Cardiology Drug Formulary
Cummings School of Veterinary Medicine at Tufts University

Heart diseases are common in dogs and cats, and this list is intended to be a brief summary of the commonly used cardiac drugs and how these drugs are used at the Cummings School cardiology service. Note that we have attempted to list accurate doses that we currently use, but animals and experiences vary, and the dose of any drug should be reconfirmed with other sources prior to use.

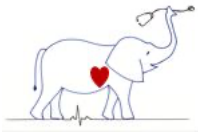
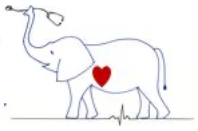
Angiotensin-Converting Enzyme Inhibitors - ACE inhibitors inhibit conversion of angiotensin I to angiotensin II and increase concentrations of certain vasodilating kinins and prostaglandins, resulting in vasodilation and reduced fluid retention.
Indications: Used in the management CHF, asymptomatic heart disease (less convincing evidence of benefit), systemic hypertension, protein losing nephropathy, and sometimes pulmonary hypertension in dogs and cats.
Dose: See doses under enalapril, lisinopril, benazepril. Twice a day therapy is usually recommended as the target dose.
Side Effects: Azotemia, hypotension, gastrointestinal side effects; side effects most commonly seen when used concurrently with diuretics
Follow-up: Obtain baseline renal values and electrolytes; Recheck renal function and electrolytes in 5 to 14 days. Serial blood pressure measurements, esp. in animals with weakness or azotemia after starting the drug.

Angiotensin Receptor blocker Neprilysin Inhibitor (ARNI) – Brand name Entresto (sacubitril/valsartan combination)
Indications: RAAS blockade for use with advanced DMVD or CHF (similar to the use of ACE inhibitors or ARBs; not widely studied or used in dogs or cats yet)
Dose: 20 mg/kg PO q 12 h has been proposed; anecdotally starting doses of 5-10 mg/kg PO q 12-24h (dogs)
Side Effects: Should NOT be administered within 2 days of an ACE inhibitor.
Other side effects may be similar to ACE inhibiters or ARBs (eg azotemia, hypotension, gastrointestinal side effects), but have not been widely used in dogs or cats.
Follow-up: Extrapolated from ACE inhibitors and ARBs: Obtain baseline renal values and electrolytes; Recheck renal function and electrolytes in 5 to 14 days. Serial blood pressure measurements, esp. in animals with weakness or azotemia after starting the drug.

Amiodarone – Class III antiarrhythmic used primarily in dogs. Prolongs action potential and increases effective refractory period of cardiac tissue by blocking potassium channels and slowing repolarization. Also has some Class I, II, and IV effects.
Indications: Used in dogs to treat malignant or refractory arrhythmias often associated with myocardial dysfunction including ventricular tachycardia, supraventricular tachycardia or atrial fibrillation. Does not appear to have significant negative inotropic effects and therefore is relatively safe to use in patients with myocardial dysfunction. Can be combined with β-adrenergic blocker.
Formulation: For injection: Nexterone® (amiodarone without preservative) 150 mg (1.5 mg/ml) or 360 mg (1.8 mg/ml) in premixed bags
Tablets: 200 mg, 400 mg
Dose:

- Dogs 5-10 mg/kg PO BID for the first 7 days and then 5-10 mg/kg PO SID after that. Often shoot for 7 mg/kg q 24 as long term dose in dogs
- Injectable: proposed dose of 2-5 mg/kg IV bolus administered over 30-60 minutes, followed by a CRI of 0.8 mg/kg/hr with a plan to reduce to 0.5 mg/kg/hr after 6 hours if arrhythmia is well controlled.
- Dosing less clear in cats.

Side Effects: May cause anorexia or vomiting. Elevated liver enzymes (hepatotoxicity, often reversible) is a more concerning side effect seen several weeks after initiation. May cause neutropenia, neurologic signs /

ataxia, especially at higher doses and with prolonged use. Less common side effects include corneal deposits, thrombocytopenia, bradycardia and positive Coombs' test, or thyroid abnormalities. Some IV formulations can cause anaphylaxis in dogs; the Nexterone formulation is the formulation of choice.
Follow-up: Amiodarone blood levels and chemistry 1-2 weeks after starting the medication. Routine serial evaluation of liver enzymes every 3-4 months. +/- Thyroid testing.

Amlodipine – Dihydropyridine calcium channel blocker that decreases calcium influx in cardiac and vascular smooth muscle. Its greatest effect is vasodilation.
Indications: Used most often to treat systemic hypertension in cats and dogs.
Formulation: Tablets: 2.5 mg, 5 mg, 10 mg
Dose:

- Cats → 0.625 mg (¼ of a 2.5 mg tablet) PO q24. In cats > 4 kg often need to give 1.25 mg (½ of a 2.5 mg tablet) PO q24; rarely given q 12 hr.
- Dogs → 0.1 – 0.5 mg/kg PO q 12 to q 24, start at lower end of dose; q 12 hr often needed. Combine with an ACE inhibitor if proteinuria present.

Side Effects: Hypotension, inappetence, azotemia, lethargy, reflex tachycardia, and weight loss possible in cats. Reversible gingival hyperplasia in dogs more often than in cats. Headaches common in humans.
Follow-up: Recheck blood pressure in one week and then at regular intervals after that.

Apixaban – Oral selective factor Xa inhibitor that blocks the active site of Xa and does not require a co-factor. Inhibits thrombin generation and may prolong clotting times at higher doses.
Indications: Treatment or prevention of arterial or venous thrombosis in the pulmonary and/or systemic circulation. Is more commonly used if there is clear presence of thrombus documented.
Dose:

- Cats → If < 5kg: 0.625 mg PO q12h; If > 5 kg: 1.25 mg PO q12h.
- Dogs → If < 5kg: 0.625 mg PO q12h, if 5 to 10 kg: 1.25mg PO q12h, if 10 to 20 kg: 1.875 mg PO q12h, if 20 to 30kg: 2.5mg PO q12h, if > 30kg: 5mg PO q12h (dose from Scansen)

Side effects: Petechia, ecchymosis or other signs of hemorrhage should lead to dose reduction
Follow up: Monitor for signs of hemorrhage

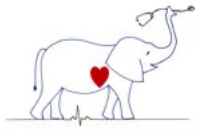
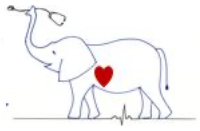
Arginine vasopressin – Mimics the effect of ADH on the receptors of the renal tubule to permit reabsorption of water. Also has potent vasopressive activity via activation of the V1 receptor on vascular smooth muscle. During infusion it rapidly increases mean arterial pressure.
Indications: Used to treat vasodilatory shock via CRI in addition to fluid therapy. Also can be used to treat central diabetes insipidus.
Dose:

- For shock → 0.001-0.04 units/min. Do not exceed 0.04 units/min. (0.5-5 milliunits/kg/min).
- For CPR → 0.8 units/kg IV bolus; can be repeated.

Side effects: Allergic reactions have been reported in people.
Follow up: Monitor blood pressure and urine output. Titrate infusion rate to achieve desired pressure response.

Aspirin – Irreversibly inactivates COX-1 in platelets → interferes with platelet formation of thromboxane A_2 (TXA_2) → decreases platelet aggregation
Indications: Shown to be inferior to clopidogrel for ATE prevention in cats, but could be considered as an alternative to clopidogrel in certain circumstances. Occasionally used as component of dual antiplatelet therapy.
Dose:

- Cats → Multiple proposed doses. "Low dose": 5mg/kg PO q 72 h; "High dose": 10mg/kg PO every 48-72 h (eg. ½ to one 81 mg "baby aspirin" Monday, Wednesday, Friday). Ideal dose unknown.

- Dogs → 0.5-2 mg/kg PO q 24 h; some recommend up to 10 mg/kg PO q 24 h

Side effects: Gastrointestinal irritation, vomiting, bleeding

Atenolol – Class II antiarrhythmic (beta blocker). Atenolol is a cardioselective β1-receptor antagonist. Should not be combined with another β-blocker and should be slowly titrated in patients with significant ventricular systolic dysfunction. Use should be avoided in animals getting calcium channel blockers, or if used then monitoring by a veterinary cardiologist is highly advised to avoid cardiovascular collapse.
Indications: Generally, not used as monotherapy for ventricular arrhythmias in dogs but commonly used in combination with other antiarrhythmic agents (e.g., mexiletine). Can be used in cats with less severe ventricular arrhythmias. Also used for HCM in cats (esp. LVOTO) and for SAS in dogs, as well as other indications such as systemic hypertension.
Formulation: Tablets: 25 mg, 50 mg, 100 mg
Dose:

- Dogs → 0.2–2 mg/kg PO q12 or q24.
- Cats → often 6.25 to 12.5 mg per cat PO q12h or q24h (BID advised based on pharmacokinetics).

Side effects: Side effects are often dose-related and can include bradycardia, AV block, weakness, hypotension, recurrence of signs of CHF, syncope, lethargy and weakness. Bronchoconstriction is possible. Dose reduction often results in elimination of signs of side effects.
Follow up: As is routine for management of the arrhythmia, myocardial disease or CHF. Serial exams are often required, usually q 2-4 weeks, in order to assess response to therapy and assist in up-titration of the drug in dogs with CHF.

Atropine – Anticholinergic
Indications: Used in patients with bradyarrhythmias either as therapy or as a diagnostic test to differentiate between vagally mediated and non-vagal bradycardia (atropine response test). Appropriate response has been defined as a heart rate of > 140 bpm
Formulation: 0.54 mg/ml injectable and 0.4 mg/ml injectable (old formulation)
Dose: Atropine response test: 0.04 mg/kg IV or SQ or divided half IV and half SQ
Side effects: Transient paradoxical bradycardia/worsening of AV block, tachycardia, exacerbation of arrhythmia, dry mouth, constipation, urine retention, CNS signs

Benazepril – See ACE inhibitors above
Dose: 0.25 to 0.5 mg/kg q 12-24 hours (target dose is q12, esp. if 0.25 mg/kg dosing)

Beta-Blockers - Beta blockers are used to slow heart rate, control ventricular and supraventricular arrhythmias and for heart rate control in atrial fibrillation, used for dynamic LVOTO, also used by some for SAS or PS and they may be helpful to improve outcome in certain forms of CHF (documented in people for metoprolol, bisoprolol and carvedilol). These drugs might not be tolerated in dogs or cats with active CHF and are best employed in animals that are minimally symptomatic with early/mild heart failure, or in animals in later stages of CHF that are already well controlled on a stable cardiac drug regimen.
Dose: See Atenolol, Carvedilol, Metoprolol, Bisoprolol
Side Effects: Side effects are often dose-related and can include bradycardia, AV block, weakness, hypotension, recurrence of signs of CHF, syncope, lethargy and weakness. Bronchoconstriction is possible. Dose reduction often results in elimination of signs of side effects.
Follow-up: As is routine for management of the arrhythmia, myocardial disease or CHF. Serial exams are often required, usually q 2-4 weeks, in order to assess response to therapy and assist in up-titration of the drug in dogs with CHF.

Bisoprolol – Selective β1-receptor antagonist with minimal action on β2 receptors. See Beta-blocker.
Dose: In dogs give .1-.2 mg/kg PO q12 or q8. No dose established in cats.

Carvedilol – Non-selective β-receptor antagonist with selective α1 blocking activity. See Beta-blocker
Formulation: Tablets: 3.125 mg, 6.25 mg, 12.5 mg, 25mg
Dose:

- Initial dose of 0.2 mg/kg q 12 hrs with slow titration upwards q 2 weeks towards a target dose of 0.8 mg/kg or 1.0 mg/kg q 12 hrs;
    - Dogs with CHF often do not tolerate this upward dose titration and 0.4 to 0.6 mg/kg q 12 hrs is often the top tolerated dose.
    - Higher starting dose (e.g., 0.4 to 0.6 mg/kg q 12 hrs) OK if normal LV contractile function.
- Cats often started at ¼ to ½ of a 3.125 mg tab PO q12h.

Clopidogrel (Plavix) – Irreversible platelet inhibitor. Inhibits binding of ADP to $P2Y_{12}$ receptor.
Indications: Cats with left atrial enlargement or ATE. Dogs with suspected or documented pulmonary or systemic thrombi or risk of thromboembolism/hypercoagulable state
Formulation: Tablets: 75 mg
Dose:

- Cats: Typically 18.75mg PO q24h (9.375mg in tiny cats)
  5-10mg/kg loading dose in cases of acute ATE
- Dogs: 2-3 mg/kg PO q24h

Side Effects: Petechia, ecchymosis or other signs of hemorrhage. Bitter taste, can cause foaming at the mouth/drooling, especially in cats. This side effect can be avoided by administering in an empty gelatin capsule (size #3 or #4, depending on whether other medications are included in the same capsule)
Follow-up: Monitor for signs of hemorrhage

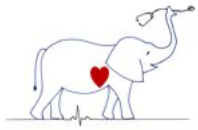
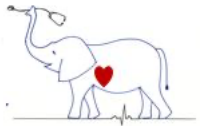
Dalteparin (Fragmin): See Low Molecular Weight Heparins

Digoxin – Inhibitor of Na+K+ATPase pump (positive inotrope), parasympathomimetic (decreased SA nodal firing rate, slowed AV nodal conduction, reduced sympathetic output) and baroreceptor function enhancer.
Indications: Used for supraventricular arrhythmias including atrial fibrillation, refractory CHF and management of vasovagal syncope associated with CHF.
Formulation: Tablets: 0.125 mg, 0.25 mg tablets
Elixirs: 0.05 mg/ml, 0.15 mg/ml
Dose: Difficult to dose and therefore a number of dosing schemes are available.

- Dogs: Start at 0.005 mg/kg q 12 hours as "base dose" and make dose reductions based on cachexia, renal insufficiency, large volume effusions, and certain breed-specific limitations (Starting dose no more than 0.125 mg q12 for Doberman regardless of size; no more than 0.25 mg q12 as a starting dose in any dog).
- Cats: Limited applications in cats except perhaps CHF accompanied by rapid atrial fibrillation. Giant cat ¼ of a 0.125 mg tab PO q24, normal sized cat ¼ tab PO Q 48 hrs, small, thin, old renal disease cat ¼ tab PO q 72 hrs

Side Effects: Anorexia, gastrointestinal side effects, neurologic side effects (depression or dull mentation), cardiac arrhythmias and PR interval prolongation
Follow-up: Digoxin serum levels should probably be maintained 0.8-1.2 ng/ml range in a 6 to 10 hour post-pill blood sample, obtained 5 to 8 days after starting digoxin - this is towards the lower end of the therapeutic range reported for most laboratories.

Diltiazem – Class IV antiarrhythmic. Non-dihydropyridine calcium-channel blocker works primarily to slow nodal conduction and sinus node firing rate, but also has mild vasodilatory and negative inotropic effects; these latter effects can be very problematic in overdose situations.
Indications: Used to treat supraventricular tachycardia, atrial fibrillation, systemic hypertension, sometimes pulmonary hypertension, and hypertrophic cardiomyopathy.

Formulation: For injection: 5 mg/ml (in 5, 10 and 25 ml vials)
Tablets: 30 mg, 60 mg, 90 mg, 120 mg in non-sustained release
Sustained release:
Dilacor: Extended release formulation in 240 mg capsules with 4 tablets inside each containing 60 mg. For dogs use 2-5 mg/kg PO twice daily. Dosage may be titrated upward. May be more effective for arrhythmia control (atrial fibrillation rate control) if given with digoxin.
Cardizem CD is an extended release formulation of diltiazem.
Formulation: Cardizem-CD®: 120 mg, 180 mg, 240 mg. Dosed in cats at 10 mg/kg PO q24.

Dose:

- Dogs → For acute treatment of hemodynamically unstable SVT give 0.05 to 0.25 mg/kg IV over 3 to 5 minutes. Repeat twice if necessary with 5 to 20 minutes between doses (if using 0.25 mg/kg wait 20 min before giving the next dose). For chronic treatment of SVT, if using a non-sustained release formulation, 1 mg/kg PO q6-8 and gradually titrate up to 4 mg/kg as needed. For treatment of atrial fibrillation, give 0.5 – 1.5 mg/kg PO 3 times daily. In general we do not use the non-sustained release formulations as they rarely give adequate arrhythmia control throughout the day.
- Cats → For acute treatment of hemodynamically unstable SVT give 0.125 – 0.25 mg/kg IV over 2 minutes; with subsequent boluses at 15 minute intervals until conversion or to a total dose of 0.75 mg/kg (use oral doses for hemodynamically stable SVT).
  Cats → For chronic treatment of SVT dose at 7.5 – 15 mg per cat PO 2-3 q8 using regular tablets or 30 mg per cat PO q24 using sustained release tablets.

Side Effects: Bradycardia is the most common side effect in dogs. Hypotension, myocardial depression, sinus bradycardia, and AV block can develop. If acute hypotension occurs (especially in situations of toxicity), treat with fluid therapy and administration of calcium gluconate or calcium chloride, +/- IV lipids or catecholamines or high dose insulin. It may also cause anorexia and vomiting. Vomiting and lethargy are the most common side effects in cats.
Follow-up: Monitor heart rate, heart rhythm and blood pressure during treatment.

Dobutamine – positive inotrope
Formulation: For injection (by CRI): Dobutamine 12.5 mg/ml; Must be diluted in 5% dextrose or saline solution
Dose: 2.5–15 µg/kg/min constant rate intravenous infusion (CRI). Do not bolus. Gradual up–titration to effect. Increase infusion rate based on clinical response (increased temperature, improved perfusion, improved blood pressure).
Side Effects: Tachycardia, premature complexes, tachyarrhythmia, seizures

Empagliflozin (Jardiance) – See SGLT-2 inhibitor section below
Dose:

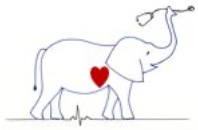
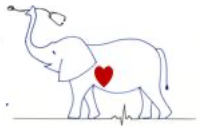
- Dogs: 1 mg/kg PO SID
- Cats:

Enalapril – See ACE inhibitors above
Formulation: 2.5 mg, 5 mg, 10 mg, 20 mg
Dose: 0.5 mg/kg q 12-24 hours; target dose is q12

Enoxaparin (Lovenox) – See low molecular weight heparins

Entresto – see ARNI section above

Esmolol: see beta-blocker

Formulation: Injection: 10 mg/ml, 20 mg/ml as vials or infusion bags
Dose**:** 0.05 to 0.2 mg/kg, IV (over 3-5 minutes as slow bolus). 0.025 to 0.1 mg/kg/min, IV-CRI
Rapidly hydrolyzed, short-duration of action. Sustained effect requires CRI. Monitor heart rate, ECG and BP during administration.
Side Effects: Do not use in dogs with CHF or markedly reduced contractile function. Dogs with normal ventricular function can tolerate higher dosages. Myocardial depression, bradycardia (sinus arrest and AV block), hypotension

Flecainide – Class Ic antiarrhythmic drug. Sodium channel blocker that prolongs the effective refractory period and stabilizes membranes. Increases the threshold for atrial and ventricular fibrillation.
Indications: Used for ventricular arrhythmias and may have some efficacy for atrial fibrillation conversion.
Formulation: Tablets: 50 mg, 100 mg, 150 mg
Capsule: 200 mg extended release (Tambocor®)
Dose: Uncertain in dogs – reports of 1-4 mg/kg q 8 to 12 hrs
Side Effects: Proarrhythmic effect is possible.
Follow-up: As appropriate for ventricular arrhythmias to determine whether arrhythmia control has been achieved.

Furosemide (Lasix) – Loop diuretic is the most commonly used diuretic for treatment of CHF.
Indications: CHF – pulmonary edema, pleural effusion, or ascites due to CHF; typically used in combination with pimobendan +/- an ACE inhibitor.
Formulation: Injectable: 50 mg/ml (use Salix® brand as the pH is lower and does not cause abscessing)
Veterinary formulations: (Salix®): Tablets: 12.5 mg and 50 mg
Human formulations: Tablets: 20 mg, 40 mg, 80 mg and 1% syrup (10 mg/ml)
Dose: The dose is adjusted to clear significant edema accumulations and cause the animal to be minimally symptomatic, while trying to avoid side effects. We often use a "lowest possible dose of furosemide" strategy in animals with CHF. The owner monitors respiratory rate and effort and we give the owner upper and lower limits for acceptable furosemide dose; owners should "give more for difficulty breathing or rapid respirations especially if respiratory rate > 35 breaths per minute at rest, and give less if breathing well but weakness, lethargy or anorexia develops".
Chronic treatment:

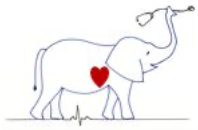
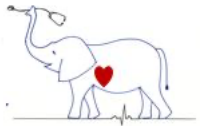
- Dogs often started at 1-2 mg/kg q 12-24 h; the dose is escalated up to 4 mg/kg q 8hrs or higher in certain situations.
- Cats often given 6.25 mg/cat/day for chronic therapy (1-2 mg/kg q 12-48 hours; typically 6.25 mg/cat q 48hrs to 12.5 mg q12; start q12 if therapeutic thoracentesis was done).
- When a dose of 2.2 mg/kg twice a day is exceeded during chronic therapy, we often add in spironolactone, torsemide, hydrochlorothiazide with spironolactone, or add in an injectable dose of furosemide.

Emergency management:

- Doses up to 4 mg/kg q 1 hour for 2-5 doses may be required.
- Furosemide can also be used as a CRI at 0.1-2 mg/kg/hour. Start at 0.5 to 1 mg/kg/hr and titrate as needed up to 2 mg/kg/hr.

Side effects: major electrolyte disturbance including hypokalemia, hyponatremia, hypochloremia, hypomagnesemia, metabolic alkalosis, hypotension, dehydration and pre-renal azotemia.
Follow-up: Measure renal function prior to starting therapy and then repeat the BUN, creatinine and electrolytes 5 to 10 days after starting drugs to treat congestive heart failure and then q 3 to 6 months.

Heparin – Unfractionated heparin is a potent anticoagulant and works by forming a heparin-antithrombin complex which neutralizes factors IIa (thrombin), XIIa, XIa, IXa, and Xa. It also increases plasminogen activator to activate fibrinolysis.

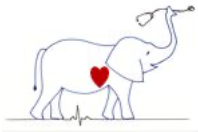
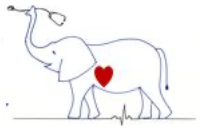
Indications: Used to prevent and treat hypercoagulability disorders and prevent coagulation disorders such as thromboembolism, venous thrombosis, DIC and pulmonary thromboembolism.
Formulation: Injectable: 1,000 U/ml, 10,000 U/ml, 20,000 U/ml (most used is 1,000U/ml)
Dose: Variable. Several Sub-Q dosing strategies exist (75 to 500 units/kg sub-q q 8 hr; 250 units/kg is often needed if the PTT is to be altered by administration. Several IV infusion doses also exist including an initial bolus of 200 U/Kg IV followed by a CRI at 15 to 25 U/kg/hr. CRI at 600 units/kg/day has also been proposed.
Side Effects: Bleeding and thrombocytopenia are most common and the antidote is protamine sulfate which has a high side effect profile so is avoided if possible. Hypersensitivies, vasospastic reactions, osteoporosis and diminished renal function (after long-term, high-dose therapy), rebound hyperlipidemia, hyperkalemia, alopecia, suppressed aldosterone synthesis and priapism are also possible.
Follow-up: Therapeutic dosage is typically monitored using partial thromboplastin time (PTT). The goal is to prolong the PTT 1.5 to 2.5 times normal.

Hydralazine – Direct acting arterial vasodilator
Indications: Sometimes used as an adjunct to treatment of DMVD in dogs with refractory CHF or some individuals use it for life-threatening pulmonary edema in an ER setting. Also used for control of systemic hypertension either in acute or chronic settings
Formulation: Tablets: 10 mg, 25 mg, 50mg
Dose: 0.5-3 mg/kg PO q 12 h; initial dose often 1 mg/kg PO
Side effects: Hypotension, anorexia, reflex sinus tachycardia and persistent vomiting
Follow-up: Serial measurement of blood pressure

Hydrochlorothiazide (HCTZ) – Diuretic; Blocks Na/Cl cotransporter in DCT resulting in more Na and Cl lost in urine. Indirectly stimulates Na/K ATPase in collecting duct (because of increased Na in urine and because of RAAS activation).
Formulation: 12.5 mg, 25 mg, 50 mg tablets; More often in combination with spironolactone (Aldactazide) 25mg/25mg tablets
Indications: Often used in combination with other diuretics in cases of diuretic resistance. Other uses include nephrogenic DI or hypercalciuria.
Dose: 1-4 mg/kg PO q 12-24 h.
For patients already receiving spironolactone, HTCZ is sometimes introduced slowly by substituting a portion (¼ or ½) of the daily dose of spironolactone with Aldactazide (spironolactone/HCTZ).
Side effects: Azotemia, electrolyte depletion, arrhythmia associated with hypokalemia, hyperglycemia, hypercalcemia (indirect activation of basolateral Na/Ca exchanger by low Na within cells in DCT)
Follow up: Measure renal function prior to starting therapy and then repeat the BUN, creatinine and electrolytes 5 to 7 days later and then q 2-3 months

Hyoscyamine (Levsin) - Blocks acetylcholine at muscarinic receptors (anticholinergic/parasympatholytic agent). Causes reductions in glandular secretions, GI and urinary tract motility, mydriasis, and increased heart rate.
Indications: Used to treat bradycardia such as sick sinus syndrome (and as an anti-emetic).
Dose: Dogs → 0.003 – 0.006 mg/kg PO q8. Cats → None established.
Side Effects: Mydriasis, xerostomia (dry mouth), constipation, urinary retention, xerophthalmia (dry eye), CNS excitement and tachycardia.
Follow-up: Monitor heart rate and intestinal motility.

Ivabradine (Corlanor) – Reduces the heart rate via selectively lowering the pacemaker current in the SA node (inhibition of the i_F or funny channel). In contrast to β-adrenoreceptor blockers and calcium channel blockers, has no negative inotropic properties.

Indications: Similar to beta blockers. For use in patients where reduced heart rate is desired and beta-blockers are not tolerated or contraindicated.
Dose: Cats → 0.1 to 0.3 mg/kg q12h
Side Effects: Bradycardia
Follow-up: Monitor heart rate and blood pressure.

Lidocaine – Class Ib antiarrhythmic (no effect on the QRS complex). Drug of choice for controlling all types of acute ventricular tachyarrhythmias. Effectiveness depends on extracellular potassium concentrations (low K^+ concentrations reduce effectiveness). Contraindicated in patients with bradyarrhythmias; increases the defibrillation threshold although this is of uncertain clinical significance in veterinary medicine.
Indications: Used to treat patients with dangerous and sustained ventricular dysrhythmias causing hemodynamic compromise. Because lidocaine does not depress contractility or produce vasodilation, can be safely used in patients with congestive heart failure (CHF).
Formulation: Injectable: 2% lidocaine (20 mg/ml)
Dose:

- Dogs→ Initiate therapy with bolus of 2 mg/kg IV. Can repeat up to 3 times in 10 minutes to control rate and malignancy of ventricular rhythm. If rhythm improves, establish 30–75 µg/kg/min CRI. Titrate infusion to maintain rhythm control (often aim for 40-50 mcg/kg/min; side effects more common at 60 mcg/kg/min and above).
- Cats → Slow bolus of 0.25–1 mg/kg, followed by 10–30 µg/kg/min CRI if effective in controlling rhythm.

Side Effects: Severe adverse events uncommon. Nausea, inappetence most common in cats. CNS excitability can occur in both dogs and cats, resulting in seizures. Cats very sensitive to CNS effects. Diazepam can be used if lidocaine toxicity suspected.
Follow up: Serial monitoring of arrhythmia and heart rate, monitor for mental dullness, neuro toxicity and GI side effects.

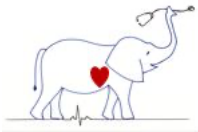
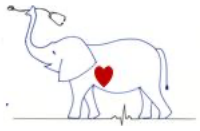
Lisinopril – See ACE inhibitors above.
Formulation: Tablets: 2.5 mg, 5 mg, 10 mg, 20mg
Dose: 0.5 mg/kg q 12-24 hours

Low Molecular Weight Heparins – anticoagulant drugs that have high affinity for antithrombin III, inhibit of factor X strongly, and don't inhibit thrombin much at typical doses.
Indications: Can be used to prevent thrombus formation or to treat documented thrombosis. Require subcutaneous injection with a very small volume of drug, and they have a longer half-life than unfractionated heparin so twice a day (or maybe 3 times a day) can be effective. Considerably more expensive than unfractionated heparin, but can be used on a chronic basis (months to years).
Formulation: Lovenox: 100 mg/ml
Dalteparin: 10,000 U/ml
Dose:

- Enoxaparin (Lovenox) 1mg/kg SQ BID (Sometimes q 8 hrs if active thrombus)
- Dalteparin (Fragmin):
- Dogs 150 U/kg SQ BID-TID;
- Cats 150 to 200 U/kg SQ 4-12 hours.

Most often used q 12 hours for long term prevention of ATE in cats in our practice.
Side effects: hemorrhage; relatively same as heparin
Follow up: Serial monitoring for bleeding or resolution of thrombus

Metoprolol – Selective β1-receptor antagonist. See Beta-blocker.
Formulation: Tablets: 25 mg, 50 mg

Extended Release: 25 mg

Dose: Recommend use the sustained release version of the drug (or give q 6-8 hours if non-sustained release). 0.2 mg/kg q 12 hrs, with slow titration upwards q 2-3 weeks up to 0.4-0.6 mg/kg q 12 hrs.

Mexiletine - Class Ib antiarrhythmic. Has electrophysiologic, hemodynamic, and toxic properties similar to lidocaine. Suppresses ventricular arrhythmias in dogs; survival effects unknown. Combination with atenolol may increase effectiveness.
Indications: Used when other antiarrhythmic medications (e.g., sotalol) might be contraindicated because of systolic dysfunction or myocardial failure (e.g., Doberman pinscher with dilated cardiomyopathy and ventricular arrhythmias, boxer with severe myocardial dysfunction and ventricular arrhythmias).
Formulation: Capsules: 150 mg, 200 mg, 250mg
Dose: Dogs → 4–8 mg/kg PO q8.
Side effects: Anorexia, diarrhea, or other GI disturbances.
Follow up: Monitor ECG

Nitroglycerin – Venous vasodilator and coronary artery dilator. Nitroglycerin is metabolized to nitric oxide, and this accounts for the vasodilator action.
Indications: Most commonly used in situations of severe pulmonary edema, especially when initial furosemide administration has failed to improve dyspnea. Less effective than sodium nitroprusside and there is debate as to how much transcutaneous drug is absorbed and the effectiveness of the transcutaneous route.
Formulation: Ointment: 2% ointment
Injectable: 50 mg/10 ml
Dose:

- Dogs: ¼ inch to 2 inches applied to hairless skin or the oral mucosa q 6-12 hr (amount related to size of the dog).
- Cats: ¼ to ½ inch applied as in dogs.
- Administered for 1-3 days until pulmonary edema is resolved and other drugs can be added in. Drug tolerance develops with chronic use.

Side effects: Hypotension, depression, lethargy, nausea, and pre-renal azotemia. Transcutaneous route applied wearing non-permeable gloves and adhesive tape labeled "Nitrol" is placed on the outer surface of the ear to alert anyone working with the animal to avoid contact with the drug (it causes bad headaches).
Follow up: Follow blood pressure and renal values

Pimobendan – A calcium sensitizing drug with positive inotropic effect and a phosphodiesterase inhibitor with vasodilating effects.
Indications: For treatment of congestive heart failure (CHF) from either valvular insufficiency or DCM in dogs. Also used in pre-clinical stages of myxomatous mitral valve disease and dilated cardiomyopathy in dogs. Limited information on use cats with obstructive hypertrophic cardiomyopathy and is generally avoided in that setting. However, it is commonly used to treat cats with CHF associated with dilated cardiomyopathy and non-obstructive HCM and other forms of feline heart disease. Might be useful in ICU setting of low cardiac output critical illness.
Formulation: Chewable tablets: 1.25 mg, 2.5 mg, 5 mg, 10 mg
Do not formulate into a suspension as this affects absorption and drug effect.
Dose: 0.25-0.3 mg/kg q 12 hours. We often use higher doses (off label) for advanced, refractory CHF, including q 8 hr dosing as well as higher doses (up to 0.75 mg/kg/dose).
Side effects: Gastrointestinal effects, possibly arrhythmias. Overall low side effect profile.
Follow-up: Routine follow-up is used after initiation of this medication. Higher doses might help in refractory CHF (off label).

Procainamide: Class Ia Antiarrhythmic. Procainamide is a fast sodium channel blocker with some autonomic effects and can enhance sympathetic tone. At therapeutic doses, the vagolytic effects that are seen with other class I agents are negligible.
Indications: Procainamide is currently the second line of defense (after lidocaine (acute IV) and sotalol (chronic oral) used to suppress ventricular tachyarrhythmias including those caused by enhanced automaticity and reentry. Contraindicated in patients with bradyarrhythmia.
Formulation:
Injection: 100mg/ml, 500mg/ml
Tablets and capsules (regular and sustained-release) are currently unavailable in US
Dose: IV formulation only.

- Dogs → 5–15 mg/kg over 1 min. If effective in controlling the rhythm, establish 20–50 µg/kg/min CRI.
- Cats → 1–2 mg/kg slowly over 20 min. If using oral compounded formulations try to use slow release due to the short half-life of the drug in dogs.
- Chronic oral dose in dogs 10-20 mg/kg q 6-8 hr (q 6 hr or more often if not sustained release); so go to 40 mg/kg for SVT.

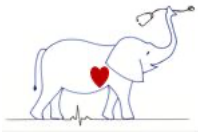
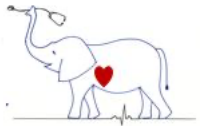
Side effects: Changes in hair coat color with lupus-like dermatologic changes, thrombocytopenia, neutropenia, and pancytopenia have been anecdotally reported.
Follow up: Generally follow-up is as indicated to check for control of arrhythmia (e.g., serial ECG or Holter recordings). It is possible to monitor plasma concentrations during chronic therapy (target plasma concentrations are 8 to 20 mcg/mL).

Propafenone – Class Ic antiarrhythmic (Na channel blocker). Causes marked depression of the upstroke of the action potential (phase 0), delays inactivation of slow Na channel, inhibitory effect on bundle of His and iKr, and has some β1 and β2 blocking effects. Prolongs the QRS, but does not change the QTi.
Indications: Used for supraventricular and ventricular tachycardia. Atrial fibrillation conversion?
Formulation: Tablets: 150mg, 225mg, 300mg
Dose: Dogs → 5–8 mg/kg PO q8h
Side effects: Anecdotally well tolerated. Possible GI disturbances. Hypotension, depression reported in people. Increases digoxin levels. In people a relatively small trial (CASH) showed increased mortality, and its use is not recommended with structural heart disease due to negative inotropic effects.
Follow up: Monitor ECG

Propantheline – Oral anticholinergic drug produces parasympatholytic effects (atropine-like).
Indications: Used to treat vagal-mediated bradycardia, sinus arrest with sick sinus syndrome, and perhaps heart block. Can be used for chronic therapy, especially if atropine response test is positive.
Formulation: Tablets: 15 mg
Dose: 0.25-0.5 mg/kg PO q8 to 12 hrs
Side Effects: Ileus, urine retention, tachycardia, dry mouth, behavior changes. Treat severe overdoses with physostigmine.
Follow-up: Serial monitoring of heart rate and rhythm. Pacemaker is generally recommended in cases of drug failure.

Rivaroxaban - Orally administered, direct inhibitor of activated Factor Xa that does not require interaction with antithrombin. It has been shown to inhibit thrombin generation and prolong clotting times.
Indications: Treatment or prevention of arterial or venous thrombosis in the pulmonary and/or systemic circulation.
Formulation: Tablets: 10 mg
Dose:

- Dogs: 10 to 40 mg/dog (0.2 to 0.9 mg/kg q 24 hr)
- Cats → 2.5 mg/cat

Side Effects: Hemorrhage
Follow up: Monitor for petechiae, ecchymoses, or other signs of hemorrhage.

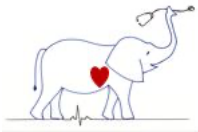
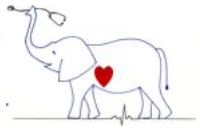
SGLT-2 inhibitors – Inhibit sodium glucose co-transporter 2, found in the proximal renal tubules. About 90% of glucose reabsorption occurs via SGLT-2, so SGLT-2 inhibitors result in glucose loss in the urine. This results in blood glucose lowering in diabetics but does not cause hypoglycemia in non-diabetic patients. SGLT-2 inhibitors improve outcome in both diabetic and non-diabetic people with CHF. The mechanism of positive effects is not known, but may be related to diuresis/natriuresis, improved cardiac energy metabolism, inflammation reduction, decreases in oxidative stress, and/or improved vascular function. Early veterinary studies are being carried out.
Indications: Congestive heart failure – currently likely to be used as an add on in advanced/refractory CHF (currently minimal studies or experience if dogs or cats)
Formulation: Empagliflozin, dapagliflozin, bexagliflozin (and other -gliflozins)
Dose: Empagliflozin – Dogs 1 mg/kg PO SID
Side Effects: Well tolerated in people, most common side effect is genitourinary infections. A transient decrease in GFR is commonly seen in people, followed by convincing long term renoprotective effects.
Follow-up: Recheck renal values and electrolytes in 1-2 weeks and then every few months. Urinalysis if clinical signs of UTI. The concurrent diuretic dose may need to be reduced if CHF is well controlled and azotemia develops.

Sildenafil – Inhibits phosphodiesterase type-5 (PDE5). PDE5 is found primarily in the smooth muscle of the pulmonary vasculature, so intended cardiovascular result is pulmonary vasodilation and reduced pulmonary hypertension. PDE5 inhibitors block degradation of cGMP, resulting in increased nitric oxide mediated vasodilatation within pulmonary vascular smooth muscle cells.
Indications: Pulmonary hypertension
Formulation:
Tablets: 20 mg (Revatio®, generic), 25 mg, 50 mg, 100 mg (Viagra®)
Dose: Tablets usually administered at 1 mg/kg q 8 hr; some dogs tolerate q 12 hours but most dogs need q 8 hr for good effect. Dose is serially escalated up to 3 mg/kg q 8 hr. IV formulation exists. Can be expensive to use on a chronic basis.
Side effects: Hypotension, perhaps skin flushing and GI side effects. Sildenafil should not be used concurrently with nitrates (life threatening hypotension from potentiation of vasodilatory effects)
Follow-up: Monitor arterial blood pressure to check for hypotension and recheck tricuspid regurgitation velocity; Dose adjusted based on clinical response, lack of side effects and +/- whether TR velocity has changed.

Sotalol - Class III antiarrhythmic drug with beta-blockers properties used when arrhythmia control is desired (e.g., usually not specifically used as "beta-blocker"). Blocks potassium channels and increases the effective refractory period of myocytes by prolonging repolarization. Also nonselective Class II activity (adrenergic antagonist).
Indications: Indicated for ventricular and certain supraventricular arrhythmias. Often used for serious ventricular arrhythmias. Good effect noted in many Boxer dogs with ARVC and ventricular ectopy. Potentially useful in sustained ventricular tachycardia in cats.
Formulation: Tablets: 80 mg, 120 mg, 160 mg, 240 mg
Dose:

- Dogs → 1–3 mg/kg PO q12.
- Cats → 1–3 mg/kg PO q12 (10 to 20 mg/cat; start at 10 mg/cat).

Side Effects: Most side effects attributed to drug's β-blocking properties. Sinus bradycardia, AV block, negative inotropic effect that may cause weakness fainting or recurrence of CHF, proarrhythmic effect,

syncope, GI side effects. Use with caution and slowly titrate in patients with significant ventricular systolic dysfunction and/or in those with CHF. Also use with caution in cats.
Follow-up: Generally follow-up is as indicated to check for control of arrhythmia (e.g., serial ECG or Holter recordings).

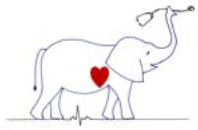
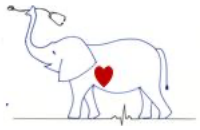
Sodium Nitroprusside – Immediate acting balanced (arterial and venous) nitrate vasodilator via generation of NO independent of autonomic innervation for use in animals with severe CHF.
Indications: Dogs and cats with severe pulmonary edema that is unresponsive to 1 or 3 doses of furosemide at 4 mg/kg.
Formulation: Injection: 25 mg/ml - Dilute in 5% dextrose solution and protect solution from light.
Dose: A continuous rate infusion ranging between 2 and 10 mcg/kg/min in dogs. The drug is usually administered for 12 to 48 hours until severe edema is resolved and other cardiac medications can be added into the drug regimen.
Side effects: Severe hypotension and reflex tachycardia. Cyanide is generated via metabolism, especially at high infusion rates. Seizures may also occur at high infusion rates, which may be signs of cyanide toxicity. Sodium thiosulfate has been used in people to prevent cyanide toxicity. Methemoglobinemia is possible and can be treated with methylene blue.
Follow up: Measurement of blood pressure is ideal. Many dogs and cats with severe pulmonary edema and a systolic blood pressure of 70 mmHg can still tolerate an infusion of sodium nitroprusside for 4-12 hours without apparent long term renal damage resulting from the presumed renal hypoperfusion. Close observation of the animal, skilled technicians, and frequent re-evaluation of the animal's condition are needed to find an effective dose (e.g., dogs should still be able to stand).

Spironolactone – Potassium sparing weak diuretic and aldosterone antagonist.
Indications: Used in combination with furosemide, to obtain a greater diuretic effect after high doses of other diuretics have been achieved and congestive heart failure is refractory. Some use in all dogs with ACVIM Class C CHF; some use in preclinical heart disease.
Formulation: Tablets: 25 mg, 50 mg, 100 mg
Dose: 1 mg/kg q 24 hours to 2 mg/kg q 12 hours. We often start 1 mg/kg q 24 hrs in dogs and increase to q 12 hours if tolerated after 5-10 days. Can be combined with hydrochlorothiazide (HCTZ) and dosed in a similar fashion. In cats we sometimes start q 48 hrs and then try to increase to q 24 hrs.
Side Effects: Gastrointestinal side effects, anorexia, hyperkalemia; facial excoriation in cats
Follow-up: Recheck electrolytes and renal values in 5 to 14 days and q 2 months thereafter. Check more frequently/sooner if used with HCTZ; can lead to profound hypochloremia and/or azotemia in selected animals.

Taurine – Dietary supplement
Indications: Often used in dogs or cats with DCM that is suspected to have a component of nutritional deficiency (either because of documented low blood taurine levels or because of a history of a nontraditional diet or a diet anecdotally associated with DCM.)
Dose:
Twinlab, Swanson, NOW, or GNC brands

- <10 kg: 250 mg q 12 hr
- 10-25 kg: 500 mg q 12 hr
- >25 kg: 1000 mg q 12 hr

Telmisartan – Angiotensin II receptor blocker (ARB). Acts through the AT1R and D1R to decrease vasoconstriction, sodium/water retention and sympathetic activation.
Indications: Treatment of proteinuria, hypertension secondary to renal insufficiency, or congestive heart failure in dogs and cats.

Dose: 0.5 to 3 mg/kg PO q24 to q12 - Cat study dose was 1.5 mg/kg BID for 14 days then 2 mg/kg q 24 hrs.
Side Effects: Hypotension, tachycardia, hyperkalemia, diarrhea/vomiting, headache/dizziness, drowsiness, decreased red blood cell counts, increases in liver enzyme values, abnormal metallic taste sensation. Not safe during pregnancy.
Follow-up: Regular rechecks of electrolytes, renal values and blood pressure

Theophylline – Phosphodiesterase inhibitor that leads to bronchodilation and occasionally an increase in heart rate or improved AV conduction at higher doses. Sustained release formulation preferred if available.
Indications: Dogs with concurrent heart disease and lung disease who are thought to have a component of bronchoconstrictions. Dogs and cats with certain bradycardias (sinus arrest, sick sinus syndrome, or in certain instances AV block).
Formulation: Sustained release Tablets/Capsules**:** 100 mg, 200 mg
Dose:

- Dogs: 10-15 mg/kg PO Q 12 hrs.
- Cats: 10-20 mg/kg q 24 hrs; sometimes increase to q 12 hrs.

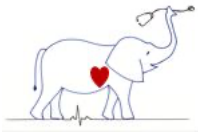
Side effects: Tachycardia, hyperexcitability, sleep disruption, pacing, panting, vomiting or other GI upset, and cardiac arrhythmias. Mild side effects may abate after 10-21 days of therapy (coffee/caffeine analogy).
Follow-up: If used for bronchodilation and the owner does not note appreciable improvement within 10-14 days then the drug should be discontinued. If used for bradycardia then either syncope/collapse should resolve, become less frequent, or serial ECGs should documented improved rhythm.

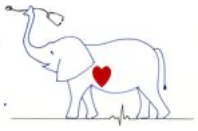
Timolol drops – Beta-blocker used to slow HR of animals at the time of echo; may also eliminate LVOTO and DRVOTO during echo. Systolic function and LVOT velocity should be assessed before application of timolol. Effect is seen within 20 minutes of application.
Dose: 1 drop of timolol 0.5% solution in one eye
Side effects: Miosis in the treated eye, rarely first-degree AV block. Caution should be observed in cats with clinical signs of congestive heart failure, left atrial enlargement, or impaired systolic function.

Tissue plasminogen activator – t-PA has low affinity for circulating plasminogen which may allow systemic administration without causing a systemic fibrinolytic state (it acts preferentially on the thrombus). Nevertheless, t-PA still causes a moderate hemostatic defect with potential for hemorrhagic stroke or bleeding elsewhere.
Indications: For treatment of acute thrombosis and arterial occlusion in cats and dogs.
Dose: Systemic dose: 5 mg/cat given as a CRI over 4 hours
For local infusion: As a CRI – 0.5-1 u/hr for a few days in people with active thrombosis via multiple side hole catheter
Side effects: Bleeding complications, "reperfusion syndrome", bleeding complications, and neurologic signs
Follow up: Monitor for bleeding and monitor for hyperkalemia or acidosis as a result of reperfusion.

Torsemide – Loop diuretic with some aldosterone receptor antagonist action usually used in advanced CHF.
Indications: Rarely used as first line diuretic; we usually add it in for diuretic resistance (furosemide dose > 4 mg/kg/day). Some switch from furosemide to torsemide; we usually slowly add in torsemide to the current diuretic dose and manage with both drugs (+/- also with spironolactone).
Formulation: Tablets: 5 mg, 10 mg, 20 mg
Dose: 0.1 to 0.5 mg/kg q 12-24 hours in dogs; typically start q 24 at 0.1 to 0.2 mg/kg. 0.1-1.1 mg/kg q 12-24 hours (cats); usually start q 24
Side Effects: Azotemia and electrolyte depletion
Follow-up: in 7 to 14 days recheck electrolytes and renal values and then q 2 months

Tranexamic acid 10-30 mg/kg slow IV TID – dog and maybe cat (anecdotal)





Drugs for Sedation of cardiac cases:
Butorphanol
Midazolam
Alfaxalone

Hydrocodone with homatropine - cough suppressant
Formulation: Tablet: 5 mg hydrocodone (+1.5 mg homatropine per tablet)
Syrup: 1 mg/ml concentration (5 mg hydrocodone + 1.5 mg homatropine per 5 ml)
Dose: PO: 0.25–1 mg/kg, q6–12h (or PRN)
Side effects: Schedule III drug with the potential for human abuse (homatropine added to reduce abuse potential). Carefully monitor dispensing and prescribing. Start with low dose and titrate up. Sedation, GI upset, constipation

Butorphanol – anxiolytic and cough suppressant
Formulation: Injection: 2 mg/ml or 10 mg/ml concentrations
Tablets: 1, 5, 10 mg
Dose: 0.1–0.5 mg/kg, IV/IM/SC; PO: 0.5–1.0 mg/kg, q4–6h
Side Effects: Effects range from "antianxiety" to heavy sedation depending on dose. Usual dose for anxiolysis in acute heart failure is 0.1–0.2 mg/kg, IM; repeated in 30 to 60 minutes if needed

For Heartworm Slow Kill from 2017 ACVIM Forum:
Moxidectin/Imidacloprid and doxycycline.
Doxycycline 20 mg/kg PO x 28 days (no need to repeat)
Moxidectin/Imidacloprid (Advantage Multi) at preventative doses q 15 days for 90 days and then q 30 days
Test 9-10 months later – 91% cure rate by 1 year. The heat treated antigen test went negative 0-3 months after the non-heat treated sample was negative.

For access to diet handouts and other helpful information for owners of pets with heart disease, see:
http://www.tufts.edu/vet/heartsmart/
OR
http://www.tufts.edu/vet/heartsmart/resources/treats_for_dogs_with_heart_disease.pdf

BIRD CARDIAC DRUG FORMULARY
Based on VIN CE 2017 (Fitzgerald & Speer recommendations)

ACE inhibitors –

- CHF
- Maybe for atherosclerosis before CHF (+/- isoxsuprine)
- Systemic hypertension
- **Enalapril** – 1.25-5 mg/kg PO BID

β blockers –

- Adjunct treatment of CHF, after stabilization using conventional management strategies
    - Especially CHF with concentric ventricular hypertrophy, tachycardia, diastolic dysfunction
- Suspected atherosclerotic disease with concentric ventricular hypertrophy without CHF. (symptomatic improvement - increased energy and activity level, appetite, and body weight.)
- Systemic hypertension
- **Carvedilol** – 1-9 mg/kg PO SID-BID, start low (1mg/kg SID-BID)

Digoxin –

- Maybe for CHF (especially if SVT)
- 0.01-0.025 mg/kg PO SID
- Recommended therapeutic levels for digoxin extrapolated from dog 0.8-1.2 ng/mL; anecdotal evidence from individual suggests that the levels may range higher for some birds.

Furosemide –

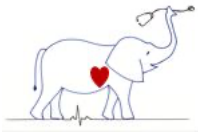
- 1-5 mg/kg IM *when stabilizing birds with severely decompensated CHF*
    - Initial frequency of q 2h is usually followed by a shift to q 6-12h.
- *Once stabilized,* furosemide can be administered orally, with the dose increased at least 2-fold (presuming oral bioavailability is 60-75% as in humans).
- Oral dose range 1-13 mg/kg BID-TID

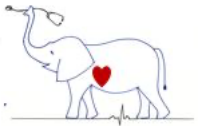
Omega-3 –

- CHF
- Atherosclerosis
- Shown to improve lipid metabolism, reduce inflammation, and minimize development of atherosclerosis in several avian species
- α-linolenic acid (flaxseed oil)
- USANA VetOmega® (former product name Optomega®)
- 0.2-0.4 mL/kg PO SID

Isoxsuprine –

- For peripheral vasodilation in atherosclerosis (symptomatic improvement of stroke-like events)
- Systemic hypertension





- Starting at 10 mg/kg PO SID-BID

Levetiracetam –

- Seizures related to stroke
- 100 mg/kg PO TID

Pentoxifylline –

- May have value in improving peripheral perfusion in birds with atherosclerotic disease.
- 15 mg/kg PO BID-TID

Pimobendan –

- CHF
- 6-10 mg/kg PO BID
- Compounded as a suspension *with inclusion of citric acid*

Sildenafil –

- For suspected pulmonary hypertension (can occur related to atherosclerosis)
- 1-5 mg/kg PO BID-TID

Spironolactone –

- When congestive signs cannot be controlled with furosemide and an ACE inhibitor alone.
- Not expected to be efficacious as a sole diuretic
- 1-2 mg/kg PO BID

Statins – Not routinely used