

EMERGENCY MANAGEMENT OF ACUTE CONGESTIVE HEART FAILURE IN THE DOG

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A good understanding of the underlying pathophysiology is required to enable a sensible approach to the treatment and management of heart failure. In patients with acute, decompensated congestive heart failure, immediate priorities include:

1. Relief of the life-threatening pulmonary oedema and/or pleural effusion.
2. Maintenance of adequate systemic arterial blood pressure.
3. Adequate delivery of blood to the vital tissues.

It should be emphasised that the efficacies of drugs that are used to treat heart failure depend very much on drug type, underlying disease and individual patient response. There are no set rules and it is important to closely monitor a patient with acute heart failure. The treatment should be adapted depending on repetitive clinical evaluation of the patient.

Acute congestive heart failure can develop suddenly with the onset of a new and rapidly progressing disease or from exacerbation of a pre-existing chronic disorder. Acute congestive heart failure being life threatening should be treated aggressively. One should select drugs with a rapid onset of action and proven haemodynamic benefits.

Cage rest

Strict cage rest is an essential part of the treatment in acute heart failure. Stress must be avoided. Ancillary investigations to confirm the cause of the acute congestive heart failure may need to be postponed until the patient is stable.

Oxygen supplementation

Arterial hypoxaemia can be best remedied by providing an oxygen rich environment and by rapidly decreasing left atrial and pulmonary venous pressure. An oxygen rich environment can be obtained by the means of an oxygen cage. Alternatively and ideally, oxygen (humidified) can be administered via an intranasal catheter providing that it does not cause distress to the animal.

Intravenous diuretics and/or thoracocentesis

A potent diuretic will reduce total blood volume and therefore pulmonary oedema. In the presence of life-threatening pulmonary oedema furosemide should preferably be administered intravenously (initially 2-4 mg/kg IV q 0.5-1-2 hrs in dogs, or as a CRI) as it has an additional and very beneficial venodilator effect when administered by this route. Dosage should then be reduced (dogs: 2-4 mg/kg q 6-8 hrs). Excessive dosing can lead to dehydration, electrolyte depletion, renal failure, low cardiac output, and circulatory collapse. Monitoring of renal function including serum electrolytes and urine production is essential.

Thoracocentesis is required to alleviate respiratory distress due to severe pleural effusion. It is not advisable to drain ascites unless the effusion is compromising respiration.

Vasodilators

Acute reduction of pulmonary venous pressure is achieved by the use of a potent vasodilator to redistribute intravascular fluid volume. Because of the general lack of haemodynamic monitoring in veterinary medicine, topical administration of nitroglycerine (ointment 2%: 2.5 cm/20 kg BW q 8 hrs; transdermal patch 2.5-10 mg/24hr) is the most practical and safe vasodilator. It is a venodilator. It is applied to a hairless, well perfused area of skin (medial pinna or groin). Gloves should be worn to apply ointment. In addition, a warning sign with information about the site of the nitroglycerin administration should be left on the animal's kennel to protect other staff from inadvertent skin contact, which can cause headaches. It should be avoided in patients with cardiogenic shock. Patients become refractory to nitrates with long-term administration, therefore this product should only be used for three to five days for the initial control of pulmonary oedema.

Intravenous nitroprusside and oral hydralazine should only be used when haemodynamic monitoring is available. Sodium nitroprusside is an extremely potent, direct acting mixed vasodilator. Because of its short half-life a continuous rate infusion is necessary to achieve effect. The dose (1-10 µg/kg/min diluted in 5% dextrose) should carefully be titrated towards effect but avoiding profound hypotension. Adverse effects include hypotension, tachycardia, nausea, vomiting and with chronic administration cyanide poisoning.

Alternatively, hydralazine tablets (0.5-3.0mg/kg PO q 8-12 hrs; start low, titrate) can be administered. Hydralazine is a very potent arteriodilator. It is more efficient in treating pulmonary oedema secondary to mitral regurgitation than to dilated cardiomyopathy. Hydralazine should be administered with extreme care in dogs already receiving ACE-inhibitors. Common side-effects include first dose hypotension and anorexia, vomiting and diarrhoea.

Positive inotropes

Inotropic support is very important with acute heart failure due to dilated cardiomyopathy, and it is also used to treat severely decompensated mitral regurgitation.

Dobutamine is a synthetic catecholamine (β_1 -sympathomimetic drug) that is more efficacious than digoxin for acute management of profound myocardial failure. It can only be used in an intensive care setting. Dobutamine increases contractility with little change in heart rate or afterload. It is very short lived and therefore best suited as a continuous rate infusion (Dobutrex®, Lilly; dogs: 2.5-15 $\mu\text{g}/\text{kg}/\text{min}$ dobutamine hydrochloride, titrate up to effect). Efficacy is limited following chronic administration because of down-regulation of β -adrenergic receptors, but administration over 3 days has more prolonged effect of up to two to three weeks duration. Serious side-effects include ventricular arrhythmias and therefore constant ECG monitoring during dobutamine administration is strongly recommended.

Digoxin is a comparatively weak positive inotrope with a narrow margin of safety. In most cases digitalis glycosides can be administered orally, starting at maintenance dosage (Lanoxin® tablets, 0.22 mg/m^2). Rapid

intravenous digitalisation is rarely necessary in dogs with acute heart failure except to control certain supraventricular arrhythmias.

Pimobendan (0.2-0.6 mg/kg/day in dogs divided over 2 doses) is a novel agent (inodilator) for the treatment of canine congestive heart failure. It has a dual mode of action, acting directly on the heart as a calcium sensitiser to increase myocardial contractility and on the peripheral circulation through selective phosphodiesterase III inhibition to produce both peripheral and coronary vasodilation. Pimobendan is a good alternative to dobutamine in animals in need of inotropic support if the dog will accept oral therapy. It has diminished the need for dobutamine CRI tremendously. It should however be avoided in dogs with acute mitral chord rupture or in dogs with severe arrhythmias.

Anti-arrhythmic treatment

The most commonly encountered arrhythmias in acute heart failure are atrial fibrillation, supraventricular tachycardia and ventricular tachycardia. Substantial haemodynamic and clinical improvement can often be realised by successful treatment of the arrhythmia, but stabilisation of the congestive heart failure often reduces the need for anti-arrhythmic treatment. Specialist attention should be sought if the arrhythmia persists.

Take home message

Cage rest, oxygen and furosemide are the mainstay treatment of dogs in acute congestive heart failure. Inotropic support should be added in dogs with systolic dysfunction. Drugs that are used to treat heart failure depend very much on drug type, underlying disease and individual patient response. There are no set rules and it is important to closely monitor a patient with acute heart failure. Therefore treatment should be adapted depending on repetitive clinical evaluation of the patient.

Further reading

KITTLESON, M.D. & KIENLE, R.D. (1998) Small Animal Cardiovascular Medicine. Mosby.

FOX, P.R., SISSON, D. & MOISE, N.S. (1999) Textbook of Canine and Feline Cardiology. Second Edition. W.B. Saunders company.

MCQ

What is the primary goal in the treatment of acute congestive heart failure?

- a) Controlling the arrhythmia.
- b) *Relief of the life-threatening pulmonary oedema and/or pleural effusion.***
- c) Avoiding concurrent renal failure.
- d) Intranasal oxygen delivery

What is the most practical and safe vasodilator in veterinary medicine for the treatment of acute congestive heart failure?

- a) Enalapril tablets
- b) Nitroprusside continuous rate infusion
- c) Hydralazine tablets
- d) *Nitroglycerine***