# New Standards in 2012 for Treating Heart Failure in the Dog and Cat

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Chronic heart failure (CHF) traditional therapy (for CHF secondary to chronic degenerative valvular disease etc.) still provides a guarded prognosis. Though current standard treatment regimens provide a good quality of life for many canine patients, complications can lead to early patient loss. Ongoing congestion or syncope can be concerns, sudden death due to arrhythmias, or client-elected euthanasia due to poor quality of life may also lead to loss.

**Treatment**

Combination therapy is essential and must be customized to each patient. Different stages of heart failure, and differences in types of failure depending on breed, etiology, and concurrent illness make it necessary to fine tune therapy both on a per-patient basis, and within the patient, to adjust therapy based on response or non-response during the treatment timeline.

The choice of drugs is dependent on the stage of the clinical heart failure:

- Asymptomatic
- Mild to Moderate
- Advanced

**Classifications of heart failure**

**Asymptomatic heart disease**

At this level, a cardiac murmur or an ultrasound diagnosis of heart disease has occurred, but clinical signs are absent. Re-evaluation is the standard, and medication is not required. Some of these patients benefit from a lower-salt diet, such as a kidney diet.

**Mild to moderate heart failure**

Clinical signs of heart failure are evident at rest or during mild exercise, and begin to interfere with normal activities. Typical signs include:

- Dyspnea +/- tachypnea
- Exercise intolerance
- Cough
- Mild to moderate ascites.

We often recommend starting therapy at home. Mitral valvular endocardiosis patients for example, generally receive diuretic therapy, ACEI therapy, sodium-restricted diets, and pimobendan in the moderate cases of heart failure.

Dilated cardiomyopathy is best treated with pimobendan, digitalis (especially those with atrial fibrillation), diuretics, ACEI, Na-restricted diets, pimobendan, Omega-3 fatty acids, taurine nutraceuticals (especially for Cocker Spaniels), +/- a beta blocker.

**Advanced heart failure**

Clinical signs of advanced congestive heart failure are obvious, and include:

- Dyspnea
- Marked ascites
- Severe exercise intolerance
- Hypo-perfusion at rest.

Hospitalization is mandatory for most patients, at least until stabilized.

Treatment for advanced heart failure includes ACEI, oxygen therapy, aggressive diuretic therapy, topical nitroglycerin ointments, digitalis (if atrial arrhythmias), and in really advanced cases, one would add either dobutamine or sodium nitroprusside. New cardiac drugs, such as pimobendan, are also indicated.

Most dogs with heart failure should receive an ACEI, such as benazepril (Fortekor®), a diuretic (furosemide), and pimobendan. Digoxin is indicated when there is an atrial arrhythmia, especially atrial fibrillation.

Triple Therapy in Advanced Heart Failure is the Current Approach to Treating heart Failure: Benazepril, Furosemide, and Pimobendan. Omega-3 Fatty Acids are also important in every case.

**Understanding ace inhibitors**

**Heart failure-angiotensin II is the problem**

Heart failure is a syndrome with multiple causes that may involve the right ventricle, the left ventricle, or both. Cardiac output in heart failure is often below the normal range. The primary signs and symptoms of all types of heart failure include tachycardia, decreased exercise tolerance, dyspnea, pulmonary edema and cardiomegaly. Decreased exercise tolerance is the major direct consequence of diminished cardiac output. The other clinical manifestations result from neurohumoral compensation. Two neurohumoral compensatory mechanisms include the sympathetic nervous system and the renin-angiotensin-aldosterone hormonal response. Angiotensin II contributes to the activation of the neurohormonal system

**Ace inhibitors - Why they work**

Benazepril is one of the many ACE inhibitors that are now available that block the formation or actions of angiotensin II. These drugs may block renin secretion, the enzymatic action of renin, and the conversion of angiotensin I to angiotensin II. These drugs differ in their structures in pharmakinetics, but in clinical use they sometimes can be interchangeable. It is important to choose drugs that are inactivated by non-renal metabolism. Benazepril is the drug of choice in cases of heart failure and renal failure. The active metabolite, benazeprilat is eliminated both by the kidney and by the liver (50-50%). If excretion from the kidney is reduced, the liver takes over so that the elimination of the drug can take place as usual. ACE inhibitors not only block the conversion of angiotensin I to angiotensin II but also inhibit the degradation of other substances, including bradykinin and enkephalins.

Convincing evidence now indicates that the renin-angiotensin-aldosterone system plays a major role in the pathogenesis and progression of heart failure. Angiotensin II is a potent vasoconstrictor agent and, through the release of aldosterone, promotes salt and water retention. Angiotensin II also contributes to the activation of other neurohormonal systems, both within the heart and throughout the body, by promoting release of certain hormones, such as norepinephrine. When the renin-angiotensin-aldosterone system is activated, cardiac afterload and preload increase. These overactive compensatory mechanisms result in remodeling of the heart, ventricular dilation/ hypertrophy, and sodium and water retention which then predisposes the animal to progressive left ventricular failure.

**Pimobendan: What you need to know**

This drug is a:

- Positive inotrope, [inodilator]-- a benzimidazole pyridazinone derivative
- Drug used as an adjunct with other CHF drugs (in combination with furosemide and benazepril, for example)
- Calcium sensitizer [ at Ca++ binding sites of troponin C]—leads to improved systolic efficiency without leading to significantly increased myocardial oxygen requirement and intracellular calcium buildup
- Mixed arterio- and veno-dilator

**Treating feline hypertrophic cardiomyopathy**

Hypertrophic cardiomyopathy (HCM) is the most common cardiac disease of the cat and is characterized by unexplained and significant left ventricular hypertrophy. The left ventricle is non-dilated and often hyperdynamic. Left ventricular hypertrophy can occur secondary to hyperthyroidism, systemic hypertension, or subaortic stenosis.

**Treatment**

Thoracocentesis should be performed in all dyspneic cats when pleural effusion is suspected. Give furosemide when pulmonary edema is present. In the crisis setting, give 2-4 mg/kg IV initially, then 1-2 mg/kg IV or IM every 4-6 hours until the edema has resolved. Furosemide is often continued as needed (6.25-12.5 mg SID-BID) to control edema formation. Apply ¼ inch of nitroglycerin to a hairless area every 4-6 hours until the edema has resolved. Administer via face mask if tolerated; otherwise use an oxygen cage or tent (50% oxygen). A beta-blocker, such as atenolol (6.25 mg SID-BID), may be indicated, especially when echocardiography shows outflow tract obstruction. The use of benazepril may be beneficial. ACE inhibitors have been shown to possibly reduce left ventricular hypertrophy in cats. Aspirin may reduce chance of thrombus formation.

**Benazepril: What you need to know**

Benazepril is an angiotensin converting enzyme inhibitor (ACEI), indications are for chronic renal insufficiency (CRI) in cats, and in dogs for congestive heart failure (CHF). This drug shows great promise as an adjunctive therapy because there is also evidence to suggest that this drug may play a role in treatment of hypertrophic cardiomyopathy in cats, though this is currently an off-label use.

The drug is metabolized into the active intermediary, benazeprilat. Peak plasma levels occur in about 2 hours, and last 16-23 hours in the feline. Benazeprilat acts along the renin-angiotensin-aldosterone pathway. It appears that the drug inhibits mostly tissue ACE (89%) rather than plasma ACE (11%). At peak plasma levels, there is 100% enzyme inhibition, and over 23 hours, over 90% inhibition occurs.

In cats with CRI, in vivo effects include increased blood flow in the kidneys, with efferent arteriolar vasodilation, variable GFR, reduced protein loss in the urine, significantly increased appetite and weight gain, prolonged survival, mild reduction in blood pressure, reduced risk of hypokalemia, and improved quality of life. The extent of proteinuria in CRI cats has been shown to be a predictor of rate of progression of CRI, and so U-protein levels may potentially serve a screening function, and reducing proteinuria may slow progression of CRI.

The usual benazepril dose for cats for CRI is 0.5-1.0 mg/kg once daily PO and dosage adjustment in mild to moderate renal insufficiency is not necessary since 85% of metabolites are excreted through biliary pathways, and only 15% via the kidneys.

The drug may generally be used in polytherapy in combination with mainstream drugs, though studies are still being done on the pharmacology of the drug in this species.

In dogs, benazepril treated heart patients will show increased activity levels, increased appetite, reduced mean arterial pressure (MAP) and improved exercise tolerance along with reduced coughing as reported in a study of CHF secondary to mitral insufficiency

(MI). Best benefits accrue in those patients with early stage CHF, where reduced peripheral resistance, increased cardiac output, and maintenance of GFR occur post-treatment.

Similar benefits seem to occur in the cat and one study indicated that mild blood pressure reduction, and reduction in the left ventricular wall (LVW) thickness occurred after 12 months of therapy. In this study, no reduction in septum thickness occurred. Aspirin and diltiazem were administered also to some patients in this study.

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