12h</p>	<ul style="list-style-type: none"> <li>Used for treatment of significant bradycardia associated with clinical signs (e.g., advanced AV block, sick sinus syndrome). Can be used as an alternative when pacemaker therapy is not available. The drug has been shown to inhibit platelet aggregation.</li> <li>Nausea, diarrhea are potential adverse effects</li> <li>Contraindications: Severe liver dysfunction, bleeding disorders</li> </ul>
<p><b>Clopidogrel</b> [thienopyridine-antithrombotic]</p>	<p>Tablet: 75 mg</p>	<p>PO: 18.75 mg <b>per cat</b>, q24h</p>	<ul style="list-style-type: none"> <li>No specific monitoring required</li> <li>Superior to aspirin for prevention of a second ATE event</li> <li>Bitterness of preparation may cause ptyalism in some patients</li> </ul>
<p><b>Diltiazem</b> [calcium channel blocker]</p>	<p>Diltiazem Tablets: 30, 60, 90, 120 mg</p> <p>Sustained release capsules: 60, 120, 180, 240 mg including the Dilacor XR® formulation (the 240 mg capsule, when opened, contains 4 x 60 mg tablets) Cardizem CD®: 120, 180, 240 mg</p>	<p>Standard formulation PO: 7.5 mg <b>per cat</b>, q8h</p> <p>Sustained release PO: 30-60 mg <b>per cat</b>, q12-24h</p>	<ul style="list-style-type: none"> <li>Initiate therapy at the lower end of the dose range</li> <li>Cardizem CD® can be formulated into smaller capsules</li> <li>Neither of the sustained release formulations (Cardizem CD® or Dilacor XR®) can be reformulated into a suspension</li> <li>Cats without CHF can tolerate higher initial and target dosages</li> <li>Hypotension, myocardial depression, AVB</li> </ul>
<p><b>Enalapril*</b> [ACEI]</p>	<p>Tablet: 2.5, 5, 10, 20 mg</p>	<p>PO: 0.25-0.5 mg/kg, q12h or 0.5 mg/kg, q24h</p>	<ul style="list-style-type: none"> <li>Generally start at lower range and increase to maximal dosage with monitoring of renal function and serum potassium and BP</li> <li>Contraindications: dehydration, hyponatremia</li> <li>Hyperkalemia, azotemia, acute renal failure</li> </ul>
<p><b>Furosemide*</b> [loop diuretic]</p>	<p>For injection: 10 mg/ml, 50 mg/ml</p> <p>Veterinary formulations (Salix®): Tablets: 12.5, 50 mg</p> <p>Human formulations: Tablets: 20, 40, 80 mg tablets 1% syrup (10 mg/ml)</p>	<p>Parenteral: 0.5-2.0 mg/kg, q1-8h IV/IM/SC</p> <p>Dosing intervals depend on the response to therapy: initial boluses every 2h, thereafter q6-8h.</p> <p>CRI: 0.25-0.6 mg/kg/h</p> <p>PO: 1-2 mg/kg, q12 - 24h to a maximum total daily dose of 4-6 mg/kg</p>	<ul style="list-style-type: none"> <li>Parenteral boluses and CRI treatment of lifethreatening pulmonary edema is tapered over 12-24h as the clinical signs resolve</li> <li>Typical chronic heart failure dose is 1-2 mg/kg q12h</li> <li>Compounded liquids (from tablets) may be better-tolerated than the commercially available, alcohol-based, 1% syrup</li> <li>Polydipsia and polyuria can exacerbate urinary incontinence</li> <li>Azotemia, hypochloremia, hypokalemia, hypomagnesemia, hyponatremia, metabolic alkalosis are common dose dependent sideeffects</li> <li>Hypokalemia is common in inappetent patients</li> </ul>
<p><b>Gabapentin*</b> [anxiolytic/analgesic]</p>	<p>Capsules: 100, 300, 400 mg</p>	<p>PO: 50 to 100 mg per cat, given 2 to 3 hours before visit</p>	<ul style="list-style-type: none"> <li>Useful for fearful cats prior to cardiac evaluation</li> <li>Advise client that the cat may be sedate for 12hrs after administration</li> </ul>

<p><b>Heparin-Unfractionated</b> [antithrombotic]</p>	<p>For injection: 1,000, 5,000, 10,000 IU/ml</p>	<p>Parenteral: 150-300 IU/kg SC q8h</p> <p>CRI: 10-20 IU/kg/h</p>	<ul style="list-style-type: none"> <li>• Monitor for bleeding including GI tract and urinary tract</li> <li>• Careful monitoring of clotting times is required with prolonged use</li> <li>• Can be combined with aspirin and/or clopidogrel</li> <li>• There are numerous variants in ampule size and concentration so overdosing is a very real risk, take care when using or prescribing</li> </ul>
<p><b>Heparin-Low Molecular Weight</b> [antithrombotic]</p>	<p>For injection:</p> <p>Dalteparin (Fragmin®) 10,000 IU/ml and many variants</p> <p>Enoxaparin (Lovenox®, Xaparin®) 100 mg/ml and many variants</p>	<p>Dalteparin-Parenteral: 100-200 IU/kg SC q12-24h</p> <p>Enoxaparin-Parenteral: 1-2 mg/kg SC q12-24h</p>	<ul style="list-style-type: none"> <li>• No specific monitoring required</li> <li>• Can be combined with aspirin and/or clopidogrel</li> <li>• There are numerous variants in ampule size and concentration so overdosing is a very real risk, take care when using or prescribing</li> </ul>
<p><b>Hydrochlorothiazide*</b> [thiazide diuretic]</p>	<p>Tablets: 25, 50 mg</p>	<p>PO: 0.5-2.0 mg/kg, q12-24h</p>	<ul style="list-style-type: none"> <li>• This is typically used as a rescue diuretic when furosemide resistance is encountered (e.g., the recommended maximum daily dose is exceeded)</li> <li>• A small reduction (<math>\approx 25\%</math>) in furosemide dosage may limit adverse effects when hydrochlorothiazide is introduced as a rescue diuretic in chronic heart failure</li> <li>• Monitor renal parameters, electrolytes and PCV closely when used with other diuretics</li> <li>• Hypovolemia, azotemia, hypochloremia, hypokalemia, hypomagnesemia, hyponatremia, metabolic alkalosis are very common side-effects when used in combination with furosemide</li> </ul>
<p><b>Mirtazapine*</b> [appetite stimulant]</p>	<p>Topical suspension (Mirtaz®): 2% w/w ointment</p> <p>Tablets: 7.5, 15, 30, 45 mg</p>	<p>Topical (ear pinna): Apply 1.5 inch of ointment to the inner ear pinna, which equates to <b><math>\sim 2</math> mg per cat</b></p> <p>PO: 1.875 mg <b>per cat</b>, q24h</p>	<ul style="list-style-type: none"> <li>• Wear gloves when applying the topical agent to avoid human contact</li> <li>• Typically used for 7-14 days in cases with weight loss and inappetence, prolonged use is not studied</li> </ul>
<p><b>Nitroglycerine Ointment</b> [vasodilator]</p>	<p>2% paste (Nitrol®, Nitro-Bid®, Nitrostat®): 1 inch = 15 mg</p>	<p>Topical administration: 2-4 mg <b>per cat</b>, q6-8h for 1 to 2 days</p>	<ul style="list-style-type: none"> <li>• Delivered dose is affected by perfusion of the application area</li> <li>• Apply to hairless/well-perfused skin sites</li> <li>• Duration of administration typically 12-24h</li> <li>• Hypotension is possible</li> </ul>
<p><b>Omega-3 Fatty Acids</b> [nutraceutical, fish oil]</p>	<p>Docosahexaenoic acid (DHA) and eicosapentaenoic (EPA) combined in a fixed-dose capsule (Typically, 1.5:1 or 2:1 EPA:DHA)</p> <p>Note: most commercial 1 gm (1000 mg) omega 3 capsules contain 180 mg EPA and 120 mg DHA; EPA and DHA are also available in separate capsules</p>	<p>PO: EPA, 40 mg/kg, daily dosage</p> <p>PO: DHA 25 mg/kg, daily dosage</p> <p>PO combination formulation= 1 gm (1000mg) capsule per 5 kg body weight (or per cat) per day</p>	<ul style="list-style-type: none"> <li>• Gel caps or soft pills with 180 mg EPA and 120 DHA are often appropriate size</li> <li>• Avoid products with Vitamin A or D (Vitamin E is a safe additive)</li> <li>• Adverse GI side-effects are possible and can limit tolerance, especially early in therapy</li> </ul>

<p><b>Pimobendan</b> [inodilator]</p>	<p>Chewable tablet (Vetmedin®): 1.25, 2.5, 5, 10 mg</p> <p>Capsules (Vetmedin®, available in some countries outside of the US): 1.25, 2.5, 5.0 mg</p>	<p>PO: 0.625-1.25 mg <b>per cat</b>, q12h</p>	<ul style="list-style-type: none"> <li>• Do not reformulate into a suspension</li> <li>• Initial dose should be given on an empty stomach if a rapid onset of action is desired</li> <li>• Contraindicated in patients with known outflow tract obstruction</li> <li>• Potential idiosyncratic side-effects (none consistently reported)</li> </ul>
<p><b>Rivaroxaban</b> [factor Xa inhibitor - antithrombotic]</p>	<p>Tablets: 2.5, 10, 15, 20 mg</p>	<p>PO: 1.25 mg to 5 mg <b>per cat</b>, q12-24h</p>	<ul style="list-style-type: none"> <li>• Higher dosages are often used for the first 3 to 7 days for animals with active thrombosis, then lowered to a maintenance dosage for chronic preventative therapy</li> </ul>
<p><b>Sotalol*</b> [antiarrhythmic/ beta-blocker]</p>	<p>Tablets: 80, 120, 160, 240 mg</p>	<p>PO: 1-2.5 mg/kg, q12h</p>	<ul style="list-style-type: none"> <li>• Use with caution and at the lower end of the dosage range in CHF</li> <li>• Cats without CHF and or myocardial failure will tolerate higher initial and target doses</li> <li>• Do not combine with atenolol, other betablockers or diltiazem</li> <li>• Myocardial depression, bradyarrhythmias (sinus and AVB), pro-arrhythmia</li> </ul>
<p><b>Spirolactone*</b> [aldosterone receptor blocker, K+ sparing diuretic]</p>	<p>Tablets: 25, 50, 100 mg</p>	<p>PO: 1-2 mg/kg, q12-24h</p>	<ul style="list-style-type: none"> <li>• Negligible to weak diuretic effect: administered for cardioprotective/anti-fibrotic effects</li> <li>• Higher dosages may be used for right-sided CHF</li> <li>• Risk of hyperkalemia may be exacerbated by cotherapy with an ACEI, especially if furosemide is not also administered</li> <li>• Facial excoriations have been reported</li> </ul>
<p><b>Taurine</b> [amino acid]</p>	<p>Tablets/Caplets/Capsules: 250, 500, 1000 mg</p> <p>Powders of various strengths</p>	<p>PO: 250-500 mg <b>per cat</b>, q12h</p>	<ul style="list-style-type: none"> <li>• Empirical therapy can be administered in suspected deficiency cases</li> <li>• Deficiency can be confirmed prior to supplementation by measuring whole blood/plasma concentrations</li> </ul>
<p><b>Telmisartan</b> [ARB]</p>	<p>Oral suspension (Semintra®): 10 mg/mL</p> <p>Tablets: 20, 40, 80 mg</p>	<p>PO: 1.5 mg/kg q12h for 2 weeks, then 2 mg/kg q24h</p>	<ul style="list-style-type: none"> <li>• Generally start at lower range and increase to maximal dose with monitoring of renal function and serum potassium and BP</li> <li>• Contraindications: dehydration, hyponatremia</li> <li>• Hyperkalemia, azotemia, acute renal failure</li> </ul>
<p><b>Torseamide</b> [loop diuretic]</p>	<p>Tablets: 5, 10, 20 mg</p>	<p>PO: 0.05–0.25 mg/kg, q12–24h</p> <p>Alternative: PO: 1.25 mg <b>per cat</b>, q12-24h</p>	<ul style="list-style-type: none"> <li>• Potent diuretic, generally given after furosemide resistance (e.g., greater than 6 mg/kg/day) occurs to replace furosemide</li> <li>• Evaluate renal function and serum electrolytes within a week of initiating toseamide or increasing the dosage</li> <li>• Hypochloremia, hypokalemia, hypomagnesemia, hyponatremia, azotemia, renal failure</li> <li>• Consider consultation with cardiologist</li> </ul>

## Note:

This is a FELINE formulary only; typical dosage ranges are shown; clinicians should be familiar with the pharmacology, indications, contraindications, monitoring and toxicity of any drug prescribed. When wide dosage ranges are shown, the clinician should understand potential needs for up-titration of doses as well as potential for cardiac depression and hypotension in cats with heart failure or impaired ventricular function.

When proprietary names are not indicated, there are usually generic equivalents available.

\*These drugs are generally available as a suspension or solution from a compounding pharmacy. Consult with a registered pharmacist regarding stability and storage.

*Drugs not associated with an asterisk should not be reformulated or reconstituted without consultation with a registered pharmacist.*

†This is a veterinary formulation labeled for use in another species.

With the (possible) exception of nitroglycerine ointment, cardiac medications are ineffective when administered topically.

## Abbreviations used in this table:

ACEI = angiotensin converting enzyme inhibitor

ARB = angiotensin receptor blocker

ATE = arterial thromboembolism

AVB = atrioventricular block

BP = blood pressure

CHF = congestive heart failure

CM = cardiomyopathy

CRI = constant rate infusion

GI = gastrointestinal

h = hour

HR = heart rate

IM = intramuscularly

IV = intravenously

PCV = packed cell volume

PO = per os (by mouth)

q h = every \_\_ hours

RAAS = renin angiotensin aldosterone system

SC = subcutaneously