Proceedings of the 34th World Small Animal Veterinary Congress
WSAVA 2009
São Paulo, Brazil - 2009

Next WSAVA Congress:

Reprinted in IVIS with the permission of the Congress Organizers
Heart failure is the inability of the heart to cover the body's metabolic requirements, which will gradually lead to a decrease in the quantity and quality of life of our patient. While we know that drug treatment (added to the restriction of exercise and dietary management) do not "cure" to our patient, at least meet the goal of providing quality and quantity of life in this cardiac patient, as these deal with measures to prevent and reduce the decompensated heart. We can say that the management of cardiac patient is based on the interrelationship between pet owner and veterinarians, each properly fulfill its part in this process.

PHARMACOLOGICAL MANAGEMENT:

a) Diuretics:
Drugs are essential in treating congestive heart failure; its use is based on a reduction in preload which promotes cardiac output and thus reduce congestion and fluid retention. Basically there are three types of diuretics, classified according to their place of action:

- Loop diuretics (loop of Henle)
- Thiazides (distal tubule)
- Potassium-sparing (distal tubule)

Of these three groups is the most used Furosemide (loop diuretic), basing their choice on which it is a very quick and diuretic effect. Furosemide inhibits the reabsorption of sodium, potassium and chloride at the loop of Henle, thus increasing the excretion of water. The dose is 2 to 4 mg/kg, IV/IM/PO. Administered IV also causes a vasodilator effect, beneficial in emergency situations. Thiazides exert their action by inhibiting the distal tubular sodium reabsorption and causing the secretion of potassium, so its diuretic effect is modest. It is usually associated with furosemide therapy. Hydrochlorothiazide (2-4 mg/kg/12 hours in dogs and cats in 1-2 mg/kg/12 hours,PO) and chlorothiazide (20-40 mg/kg/12 hours PO, in both species). Presented as the risk of other no wanted effects, like dehydration, metabolic acidosis or hypokalemia.

For low levels of potassium, the most used is spironolactone, which inhibits the action of aldosterone in the distal tubule cells. Causes a moderate diuresis. The dose is 1-4 mg/kg/12 hours PO in dogs and cats, and the collateral effects of its use as a diuretic include hypovolaemia and hyperkalemia.

b) Positive inotropic agents:
These drugs are used to enhance myocardial contractile capacity. We have thus, sympathomimetic agents (eg dopamine, dobutamine, etc.) Used in severe heart failure and EV, and agents are also digital.

Of the latter group the most commonly used is digoxin, which inhibits the Na-K-ATPase of the cell membrane, and promotes the entry of calcium into the cell. Digoxin is a drug that has been used for a long time, and opinions about the benefits of its use are divided. Although digoxin is widely known as a positive inotropic agent, reality shows us that causes a mild inotropic effect, being the main advantage of using the effect parasympathomimetics, resulting in a decrease in heart rate. Digoxin is also used as an agent antiarrhythmic supraventricular. The dose in dogs fewer than 20 kg is 0.005 – 0.011 mg/kg/12 hours PO and dogs over 20 kg becomes 0.22 mg / mts²/12 hrs, PO. Ideally, an exact dosage of the drug, since the margin between the therapeutic range and toxicity are very close.
**c) Vasodilators Agents:**

Improve the cardiac output by reducing either the preload or the cardiac output, or both simultaneously.

- **Arterial Vasodilators:**

Hydralazine have an action on vascular smooth muscle and thereby improve cardiac performance by decreasing the cardiac output. The dose in dogs is 1-3 mg/kg/12 hours PO. Should be used with caution in patients with advanced renal failure.

- **Vasodilators Mixed:**

The sodium nitroprusside have a direct vasodilator effect on the smooth muscle of both arteries and veins (mixed effect), thereby causing a decline in both vascular pressure. Its main indication a dose of 1-10μgr in dogs for the acute and severe congestion.

- **Inhibitors of converter enzyme:**

Exert their action indirectly by inhibiting the enzyme converter of angiotensin II (ACE inhibitors). This enzyme is produced by the passage of angiotensin I to angiotensin II (AGII). The action of AG II is a potent arteriolar vasoconstrictor (venous and slightly) and favors the release of aldosterone (which increases the pressure to sodium and water retention), which is why the selective blockade of this enzyme will produce a hypotensive effect indirectly. ACE inhibitors are drugs of mandatory use in patients with congestive heart failure, many studies have shown beneficial effects in both morbidity and mortality. The most widely used is enalapril maleate, which once metabolized by the liver becomes enalaprilat which owns the ACE inhibitor effects. Their effects on cardiovascular patients with heart failure are: decrease in peripheral resistance, in pulmonary vascular resistance, blood pressure and half-right atrial and pulmonary wedge pressure. Canine dosage of 0.25 - 0.5 mg / kg / 12-24 hrs, PO.

**D) Antiarrhythmics Therapies:**

- **Class I:** or membrane stabilizers (eg, lidocaine, mexiletine, quinidine, procainamide, phenytoin, propafenona, etc.).

- **Class II:** or beta adrenergic blockers (eg propranolol, atenolol, carvedilol, timolol, etc.).

- **Class III:** or prolong the action potential duration and refractory period (eg, amiodarone, sotalol, bretillo, etc.).

- **Class IV:** blockers or calcium channel (eg, Diltiazem, verapamil, etc.).

  - **Antiarrhythmics Class I:**

    Are membrane depressants and block the fast sodium channels, thereby reducing the speed of ventricular tissues. Decrease the excitability of cells ectopically activated. The most commonly used is Lidocaine, used for treatment of ventricular rhythm disturbances. Dose in dogs is 2-4 mg/kg IV bolus, followed by a continuous infusion of 25 to 100 μgr/min. Another drug of this class is mexiletine. It is a synthetic analogue of lidocaine and the dose in dogs is 5-8 mg / kg / PO 8-12 hrs.

  - **Class II Antiarrhythmics:**

    Beta blockers work by blocking the stimulation induced by catecholamines, lowering the heart rate (negative chronotropism) improve myocardial perfusion by increasing diastolic time. But they present a negative inotropic effect. Among the most widely used drugs of this class is propranolol
with a beta blocker effect on β1 and β2 adrenergic receptors. Antiarythmic exerting its effect mainly by blocking the receptor β1. Shown in supraventricular or ventricular arrhythmias caused by a hyper-sympathetic tone. Among the most common to have atrial fibrillation and is administered alone or in combination with other antiarrythmic agents. It is also very useful in processes with diastolic failure (hypertrophic cardiomyopathy, or hypertrophy of stenosis, etc.). Canine dosage ranges from 0.2 to 1 mg/kg/8hs, PO. The other actor most frequently used beta blocker is Atenolol, which present less risk of bronco constriction that propranolol. The indications are similar, and is administered at doses of 0.5 - 1 pm mg/kg/12-24 hrs PO in dogs and cats for a total dose of 6,25-12,5 mg C/12 -24 hrs, VO.

- **Class III Antiarrythmics:**
  Present a mechanism of action is not as clear as they possess some properties antiarrythmic of the other three groups (I, II and IV), although its main effect is to prolong the refractory period and interfere with the flow of repolarization. Have excellent results in human and veterinary medicine but is not yet widespread use in Europe and USA, our personal experience (with amiodarone) leads us to believe that no doubt occupy a place of excellence among the antiarrythmic drugs. One of this group of drugs most commonly used is amiodarone, which is then absorbed by the gastrointestinal tract is metabolized by the liver becoming desetilamiodarone, which has significant antiarrythmic effects. Many studies in human medicine have shown the beneficial effects of the use of amiodarone as antiarrythmic agent, as in preventing the risk of sudden death. Is indicated in cases of both ventricular and supraventricular arrhythmias, being mainly used by the authors in the management of atrial fibrillation and ventricular arrhythmias in ambulatory patients. The dose in dogs is 8-10 mg/kg/12 hours PO. Caution should be exercised in its administration in patients with thyroid disorders, bradycardia and atrioventricular blocks. Another drug of Class III is the sotalol, whose main use is in ventricular arrhythmias (severe or refractory to conventional treatment) for dilated cardiomyopathy or in cases of arrhythmogenic right ventricular dysplasia. Being widely used in patients of Boxer breed. In these races is given in doses of 40 - 80 mg total every 12 hours.

- **Antiarrythmics Class IV:**
  Drugs are also known as calcium blockers, because of the action on the channels of the electrolyte. By its action reduces the depolarization of the sinus node and prolong the refractory period in ventricular atrioventricular node. For its effect on vascular smooth muscle (vessel dilation) are also indicated in the management of hypertension. Its use is directed primarily to the treatment of supraventricular arrhythmias. The drugs most frequently used in this Class IV is diltiazem. The dose in dogs is 0.5-1.5 mg/kg/8 hours PO. We use this to supraventricular arrhythmias, especially atrial fibrillation. It was also noted in cats with hypertrophic cardiomyopathy, the dose in cats is 0.5-2.5 mg/kg/8 hrs, PO.

**References available upon request**