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MANAGEMENT OF FELINE HYPERTROPHIC CARDIOMYOPATHY: INNOVATIONS AND CONTROVERSIES

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The treatment of HCM is different than that of DCM (systolic myocardial failure) and entails the goals of reducing LVEDP, abolishing sinus tachycardia and other arrhythmias, improving myocardial oxygenation, and alleviating and preventing pulmonary edema. Positive inotropic agents are not needed and generally contraindicated because they may increase LVEDP and aggravate outflow obstruction. The latter precaution should be exercised in the use of arterial vasodilators and, to a lesser degree, preload reducing agents (diuretics and mixed or venodilators).

Diuretic therapy is indicated to eliminate pulmonary edema. Furosemide is the diuretic of choice in emergencies because it reduces LVEDP and, hence, left atrial, and pulmonary venous pressures through diuresis and venodilation. In the emergency situation, treatment with parenteral furosemide (2-4 mg/kg IV or IM) is accompanied by the use of topical nitroglycerin (1/8-1/4 inch tid-qid for first 24 hours, then "8 hours on, 8 off" only if necessary) and oxygen supplementation (40%). Although furosemide diuresis is usually successful, the addition of enalapril (0.25-0.5 mg/kg sid) is indicated in refractory cases or when biventricular failure (pleural effusion) ensues. It should be kept in mind that drugs which reduce preload (and afterload) may worsen outflow obstruction in hypertrophic obstructive cardiomyopathy (HOCM).

Drugs that enhance ventricular relaxation and slow the heart include the beta adrenergic (atenolol), and calcium channel (diltiazem) blockers. Such therapy is indicated in treatment of the diastolic failure of HCM. Beta blockers improve diastolic performance only indirectly, enhancing ventricular filling by reducing heart rate and improving myocardial perfusion. Traditionally, beta-blockers have been administered orally after stabilization (24 to 36 hours after institution of diuretic therapy) to reduce and prevent elevations in LVEDP, to lower systolic pressure gradients and myocardial oxygen requirements, to prevent stress-induced tachycardia and reduce resting heart rate, and for its antiarrhythmic effects. When arrhythmias are present, this drug may be initiated earlier in the disease course. This is the author's treatment of choice for asymptomatic HCM, for cats with documented outflow obstruction (HOCM), and when tachycardia persists.

Calcium channel blocking agents have been effective in human HCM by reducing heart rate, myocardial oxygen consumption, and diastolic dysfunction. In addition to directly enhancing myocardial relaxation, these drugs dilate peripheral and coronary arteries. Bright has demonstrated the utility of diltiazem (3-7.5 mg po tid) in the treatment of feline HCM, including those cases refractory to the beta-blocker, propranolol. Unfortunately, current packaging for human use, makes accurate feline dosing of diltiazem difficult. Long-acting diltiazem may be substituted and includes Cardizem CD (45 PO sid; requires disassembling capsules) or Dilacor (30 mg PO bid; requires disassembling capsules). Combining a calcium channel blocker and a beta blocker has theoretical advantages and is often done, using a long-acting form of each drug, one in the morning and one in the evening. There is no role for amlodipine in the normotensive cat with HCM as it has no theoretical or proven benefit and it may precipitate hypotension.

A report by Rush, et al. demonstrated a reduction in wall thickness with the administration of enalapril to cats with HCM. This suggests a potential role for ACE-inhibitors in the treatment of HCM. These drugs are generally safe and do play a role in cases which are refractory or in which pleural effusion is present. In asymptomatic patients, it is logical that the renin-angiotensin-aldosterone system is not pathologically activated, and hence ACE-inhibitors might not be useful. Rush's data argue that they may play a role, however. Further studies are being planned. Enalapril is used at 0.5 mg/kg daily.

Drugs other than those described above should be used sparingly and with caution. Digoxin, while generally contraindicated in HCM, may be used when supraventricular arrhythmias are refractory to calcium channel and beta adrenergic blocking agents.

Other therapies, including oxygen, aspirin or low molecular weight heparin, home confinement, and moderate salt restriction should be instituted as needed. Taurine supplementation is not indicated in the treatment of HCM. In asymptomatic cats with HCM, the author advises home confinement, moderate salt restriction, Beta- and/or calcium channel blockade, and aspirin indefinitely.

PATIENT MONITORING

Cats with asymptomatic HCM should be evaluated at 12 month intervals, while those with symptoms should ideally be seen more frequently until stabilized for a period of time. The prognosis for asymptomatic HCM is guarded to good, with a median survival of over 5 years. Cats presented in heart failure survive a median of approximately 3 months (though 20% live longer than 3 years; recent work by Rush and associates show that current therapeutic strategies have improved survival in heart failure due to HCM), while cats with emboli survive a median of approximately 2 months.

Cardiovascular Formulary for Cats

Drug	Trade Name*	Formulation(s)**	Dosage	Use
Amlodipine	Norvasc	1.25 mg tablets	0.625 PO qd-bid	Antihypertensive
Diltiazem	Cardizem	30 mg tablets	7.5 mg PO tid	Lusitrope, Vasodilator, Negative chronotrope
Diltiazem - LA				
	Dilacor XR	180, 240 mg caps.	30 mg PO bid	<i>same</i>
	Cardizem CD	180, 240 mg caps.	45 mg PO qd	<i>same</i>
Enalapril	Enacard (Vasotec)	1, 2.5, & 5 mg tablets	0.5 mg/kg PO qd	ACE-I (CHF, Hypertension)
Benazepril	Lotensin (Foretkor)	5 & 10 mg tablets	0.25-0.5 mg/kg PO qd-bid	<i>same</i>
Atenolol	Tenormin	25 mg tablets	6.25-12.5 mg PO qd	Negative chronotrope, Antiarrhythmic, Lusitrope, Antihypertensive
Esmolol	Brevibloc	10 & 250 mg/ml injectable	50-500 (100 usually) ug/kg IV	<i>same</i>
Sotalol	Betapace	80 mg tablet	2 mg/kg PO bid	Antiarrhythmic
Procainamide	Pronestyl, Procan SR	250 mg tablets 100 mg/ml inject.	2-5 mg/kg PO bid-tid	Antiarrhythmic
Furosemide	Lasix	12.5 mg tablets 50 mg/ml inject.	1-4 mg/kg PO bid-q48h; 0.5-2 mg/kg SQ, IM, IV PRN	Diuretic
Nitroglycerin	Nitrol, Nitro-Bid	2% ointment	1/8–1/4 inch topically tid for 24 hours	Venodilator (CHF)
Warfarin	Coumadin	1, 2, 2.5, 4 mg tabs.	0.1-0.2 mg QD	Anticoagulant
Heparin		Multiple	250-300 U/kg SQ tid	Anticoagulant
LMW Heparin	Fragmin	2500 U/.2 ml	100 U/kg SQ qd	Anticoagulant
Aspirin		81 mg	40-8080 mg q72h	Anticoagulant
Digoxin	Lanoxin	0.05 mg/ml elixir 0.125 mg tablets	0.007 mg/kg PO q48h (check serum [digoxin])	Positive inotrope, Negative chronotrope (CHF, SVT)
Taurine		250 mg tablets	250 mg PO qd	Taurine deficiency

*Selected name brands; some available as generic.

**Most appropriate formulations for cats – other sizes available for many drugs.

Therapy of HCM

Asymptomatic HCM, HOCM

- **Make indoor cat**
- **Atenolol: 6.25=>12.5 qd or bid (to HR goal)**
- **+/- Aspirin (Warf, Hep)**
 - ◆ **Based on LA size**
- **+/- Enalapril (LVH)**
- **Avoid repositol steroids**
- **Avoid excessive fluid Rx**
- **Avoid heavily salted foods**

Symptomatic HOCM

- **Make indoor cat**
- **Atenolol: 6.25=>12.5 qd or bid (to HR goal)**
- **+/- Aspirin (Warf, Hep)**
- **+/- Enalapril (LVH)**
- **Avoid repositol steroids**
- ***Add Lasix***
- ***Nitroglycerin, O₂ PRN in ER***
- ***Dilacor 30 mg QD***

Therapy of HCM

Symptomatic HCM

- **Make indoor cat**
- ***Lasix, +/- Nitroglycerin and Oxygen***
- ***Dilacor bid or Dilacor/Atenolol***
(if Dilacor bid & high HR, change to or add Atenolol (Dilacor AM, Atenolol PM))
- **+/- Aspirin (warfarin, heparin) – based on LA size**
- **+/- Enalapril (LVH, pleural effusion, unresponsive)**
- **Moderate NaCl restriction**