CARDIAC DISEASE IN FERRETS

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Cardiac disease is common in middle-aged and older domestic ferrets (*Mustela putorius furo*). While congestive (dilated) cardiomyopathy is the most common heart disorder in ferrets, hypertrophic cardiomyopathy and valvular disease are also known to occur. Ferrets are also susceptible to heartworm disease. It is important to be able to recognize cardiac disease in the ferret and identify and treat other disease processes that often occur concurrently.

CLINICAL SIGNS

Clinical signs of cardiac disease vary in the ferret. Generally speaking, ferrets either present for some other non-cardiac problem and the finding is incidental, or ferrets present in fulminant heart failure. Ferrets that present in heart failure are tachypneic, dyspneic, and weak. Difficulty walking in the rear legs is common. Ferrets in heart failure can clinically resemble ferrets with hypoglycemia from insulinoma and/or dyspnea from thoracic lymphosarcoma.

DIAGNOSIS

There are several diagnostic tests that should be performed on a ferret with suspected heart disease. Because of the high incidence of concurrent disease in the ferret, e.g. insulinoma or adrenal disease, screening blood tests (complete blood count and biochemistry) should be done in all cases.

Standard two-view radiographs are generally necessary in the diagnosis of heart disease. Ferrets can be difficult to restrain for radiographs but isoflurane sedation can be used for the wigglers or the highly stressed. It is important to include the mediastinum in all cases as lymphosarcoma (with mediastinal mass) is an important differential in the dyspneic ferret. The normal ferret heart is slightly globoid and is located between the sixth and eighth intercostal space. The right ventricle is slightly in contact with the sternum (visible best in lateral views), and the apex lies 10 mm from the diaphragm, but can be obscured by pericardial fat. The heart size can be calculated by the use of a modified vertebral heart score, which utilizes vertebral body size to compare size of length and width of the cardiac silhouette. (Stepien 1999).

With congestive heart failure, there usually is an enlarged, globoid heart and tracheal elevation. Pleural effusion may be present and in some cases, is so extensive that the heart is not visualized. One should be tentative with the initial diagnosis in cases of severe effusion, there may be an imperceptible mediastinal or heart base mass. Varying degrees of pulmonary edema are often present. The liver and spleen are usually enlarged from passive congestion. Ascites can be mild to severe in some cases. Hypertrophic hearts may appear normal on thoracic films.

Electrocardiography can provide important information but can be difficult to perform in most ferrets. The average ferret rigorously rejects ECG clips; use soft clips or isoflurane sedation to perform the test. The normal heart rate for the unanesthetized ferret is 180-250 bpm. Normal ferret ECG’s resemble canine patients in that there are typically small P waves and very tall R waves. Sinus arrhythmias are common and can be very pronounced in the normal ferret. Ferrets with cardiac disease may have a sinus rhythm or may be in sinus tachycardia. Atrial or ventricular premature contractions may be noted. Heart block (1^o or 2^o) is a common ECG abnormality.

Echocardiography is the most important part of the cardiac workup in the ferret. Twodimensional sonography provides information on the size, shape, and function of the chambers. It can also determine if an underlying mass is present. Pleural and pericardial effusions are readily seen. M-mode echocardiography provides indices of systolic function and allows measurement of chamber and wall thickness. Normal values have been published for ferrets (Stepien 2000). Color-flow Doppler can be used to visualize the direction and turbulence of blood flow into and out of the chambers. Pulsed-wave or continuous-wave Doppler can then be applied to assess blood flow velocity.

THERAPEUTIC AGENTS

In general, treatment for heart disease in ferrets follows the same therapeutic guidelines used in dogs and cats. Pharmacokinetic studies have not been done for cardiovascular drugs in ferrets; scaling down doses already in use for dogs or cats works well clinically.

Furosemide at 2-4 mg/kg IM or IV q 8-12h is used initially for ferrets in fulminant myocardial failure and at 1-2 mg/kg PO q 12h for long term maintenance therapy. Generic furosemide is commercially available in a 10 mg/ml elixir. Vasodilators are an important part of cardiac therapy. Nitroglycerin 2% cream is a venous dilator that reduces preload to the heart. It is useful for the first 24 hours of therapy for cardiac failure and is used at 1/8” strip applied to the inside of the pinna q 12h. Angiotensin converting enzyme (ACE) inhibitors like enalapril, captopril, or benazapril should be started as soon as oral medicating is tolerated. ACE inhibitors have shown to decrease clinical signs and mortality rates in dogs and people and can be beneficial early in the course of cardiac disease. Enalapril is used at 0.25-0.5 mg/kg PO q 24h initially and can be increased to twice daily dosing if tolerated well. Ferrets seem to be very sensitive to vasodilators and can become quite lethargic if hypotensive. Enalapril (Enacard, Merck & Co) is available in a 1 mg veterinary tablet, making it easy to dose a ferret with 1/4-1/2 tablet depending on weight. Compounding pharmacies routinely make suspensions for use in small mammals and are also very convenient to use. Care should be taken when using diuretics and ACE inhibitors together in renal patients. Renal blood work monitoring and scaling down of doses is indicated in some patients. Benazapril may be an alternative choice for renal patients. Keep in mind that all
cardiac drug use is off-label and clinically untested in ferrets.

Digoxin is a positive inotropic drug that stimulates the myocardium and depresses the atrioventricular node during supraventricular tachyarrhythmias. It is commercially available in a pediatric elixir (0.05 mg/ml, Lanoxin®, Burroughs-Wellcome) that works well in ferrets with dilated cardiomyopathy at 0.01 mg/kg q 24h initial dose. The digoxin dose can be gradually increased to twice daily if needed. Care should be taken to prevent digoxin toxicity, although this is rarely seen clinically. Digoxin levels can be monitored following dog/cat protocols for blood sampling and interpretation.

Thoracocentesis is beneficial in dyspneic animals with pleural effusion. Fluid samples should be submitted for cytological examination because mediastinal lymphosarcoma is an important differential for pleural effusion. Thoracic radiographs can be repeated following thoracocentesis and diuretic therapy. Oxygen therapy is usually indicated for ferrets in heart failure. Hypothermia must be monitored and controlled.

DILATED CARDIOMYOPATHY

Dilated (congestive) cardiomyopathy is the most common heart disease in the ferret. The etiology is unknown. Most affected ferrets are over 3 years of age at the time of diagnosis. In the author's practice, most of the cases that present with overt signs of heart failure have dilated cardiomyopathy. Radiographs reveal cardiomegaly and varying degrees of pulmonary edema and pleural effusion. Ascites is possible. Diagnosis cannot be made based on radiographs alone. Echocardiography usually shows left atrial enlargement and right ventricular dilation, similar to the disease in cats. Contractility can be poor. Mitral regurgitation is common and tricuspid regurgitation is seen occasionally. Treatment is similar to the protocol used in cats: furosemide, enalapril, and digoxin. Ferret owners should be instructed to use only a high quality commercial ferret formulation and to avoid table food treats that may be high in salt and sugar. Taurine is considered ineffective but can be supplemented if the ferret has been on an inappropriate diet.

Long term prognosis for ferrets with dilated cardiomyopathy is guarded. With early diagnosis and proper therapy, many of these ferrets can have a good quality of life for many months and even years.

HYPERTROPHIC CARDIOMYOPATHY

Hypertrophic cardiomyopathy is not as frequently diagnosed as the dilated form of the disease. Clinical signs are often vague; the ferret may be asymptomatic, or have varying degrees of lethargy, or experience sudden death. Acute thromboembolic disease has not been reported in the ferret with cardiomyopathy, although anecdotally, the Animal Medical Center in New York, had one confirmed case of this. Cardiac auscultation may reveal an arrhythmia or a murmur. These ferrets are often tachycardiac (> 280 bpm). Some ferrets do not have auscultable cardiac abnormalities. Cardiomegaly may or may not be present radiographically. The author has had several cases where the cardiomyopathy was subclinical until 24 hours following abdominal surgery at which time the ferrets irreversibly "crashed." Diagnosis is best achieved with echocardiography. The etiology of hypertrophic cardiomyopathy is unknown in ferrets but is not related to hyperthyroidism as it is in the cat.

Treatment of hypertrophic cardiomyopathy is similar to that in feline patients. Beta-adrenergic blocking drugs (atenolol @ 3-6 mg PO q 24 h) or calcium channel blockers (diltiazem @ 3.75-7.5 mg PO q 12h) are useful to reduce heart rate, and improve cardiac function. Prognosis is guarded.

HEARTWORM DISEASE

Ferrets in heartworm endemic areas are susceptible to filariasis. Dirofilaria immitis infection can result in severe cardiac disease in the ferret. Because of the relatively small ferret heart, even a very low parasite burden (one or two worms) can have serious consequences.

Ferrets with natural infections are not always microfilaremic. Heartworm testing kits utilizing the enzyme-linked immunosorbent assay (ELISA) antigen test should be used (SNAP Heartworm Antigen Test kit, Idexx Laboratories). This test detects only female heartworm protein, and it may not be accurate in all cases. Ultrasound may show the nematodes within the right ventricle or vena cava, but it is an unreliable diagnostic test for dirofilariasis.

Treatment of dirofilariasis in ferrets is possible but carries a guarded prognosis. Success depends on early diagnosis and long term (4 months) antithrombotic (prednisone at 1.0 mg/kg q 24h) therapy following adulticide treatment using mellaromine dihydrochloride (Immiticide, Rhone-Merieux) or thiacetarsamide sodium (Carparsolate). Anectodotally, moxidectin (Proheart 6, Fort Dodge Animal Health) has shown potential as both a preventative and an adulticide but has recently been pulled off the market for further FDA evaluation. Post therapy heartworm testing (ELISA) should be performed at 3 months and if positive, repeated monthly until negative. The successfully treated ferret should be negative at 4 months. It should be noted that any ferret with heartworm disease carries a guarded prognosis for successful treatment.

Prevention is best achieved by use of ivermectin at 0.02 mg/kg PO or SQ monthly to prevent maturation of the third stage of larval development. The feline heartworm oral ivermectin (Heartgard-30, and Heartgard Feline, Merck and Co.) can be dosed at 1/4 tablet PO monthly. These tablets cannot be reused once removed from the wrapper and broken into quarters. The 1% bovine preparation (Ivomec, Merck) can be used orally following dilution with propylene glycol to achieve a 0.1 mg/ml solution. The suspension should maintain potency until the expiration date of the ivermectin if kept in an amber bottle and protected from light.
References


