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HEART OF THE ISSUE

When a heart murmur is detected, the veterinary team should consider potential causes beyond heart disease.

Abstract

The clinical relevance of heart murmurs in cats is important to understand. The absence of a heart murmur is not a good indicator of the absence of disease, as many cats with cardiac disease do not have an appreciable murmur, while the presence of a murmur may be secondary to noncardiac conditions such as fever, anemia, or hyperthyroidism. While some murmurs can point toward congenital disease or hypertrophic obstructive cardiomyopathy, many murmurs in cats have largely been attributed to physiologic flow anomalies or dynamic right ventricular outflow tract obstructions, which are of no clinical relevance.



CARDIOLOGY

Clinical Relevance of Heart Murmurs in Cats

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Understanding the clinical significance of heart murmurs—or their absence—in feline patients can aid veterinary nurses in appreciating the risk of congestive heart failure versus other cardiac diseases, especially in patients that are hospitalized on fluid and/or steroid therapy, undergoing surgery, or presenting for respiratory distress. It is likewise important to understand noncardiac causes of heart murmurs in cats, such as anemia, fever, hyperthyroidism, and lactation, when assessing the importance of blood analysis. Client education also benefits when veterinary nurses demonstrate knowledge of feline heart murmurs and their causes and medical significance.

HEART SOUNDS

The normal cardiac sounds are S_1 , the closing of the mitral and tricuspid valves at the beginning of systole, and S_2 , which is the sound of the aortic and pulmonary valves closing. Together, these are the “lub-dub” sound that can be heard with a stethoscope. Variations of the “lub-dub” may indicate turbulent blood flow and are known as heart murmurs, some of which are more easily auscultable than others.

Heart Murmurs

Heart murmurs are caused by blood “vibrating” as it travels through the heart. Blood vibrates when it does not follow the typical pathway of forward

Take-Home Points

- Heart murmurs in cats can be misleading in regard to the presence of disease.
- Many cats with underlying cardiomyopathy do not have heart murmurs.
- Hypertrophic cardiomyopathy, the most common acquired cardiac disease in cats, does not produce a heart murmur.
- Many cats have physiologic flow murmurs or dynamic right ventricular outflow obstructions that are benign.
- Patients with anemia, hyperthyroidism, or fever as well as nursing mothers can all have heart murmurs.
- Ventricular septal defects produce louder murmurs when they are smaller, thus proving that murmur volume does not always equate to severity of disease.
- Caution should be used with steroids or fluid therapy in many feline patients if heart disease was not ruled out with echocardiography.
- Only echocardiography can truly identify heart disease in cats.



movement. Heart murmurs are described based on whether they are heard during systole, diastole, or both, as well as how they sound throughout those phases. Systolic murmurs are heard as the tricuspid and/or mitral valves close, while diastolic murmurs are typically heard when the aortic valve closes. Diastolic murmurs are rare. The point of maximum intensity (PMI) is where the murmur is loudest and can raise suspicion for underlying disease. For example, a feline patient with a very loud murmur heard loudest on the right may have a ventricular septal defect (VSD) with a left-to-right shunt.

Heart murmurs are classified as either organic or physiologic. Physiologic murmurs are present in the absence of cardiac disease, while organic murmurs indicate the presence of heart disease.¹ Regardless of origin, a heart murmur is always an abnormal finding during a physical examination.

Heart murmurs are graded on a scale from 1 to 6, with 1 being the softest. Because grade 1/6 and 2/6 murmurs are soft, they can be difficult to hear, especially in a feline patient whose resting heart rate is more elevated than a dog's. Grade 3/6 murmurs are typically easily heard on first placement of the stethoscope. Grades 4/6 through 6/6 sound similar

with a stethoscope; palpation of a precordial thrill—the vibration felt when placing a hand over the patient's heart—differentiates a 5/6 murmur from a 4/6 murmur. A 6/6 heart murmur can be heard without the aid of a stethoscope. Several factors can influence the audibility of heart murmurs in cats, such as obesity, purring, hissing, or growling, as well as noisy surroundings. Although the presence of a heart murmur in a feline patient can be misleading, echocardiography should always be recommended to rule out disease.

Other Heart Sounds

During the physical examination, it is essential to listen for any additional heart sounds or arrhythmias as well as heart murmurs. For example, auscultation of an S_4 gallop rhythm is typically indicative of ventricular stiffness secondary to the left ventricular hypertrophy present in hypertrophic cardiomyopathy (HCM), the most common acquired heart disease in cats.²

A gallop rhythm may be an important indicator that underlying cardiac disease exists, although it has been reported in cats with seemingly normal echocardiograms. A gallop rhythm is heard as a third and/or fourth heart sound (S_3 and/or S_4) during

Cardiomyopathy as a Cause of Heart Murmurs

Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy (HCM) is the most common myocardial disease in cats.² In Maine coons and ragdolls, it is known to be heritable, and genetic predisposition is suspected in other breeds as well. Although it is most commonly diagnosed in middle-aged male cats, it is seen in cats of all ages and in females. Often, the first clinical signs are acute dyspnea and/or tachypnea secondary to heart failure. Occasionally, the first indication of HCM is sudden death, a risk in all cats with undiagnosed heart disease.

Without obstruction, HCM does not produce a heart murmur, as the nature of the hypertrophy

does not necessarily cause blood flow turbulence. Instead, the hypertrophy, which can be regional or symmetrical, leads to diastolic dysfunction that inhibits the ventricle's ability to fill. The increase in left ventricular diastolic pressure can lead to congestive heart failure.

If concentric hypertrophy develops, the mitral valve can move into the left ventricular outflow tract during systole, creating an obstruction that produces a murmur. This is referred to as SAM, or systolic anterior motion of the mitral valve. Echocardiography can be used to diagnose this condition, known as hypertrophic obstructive cardiomyopathy. β -blockers such as atenolol

are commonly prescribed to treat the obstruction, thereby reducing the intensity of the murmur.

Other Cardiomyopathies

Dilated cardiomyopathy (DCM), restrictive cardiomyopathy, and unclassified cardiomyopathy are less commonly diagnosed in cats, and arrhythmogenic right ventricular cardiomyopathy is extremely rare. These cardiomyopathies do not always produce an appreciable murmur, and if they do, it may be coming from a benign place in the heart. DCM is a disease of systolic dysfunction that can create a soft murmur as the ventricles dilate and prevent the atrioventricular valves from closing properly.

diastole, and it does not need to be accompanied by a heart murmur. S_3 is heard during ventricular filling and can suggest ventricular dilation, most commonly associated with dilated cardiomyopathy. An S_4 gallop sound is heard during atrial contraction.

Other abnormal heart sounds heard during physical examination include tachycardia, bradycardia, and premature beats, which could be either atrial premature contractions (APCs) or ventricular premature contractions (VPCs). While arrhythmias secondary to heart disease are appreciated more commonly in dogs, electrocardiography is needed to diagnose sinus tachycardia or bradycardia and to distinguish APCs from VPCs. A potential cause of true tachycardic arrhythmia (versus sinus) in cats is atrial fibrillation secondary to left ventricular enlargement. Another cause of true bradycardic arrhythmia in cats is atrioventricular block.

TYPES OF HEART MURMURS

Feline patients without heart murmurs can have underlying cardiac disease, while many with heart murmurs can have benign murmurs of no clinical significance. One study reported data on 780 apparently healthy cats; just under half (40.8%) had auscultable heart murmurs and of those, most (70.4%) were deemed to be functional flow murmurs.³

Benign Murmurs

Nonpathologic or “innocent” heart murmurs in cats are largely identified as physiologic flow murmurs or dynamic right ventricular outflow tract obstruction (DRVOTO).

Physiologic flow murmurs commonly have a crescendo–decrescendo sound, and their PMI is typically at the heart base near the great vessels, although PMI can be difficult to ascertain in cats. These benign murmurs can be heard in normal cats secondary to anemia, in lactating mothers, or in young animals, which commonly have a lower hematocrit. They are generally attributed to a mismatch in size between the aorta and left ventricle that creates turbulence in the left ventricular outflow tract.¹

In a study of 57 healthy cats, DRVOTO accounted for 16% of heart murmurs.⁴ DRVOTO in cats can also be iatrogenically produced by the clinician applying pressure against the right side of the chest with an



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ultrasound probe or firm pressure with a stethoscope. The pressure on the chest can compress the right ventricular wall toward the interventricular septum, which creates a systolic outflow obstruction.⁴ Careful auscultation methods are therefore important in obtaining accurate findings.

Pathologic Murmurs

Congenital

Congenital cardiac disease can be diagnosed in cats with heart murmurs by using echocardiography to determine the source of the murmur. VSDs can create very loud holosystolic murmurs when they are small and unlikely to cause a health problem for the patient. Such lesions typically sound louder on the right, assuming a left-to-right shunt. Larger VSDs are of more significance but produce a softer murmur. VSDs are commonly diagnosed congenital cardiac defects in cats, and softer murmurs are more concerning.⁵

While subaortic stenosis (SAS) and pulmonic stenosis (PS) are more common congenital findings in dogs, they do occur in cats, along with any combination of multiple but rare congenital diseases. Both SAS and PS have murmurs that are ausculted over the heart base, making them difficult to distinguish owing to the proximity of the aorta and pulmonary artery, coupled with the small stature of feline patients. When the gradient of obstruction is mild to moderate, surgical correction of either is often not recommended. Animals with severe SAS benefit most from palliative care such as β -blockers (e.g., atenolol), while patients with severe PS benefit from balloon valvuloplasty with the aim of reducing the gradient to mild or moderate.



Patent ductus arteriosus (PDA) can also occur in cats. This cardiac defect creates a very specific and nearly diagnostic continuous/machinery murmur, often with a precordial thrill. A PDA is the result of the ductus that bypasses the fetal lung failing to close normally after birth. Minimally invasive surgical options exist to correct PDA in cats, and once the defect is corrected, the murmur typically goes away and the patient can be expected to live a normal life span.

Acquired

Feline patients can develop aortic insufficiency, which can generate a heart murmur. The most common diagnostic differential for cats with aortic insufficiency and left ventricular hypertrophy is systemic hypertension. Naturally, in the face of systemic hypertension, ruling out hyperthyroidism becomes important, especially if a murmur is present. While uncommon, cats can also develop chronic valve disease or mitral insufficiency, which produces a holosystolic murmur.

Infective endocarditis is rare in cats and typically produces a diastolic heart murmur or a “to and fro” murmur that is auscultated in both systole and diastole. The latter murmur is distinguishable from a continuous murmur by being distinctly auscultated in both phases versus being continuous throughout. Patients with congenital heart diseases such as SAS and VSD are at higher risk for infective endocarditis. Infective endocarditis is diagnosed through a combination of physical examination, clinical signs, new or different/

louder heart murmur, visualization of a vegetative lesion on one or more valves on echocardiography, and blood culture.⁶

Rarely, turbulent blood flow can be secondary to neoplastic infiltration of the heart in cats. Lymphoma, the most common feline cardiac neoplasia, can infiltrate the myocardium, even mimicking HCM at times. Chemodectoma, hemangiosarcoma, and metastatic carcinoma have all been reported in cats.⁷

SUMMARY

It is important to understand the clinical relevance of heart murmurs in feline patients. In the absence of underlying cardiac disease, other systemic considerations such as anemia, fever, lactation, and hyperthyroidism can create murmurs, and many murmurs can be physiologic. The most common acquired disease in cats, HCM, does not create a heart murmur, although an S₄ gallop rhythm can sometimes be auscultated. It behooves the veterinary team to consider all of these factors when a murmur is detected in a cat, whether on routine examination, in the emergency setting, or when hospitalized on a constant rate of infusion or receiving steroids, as these therapies can push a stable cat with underlying disease into congestive heart failure. Due to the nature of most acquired heart disease in cats, the absence of a heart murmur is not a significant clinical indicator of the absence of cardiac disease. **TVN**

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