



**RED LIGHT,
GREEN LIGHT**

PEER REVIEWED



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Mitral Valve Disease in a Dog

OSCAR, A 14-YEAR-OLD, CASTRATED DACHSHUND MIX, presented with a 1–2 day history of progressive cough, intermittent tachypnea with increased respiratory effort, and lethargy, and no interest in eating or drinking in the previous 12 hours. His 3-year history of heart murmur was characterized on imaging as myxomatous mitral valve (MV) disease with moderate left atrial enlargement; enalapril therapy was started at diagnosis. On examination, he was anxious and shaking. His heart and respiratory rates were 170 beats per minute and 60 breaths per minute, respectively. He was normothermic and normotensive. A grade IV/VI systolic heart murmur was detected with a point of maximal intensity over the left apical region; heart rhythm was regular, and pulses were strong and synchronous. Lung sounds were increased, with no crackles or wheezes. Thoracic radiographs showing progressive left atrial and ventricular enlargements, mildly enlarged pulmonary veins, a moderate patchy unstructured interstitial pattern in the right caudal lung lobe, and a mild unstructured interstitial pattern in the left caudal lung lobe were consistent with pulmonary edema. Caudal mainstem bronchi were compressed on lateral projections secondary to the cardiomegaly and left atrial enlargement. Radiographic findings were compatible with left-sided congestive heart failure (CHF) secondary to MV disease.

Which of the following drugs would be appropriate in *acute* management of this patient?

Based on the information provided, how would you grade the following drugs and why?

Turn the page and compare your results ►

	RED = do not use	YELLOW = proceed with caution	GREEN = safe
Acepromazine	RED	YELLOW	GREEN
Atenolol	RED	YELLOW	GREEN
Butorphanol	RED	YELLOW	GREEN
Enalapril	RED	YELLOW	GREEN
Furosemide	RED	YELLOW	GREEN
IV lactated Ringer's solution	RED	YELLOW	GREEN
Nitroglycerin	RED	YELLOW	GREEN
Pimobendan	RED	YELLOW	GREEN
Spirolactone	RED	YELLOW	GREEN
Theophylline	RED	YELLOW	GREEN

CHF = congestive heart failure, MV = mitral valve



Did you answer?

The following represents the best responses based on drug metabolism, pharmacokinetics, species, diagnostic differentials, clinical and laboratory data, and other pertinent findings.

Acepromazine

| CORRECT RESPONSE



Acepromazine is a strong sedative with potent vasodilatory properties. Low-dose acepromazine may be added to the treatment protocol for a very anxious patient that cannot be managed with more cardiofriendly choices (eg, opioids). However, caution should be used in any dog with low blood pressure. The author's preferred sedation in an anxious dog with CHF is butorphanol, because its dose-response effect is more predictable than that of acepromazine.

Atenolol

| CORRECT RESPONSE



Atenolol is a selective β_1 -adrenergic blocker. Although this dog's heart rate is fast and sympathetic nervous system activated, heart rate suppression with a β -blocker should be avoided because of possible worsening of heart failure caused by atenolol's actions of lowering heart rate and decreasing contractility. Because this patient's heart rate is not pathologically fast and is appropriate for his level of nervousness and cardiac insufficiency, it should be lowered by administering antianxiety drugs and successfully managing the pulmonary edema.

Butorphanol

| CORRECT RESPONSE



Low-dose injectable butorphanol, a sedative and good antitussive, is safe to administer to an anxious dog with respiratory distress. A breathless sensation, unfamiliar environments, and patient-owner separation can accelerate the fight-or-flight response and lead to further decompensation.

Enalapril

| CORRECT RESPONSE



Before this presentation, this dog had been receiving the ACE inhibitor enalapril for its proposed cardioprotective effects. Enalapril should be continued in this dog. However, in acute management of a dog with CHF, an ACE inhibitor could be withheld transiently until the dog is stable, eating, and drinking well, at which time the author generally reinstates and increases the enalapril dose to q12h.¹⁻⁴ The primary benefit of ACE inhibitors (eg, enalapril, benazepril) is thought to be renin-angiotensin-aldosterone system (RAAS) inhibition, leading to a survival benefit in dogs with CHF. ACE inhibitors are only modest systemic vasodilators and thus may not provide adequate

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afterload reduction in the acute management phase of CHF; they can also reduce renal perfusion pressure and decrease glomerular filtration rate, resulting in azotemia.

Furosemide

CORRECT RESPONSE

Injectable furosemide is the most effective immediate treatment for this dog's cardiogenic pulmonary edema. The IV route is ideal because of its rapid-onset action and bioavailability. However, if IV administration is too stressful for a patient, the IM or SC routes would be acceptable alternatives. After the patient is more stable and breathing more comfortably, the transition to oral furosemide can be made.

IV lactated Ringer's solution

CORRECT RESPONSE

Although this dog had not eaten or drunk for 24 hours before presentation, IV fluids (eg, lactated Ringer's solution) are contraindicated because of the sodium load. This dog should be able to withstand transient lapse of fluid and food intake while heart failure medications improve his condition. However, it is important to keep oral water available at all times during hospitalization.

Nitroglycerin

CORRECT RESPONSE

Nitroglycerin is a topical venodilator that reduces preload by dilating the splanchnic vasculature. Nitroglycerin augments preload reduction but is not generally used as a sole vasodilator, as the effects are fairly weak. Nitroglycerin is generally used only in acute management of heart failure because of the potential for the patient to develop tolerance if used continuously.⁵

Pimobendan

CORRECT RESPONSE

In the U.S., pimobendan is available in large chewable tablets, which may be difficult for a dog with respiratory compromise to swallow. However, as soon as the dog is breathing more comfortably, oral pimobendan is indicated for emergency management. The peak effect of pimobendan, an inodilator, is within 1 hour of administration. Pimobendan is indicated in all cases of CHF secondary to MV disease.^{1,6}

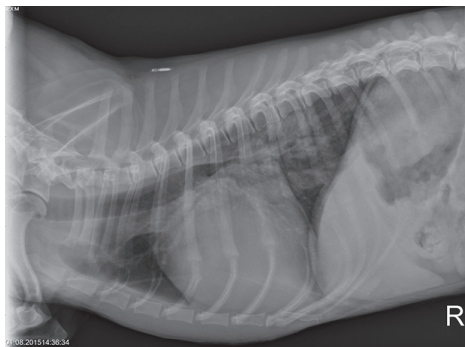
ACE = angiotensin-converting enzyme,
CHF = congestive heart failure, MV = mitral valve,
RAAS = renin-angiotensin-aldosterone system



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Lateral and DV views showing mild CHF in a dachshund with mitral valve disease.



Spironolactone | CORRECT RESPONSE

Spironolactone is a potassium-sparing diuretic that blocks the aldosterone receptor at the renal distal tubule. The primary hypothetical benefits of spironolactone are its aldosterone-inhibition effects, leading to a potential survival benefit in dogs with MV disease and CHF. Because spironolactone is not a potent diuretic and does not have rapid-onset action, it would not be an appropriate choice for acute management of a dog with CHF. Spironolactone should be introduced after the patient has been stabilized with other heart failure medications.

Theophylline | CORRECT RESPONSE

Theophylline, like aminophylline, is a methylxanthine bronchodilator that is most helpful for small airway bronchodilation in dogs with chronic bronchial disease. Addition of a bronchodilator should only be considered if concurrent airway disease is highly suspected. Possible side effects of this class of drugs include tachycardia, diarrhea, and anxiety, all of which are particularly undesirable in patients with heart disease.

CHF = congestive heart failure, MV = mitral valve

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REFERENCES

1. **Guidelines for the diagnosis and treatment of canine chronic valvular heart disease.** Atkins C, Bonagura J, Ettinger S, et al. *JVIM* 23(6):1142-1150, 2009.

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sentinel[®]
spectrum[®]
(milbemycin oxime-lufenuron-praziquantel)

Caution

Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

Indications

SENTINEL[®] SPECTRUM[®] (milbemycin oxime/lufenuron/praziquantel) is indicated for the prevention of heartworm disease caused by *Dirofilaria immitis*; for the prevention and control of flea populations (*Ctenocephalides felis*); and for the treatment and control of adult roundworm (*Toxocara canis*, *Toxascaris leonina*), adult hookworm (*Ancylostoma caninum*), adult whipworm (*Trichuris vulpis*), and adult tapeworm (*Taenia pisiformis*, *Echinococcus multilocularis* and *Echinococcus granulosus*) infections in dogs and puppies two pounds of body weight or greater and six weeks of age and older.

Dosage and Administration

SENTINEL SPECTRUM should be administered orally, once every month, at the minimum dosage of 0.23 mg/lb (0.5 mg/kg) milbemycin oxime, 4.55 mg/lb (10 mg/kg) lufenuron, and 2.28 mg/lb (5 mg/kg) praziquantel. For heartworm prevention, give once monthly for at least 6 months after exposure to mosquitoes.

Dosage Schedule

Body Weight	Milbemycin Oxime per chewable	Lufenuron per chewable	Praziquantel per chewable	Number of chewables
2 to 8 lbs.	2.3 mg	46 mg	22.8 mg	One
8.1 to 25 lbs.	5.75 mg	115 mg	57 mg	One
25.1 to 50 lbs.	11.5 mg	230 mg	114 mg	One
50.1 to 100 lbs.	23.0 mg	460 mg	228 mg	One
Over 100 lbs.	Administer the appropriate combination of chewables			

To ensure adequate absorption, always administer SENTINEL SPECTRUM to dogs immediately after or in conjunction with a normal meal.

SENTINEL SPECTRUM may be offered to the dog by hand or added to a small amount of dog food. The chewables should be administered in a manner that encourages the dog to chew, rather than to swallow without chewing. Chewables may be broken into pieces and fed to dogs that normally swallow treats whole. Care should be taken that the dog consumes the complete dose, and treated animals should be observed a few minutes after administration to ensure that no part of the dose is lost or rejected. If it is suspected that any of the dose has been lost, redosing is recommended.

Contraindications

There are no known contraindications to the use of SENTINEL SPECTRUM.

Warnings

Not for use in humans. Keep this and all drugs out of the reach of children.

Precautions

Treatment with fewer than 6 monthly doses after the last exposure to mosquitoes may not provide complete heartworm prevention. Prior to administration of SENTINEL SPECTRUM, dogs should be tested for existing heartworm infections. At the discretion of the veterinarian, infected dogs should be treated to remove adult heartworms. SENTINEL SPECTRUM is not effective against adult *D. immitis*.

Mild, transient hypersensitivity reactions, such as labored breathing, vomiting, hypersalivation, and lethargy, have been noted in some dogs treated with milbemycin oxime carrying a high number of circulating microfilariae. These reactions are presumably caused by release of protein from dead or dying microfilariae.

Do not use in puppies less than six weeks of age.

Do not use in dogs or puppies less than two pounds of body weight.

The safety of SENTINEL SPECTRUM has not been evaluated in dogs used for breeding or in lactating females. Studies have been performed with milbemycin oxime and lufenuron alone.

Adverse Reactions

The following adverse reactions have been reported in dogs after administration of milbemycin oxime, lufenuron, or praziquantel: vomiting, depression/lethargy, pruritus, urticaria, diarrhea, anorexia, skin congestion, ataxia, convulsions, salivation, and weakness.

To report suspected adverse drug events, contact Novartis Animal Health at 800-637-0281 or the FDA at 1-888-FDA-VETS.

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