

Cardiac auscultation

Vets in small animal practice must make many decisions in the consulting room using the information gathered from clinical examination, writes Ruth Willis BVM&S DVC MRCVS RCVS, Recognised Specialist in Cardiology, Vets Now Referrals, UK. This article discusses normal and abnormal heart sounds referring to auscultation recordings from small animal patients

All heart sounds in this article can be found at: vetcpd.co.uk/audio-heart

NORMAL HEART SOUNDS

The normal heart sounds are caused by vibration of cardiac structures and also by movement of blood.

The first heart sound (S1) has a distinctive 'lub' sound and is loudest over the area where the apex beat is palpable. S1 occurs at the start of ventricular contraction and is caused by vibrations associated with atrioventricular valve closure.

The second heart sound (S2) is often described as a 'dub' and is loudest over the left cranial heart base. It is caused by the sudden reversal of flow at the time of aortic and pulmonic valve closure.

The third and fourth heart sounds (S3 and S4 respectively) are sounds associated with ventricular filling during diastole and are not usually audible in small animals. If S3/4 are audible in small animal patients then this usually suggests severe heart disease with impaired diastolic function.

TECHNIQUE FOR CARDIAC AUSCULTATION

Auscultation is often performed after clinical examination and therefore some indication of cardiac function has generally been established from parameters such as pulse quality and mucous membrane colour.

Many clinicians will start with the diaphragm of the stethoscope placed over the apex beat on the left side of the thorax and then the stethoscope is gradually moved craniodorsally noting that the volume of S1 decreases and S2 increases. This is then repeated over the right hemithorax. The bell of the stethoscope can be placed over the sternum and this can be useful for detecting gallop sounds in cats.

Audio 01 is a recording of normal heart sounds in a greyhound.

DESCRIBING HEART MURMURS

Abnormal heart sounds are known as murmurs. Murmurs are described according to their timing, loudness, point of maximal intensity (PMI) and also whether they are localised or radiate around the thorax.

1. Timing

Systolic murmurs occur between S1 and S2 and may be:

- Holosystolic – occurring between S1 and S2 resulting in a 'lub-sh-dub' sound; or
- Pansystolic thereby obliterating S1 and S2 and making a 'swoosh' sound.

Audio 02 is a recording of a pansystolic murmur in a dog with mitral valve regurgitation.

Diastolic murmurs are rare in small animals and occur between S2 and S1.

Continuous murmurs in young patients may be due to a left-to-right shunting patent ductus arteriosus and the murmur associated with this condition is classically heard throughout the cardiac cycle but the volume changes, as in *Audio 03*.

Gallop sounds are low-frequency sounds heard between S2 and S1 which can sound like 'lub-dub-doo' and, without an ECG, can be hard to distinguish from the sound made by a ventricular premature beat.

2. Loudness

Murmurs are graded out of six, with six being the loudest and one the quietest. This is obviously a subjective system strongly influenced by operator experience and training. Murmur loudness is sometimes, but not always, proportional to the severity of a condition (Hägström et al, 1995).

3. Point of maximal intensity

Murmurs associated with mitral valve regurgitation are classically loudest over the left hemithorax and murmurs associated with stenotic pulmonic or aortic valves loudest at the left base. Tricuspid regurgitation murmurs are generally loudest over the right hemithorax.

4. Radiation

Some murmurs may only be audible over a small area and therefore are termed 'localised', whereas others may be audible over a wider area.

HEART SOUNDS AND MURMURS

Heart murmurs in puppies

Heart murmurs are common in puppies and present a challenge to vets in practice as, understandably, owners and breeders are concerned about their potential significance.

The following cases demonstrate two common scenarios.

Case 1: Labrador cross puppy

A male Labrador cross puppy had a murmur detected at 12 weeks of age. The murmur was a soft grade 1-2/6, holosystolic murmur localised to the left heart base, as may be heard in *Audio 04*.

The puppy was active, showing no referable clinical signs and physical examination was otherwise normal so his owner elected to monitor him.

At six months of age the puppy was rechecked and the murmur was no longer present, suggesting that the murmur detected previously may have been an 'innocent' murmur.

Case 2: Golden Retriever puppy

A 13-week-old male Golden Retriever was referred for investigation of a harsh grade 4/6 systolic heart murmur, loudest over the left cranial heart base but radiating widely around the left hemi-thorax and also to the thoracic inlet and the right hemi-thorax.

Audio 05 is a recording of a stenotic murmur.

The puppy was reported to be active and growing well with no referable clinical signs. Physical examination was unremarkable apart from the heart murmur.

From a right parasternal long axis view, the left ventricular outflow tract and aortic valve appeared unremarkable (Figure 1) but, when imaged from the left parasternal and subcostal views, interrogation of the left ventricular outflow tract using colour flow and continuous wave Doppler revealed both a sub-valvular narrowing (Figure 2) and also a turbulent raised velocity blood flow.



Figure 1: Ultrasound. Subaortic stenosis. Right parasternal long axis view optimised for the left ventricular outflow tract. LV: left ventricle; Ao: aorta.



Figure 2: Ultrasound. Subaortic stenosis. Left parasternal apical view optimised to highlight the stenotic area just below the aortic valve. Echocardiography revealed a sub-aortic valve ridge causing moderate narrowing of the left ventricular outflow tract. Note the narrow area showing colour flow variance. Ao: aorta; LV: left ventricle.

KEY POINTS: MURMURS IN PUPPIES

Innocent murmurs are likely to be:

- Soft (grade 1-2/6)
- Localised often just to the left heart base
- They may be variable and only present on some occasions
- Generally absent by six months of age.

Pathological murmurs are likely to be:

- Loud systolic, diastolic or continuous
- Radiate widely
- Are of particular concern in an 'at risk' breed such as a Boxer, Golden Retriever, Newfoundland
- Puppies with heart murmurs which are thought likely to be pathological should be referred to a veterinary cardiologist for echocardiography to determine the cause and significance of the murmur.

The echocardiography findings are consistent with a diagnosis of moderate sub-aortic valve stenosis. Dogs with a stenosis of the severity seen here will often tolerate the lesion and have a normal lifespan, without showing referable clinical signs or requiring treatment. However, dogs with this condition should not be used for breeding as their offspring may be more severely affected. There is also a slightly increased risk of aortic valve endocarditis and therefore some clinicians advise prophylactic antibiotics before any potentially bacteraemic procedure.

HEART MURMURS IN CATS

Heart murmurs are common in cats, with one study reporting that 21 per cent of normal cats had heart murmurs and, conversely, only about 50 per cent of cats with cardiomyopathy will have a heart murmur (Côté et al 2004, Ferasin et al 2003).

This implies that the sensitivity and specificity of auscultation for detecting significant cardiac disease is lower in cats compared to dogs.

Careful history taking, physical examination, screening for systemic diseases such as hypertension and hyperthyroidism and also use of biomarkers such as NTproBNP can be useful when assessing cardiac status. However, echocardiography is often required to make a definitive diagnosis, as demonstrated by the following case.

Case 3: 10-year-old cat

A 10-year-old cat is presented for investigation of a heart murmur detected as an incidental finding. Routine haematology and serum biochemistry reveal no evidence of systemic disease. Blood pressure and total thyroxine concentration are within normal limits.

While there were no clinical signs referable to heart failure reported by the owner, it is important to remember that cats often have a sedentary lifestyle and are notoriously good at hiding clinical signs.

Audio 06 is a recording of the cat's grade 4/6 pansystolic heart murmur.

No adventitious lung sounds or gallop sounds were detected. Echocardiography demonstrated that this cat had hypertrophic cardiomyopathy with left atrial enlargement, suggesting that this cat was at or approaching the point of decompensation. See echo findings in Figure 3.

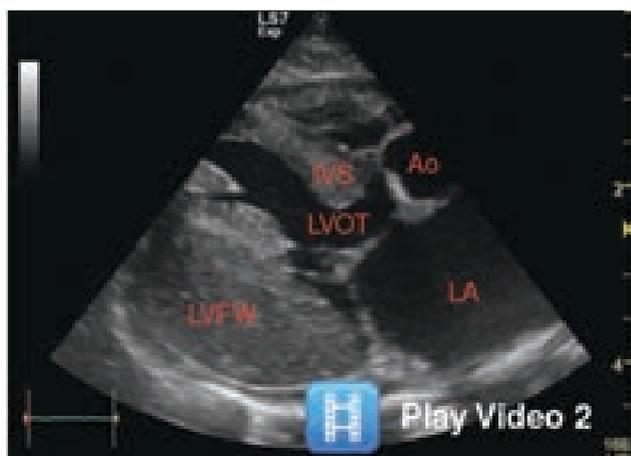


Figure 3: Echo – hypertrophic cardiomyopathy. This is a right parasternal long axis view demonstrating concentric hypertrophy of the left ventricular free wall and also the interventricular septum, especially in the region of the left ventricular outflow tract. LAFW: left ventricular free wall; IVS: interventricular septum; Ao: aorta; LA: left atrium; LVOT: left ventricular outflow tract.

Cats can also have variable murmurs due to intermittent systolic anterior motion (SAM) of the mitral valve, which may only occur during certain haemodynamic conditions. Murmurs associated with SAM are often more obvious while the cat is stressed and may become inaudible as the cat relaxes.

DYSRHYTHMIAS

Auscultation is also a means of detecting dysrhythmias which are often associated with cardiac disease. *Audio*

07 demonstrates a single premature beat in an elderly Cavalier King Charles Spaniel with myxomatous mitral valve disease causing a grade 4/6 pansystolic heart murmur loudest over the left hemithorax but radiating widely. Another common dysrhythmia especially encountered in large breed dogs is atrial fibrillation, which is generally a rapid chaotic rhythm associated with a pulse deficit and often a systolic heart murmur. Echocardiography is indicated in cases with atrial fibrillation to assess cardiac chamber dimensions and function.

SUMMARY

Auscultation is an important skill and by using recordings we can ensure that we are detecting and describing heart murmurs in a consistent way.

REFERENCES AND FURTHER READING

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Reader Questions and Answers

1: THE FIRST HEART SOUND (S1) IS CAUSED BY VIBRATIONS ASSOCIATED WITH:

- A: Atrioventricular valve closure and pulmonic and aortic valve opening
- B: Motion of the ventricular walls and acceleration of blood into the great arteries
- C: Reversal of flow when aortic and pulmonic valves close
- D: A and B
- E: A and C

2: THE SECOND HEART SOUND (S2) IS CAUSED BY VIBRATIONS ASSOCIATED WITH:

- A: Atrioventricular valve closure and pulmonic and aortic valve opening
- B: Reversal of flow when aortic and pulmonic valves close
- C: Motion of the ventricular walls and acceleration of blood into the great arteries
- D: A and C

3: DO ALL CATS WITH HEART DISEASE HAVE AN AUDIBLE HEART MURMUR?

- A: Yes
- B: No

4: DO ALL CATS WITH A HEART MURMUR HAVE HEART DISEASE?

- A: No
- B: Yes

5: AUDIO 11 ON VETCPD.CO.UK/AUDIO-HEART IS A RECORDING FROM A FOUR-YEAR-OLD CAVALIER KING CHARLES SPANIEL (CKCS). THE OWNER IS KEEN TO BREED FROM THE OFFSPRING OF THIS DOG AND, IN ACCORDANCE WITH BREED RECOMMENDATIONS, IS HAVING THE POTENTIAL GRANDPARENT CHECKED PRIOR TO MATING. IS A HEART MURMUR PRESENT?

- A: Yes
- B: No

ANSWERS: 1: D, 2: B, 3: B, 4: A, 5: A