

Cardiac Auscultation 101

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Assessment of murmurs in various ASYMPTOMATIC patient populations:

Patient	Possible differentials	Recommended diagnostics
Puppy or kitten with a soft systolic murmur	<ul style="list-style-type: none"> • <u>Innocent flow murmur</u> These murmurs tend to be soft left sided systolic murmurs that get softer with each subsequent vaccine visit and generally never loud or continuous. Innocent flow murmurs are likely a result of relative or real anemia and high heart rate commonly seen in very young patients. Be careful not to squeeze the chest too hard which might “create” a murmur. • <u>Congenital heart disease:</u> <ul style="list-style-type: none"> ○ Sub aortic stenosis (typically larger breed dogs, left basilar ejection quality murmur that radiates to right, weak pulses) ○ Pulmonic stenosis (typically smaller breed dogs, left basilar ejection quality murmur) ○ Ventricular septal defect (right sided systolic murmur) ○ Tricuspid valve dysplasia (right sided systolic murmur) 	<ul style="list-style-type: none"> • If the owners are committed to the puppy or kitten with soft systolic murmur, continued monitoring with serial auscultation is recommended. • If the murmur gets louder with the next visit or if the murmur is still present at 5-6 months of age, an echocardiogram is recommended. • If the murmur gets softer with each visit and goes away by 5-6 months of age, no action further action is needed. • Optional PCV/TS to rule out anemia.
Puppy or kitten with a loud systolic or continuous murmur	<ul style="list-style-type: none"> • A loud systolic murmur (\geq grade 4/6) is more worrisome for congenital heart disease. <ul style="list-style-type: none"> ○ See above ○ Patent Ductus Arteriosus is the most common congenital disease in the dog (continuous machinery murmur loudest at left base, hyperdynamic pulses) ○ Sub aortic stenosis and aortic insufficiency (continuous TO and FRO murmur loudest over the left base) 	<ul style="list-style-type: none"> • PCV/TS and Echocardiogram are recommended.
Young – mid adult dog with new onset murmur	<ul style="list-style-type: none"> • Could be either acquired or previously undetected congenital heart disease. • If large breed dog or at risk breed, concerned for dilated cardiomyopathy (DCM). • Whippets and Boxers may get “flow” murmurs from high LVOT due to a relatively small aorta and vigorous LV function. These high LVOT velocities are of uncertain significance. • Cavalier King Charles Spaniels and Daschunds not uncommonly get early onset mitral valve disease (MVD). 	<ul style="list-style-type: none"> • Echocardiogram • Optional chest radiographs • Optional PCV/TS
Young – mid adult cat with new onset murmur	<ul style="list-style-type: none"> • Hypertrophic cardiomyopathy (HCM) is the most likely cause. • Other possibilities include dynamic right ventricular outflow tract (flow right sided murmur), mitral valve regurgitation, other cardiomyopathy. • Lots of cats may have occult or silent HCM. 	<ul style="list-style-type: none"> • Echocardiogram • Optional NTproBNP and PCV/TS

Older small breed dog with left sided systolic murmur	<ul style="list-style-type: none"> • MVD is most likely cause. • Although there is not an exact correlation, the louder the heart murmur in a dog with suspect MVD, the more persuasive to be with diagnostics. 	<ul style="list-style-type: none"> • Chest radiograph • Optional echocardiogram • Blood pressure • Geriatric blood work • Optional BNP or NTproBNP
Older large breed dog with left sided systolic murmur	<ul style="list-style-type: none"> • Could be either MVD or DCM. • DCM murmurs are generally soft and arrhythmias are more common. 	<ul style="list-style-type: none"> • Echocardiogram • Chest radiographs • Blood pressure • Geriatric blood work • Optional BNP or NTproBNP
Older cat with new left sided systolic murmur	<ul style="list-style-type: none"> • Hyperthyroidism • Systemic hypertension • Hypertrophic Cardiomyopathy • Other Cardiomyopathy • Dynamic RVOT murmur or mitral valve regurgitation 	<ul style="list-style-type: none"> • Blood pressure • Geriatric blood work including thyroid hormone • Optional NTproBNP

Using your Stethoscope:

One of the keys to getting the most of your cardiac auscultation is proper understanding and use of your stethoscope. The main components of the stethoscope are the bell, diaphragm, tubing and earpieces. Many of the newer stethoscopes have the diaphragm and bell incorporated on the same side and one uses a light touch for the bell and a firm touch for the diaphragm. The bell transmits both low frequency and high frequency sounds. The diaphragm attenuates low frequency sounds and selectively transmits the high frequency sounds. The tubing should not be too long as sounds attenuate in the longer tubing. The earpieces should fit comfortably without entering the ear canals. Beware of oversized air-pillow type earpieces that collapse in your ears and actually dampen your ability to hear. A properly fitted stethoscope is real important to successful auscultation. In addition to a good stethoscope, a **quiet room and properly restrained patient are essential**. When ever possible, perform auscultation with the animal in a **standing position**. This is not always possible. Control respirations if possible by holding the mouth closed or occluding a nostril transiently. Sometimes, if the animal is overly excited, re-try auscultation after the animal relaxes. Purring and panting may interfere with accurate auscultation and maneuvers, for example, such as running tap water or the smell of alcohol on a cotton ball may stop the purring. Care should be taken not to confuse respiratory sounds, shivering or rubbing of the hair for heart sounds.

The majority of the auscultation should be performed with the diaphragm **firmly** placed on the chest. The bell is used to hear low frequency sounds such as gallop sounds or low frequency murmurs. The bell should be used with light pressure; too much pressure on the bell tightens the skin and creates a diaphragm. Auscultation with the bell should be used in animals with an extra heart sound (ausculted with the diaphragm), all cats (to screen for gallop sounds), and dogs suspected of cardiomyopathy or in congestive heart failure.

Develop a systemic approach to auscultation. I usually start my auscultation of the heart over the left apex beat in the dog and mid sternum in the cat. Where I put my stethoscope is guided by my hands on the chest. By starting my auscultation with my hands, I can feel for displacement of the cardiac impulse (right heart beat feels stronger than the left), a palpable thrill and it will identify where I start my auscultation. Determined heart rate and rhythm and correlate it to the femoral pulse. **Auscult over all valve areas** for any abnormal heart sounds.

After listening to the heart with the stethoscope, **auscult the lungs as a mentally separate process than the heart**. Note respiratory rate, effort and character of the breath sounds. Both left and right hemithorax should be ausculted systematically with the diaphragm of the stethoscope. In an animal with breathing abnormalities, I usually divide the lungs into 4 quadrants (cranial-ventral, cranial-dorsal, caudal-ventral and caudal-dorsal). If

there are no breathing abnormalities then just listening to right and left hemithorax should suffice. I listen for both the loudness of the breath sounds and for any abnormal breath sounds such as crackles or wheezes in each of these quadrants. Remember that one cannot properly assess breath sounds in a panting dog or purring cat.

Normal heart rate and rhythm:

Certainly heart rate can vary in a normal animal depending on the state of excitement and fitness. Sometimes true resting heart rates can only be determined in the home environment by the owner. In general, heart rate increases with excitement, pain, shock, hyperdynamic states (anemia, fever, hyperthyroidism) and congestive heart failure of various etiologies. Slow heart rates may be noted in athletic animals, hypothyroidism, hypothermia, increases in vagal tone or a conduction abnormality of the heart (sick sinus syndrome, advanced AV block).

Normal heart rate (dog) = 60 – 160 per minute

Normal heart rate (cat) = 140 – 220 per minute

Tachycardia = increased heart rate

Bradycardia = decreased heart rate

Heart rhythm is typically regular in cats and dogs. However, **many normal dogs (especially brachycephalic breeds) have respiratory sinus arrhythmia**. In respiratory sinus arrhythmia, the heart rate increases with inspiration and decreases with expiration. Sinus arrhythmia is not normal in a cat in the clinic.

Areas of cardiac auscultation:

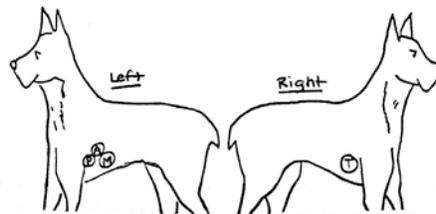
There are four main areas for cardiac auscultation (see figure):

Mitral valve (left atrioventricular valve) = left 5th intercostal space around the costal-chondral junction and in the normal animal = the area of the apex beat. Usually in the standing animal, the area opposite to the point of the elbow. First heart sounds heard better at MV.

Aortic valve = left 4th intercostal space dorsal to the MV (usually the level of the point of the shoulder). Second heart sound heard better at AoV and PV.

Pulmonic valve = left 3rd intercostal space at the sternal border. (Usually at the axilla).

Tricuspid valve (right atrioventricular valve) = right 3rd to 4th intercostal space at the costal-chondral junction.



Normal heart sounds:

The intensity of normal heart sounds may be increased with conditions such as thin body condition, young age, and hyperdynamic states (anemia, fever, hyperthyroidism). The intensity may also be decreased with obesity or heavily muscled animal, in addition, to more pathologic conditions such as pericardial effusion or pleural effusion.

First heart sound (S₁) is associated with the closure of the AV valves (lub) and is typically loudest over the mitral and tricuspid valve areas. Pulse occurs just after S₁.

Second heart sound (S₂) is associated with the closure of the semilunar valves (pulmonic and aortic valves) (dub) and is typically loudest over these valve areas.

Transient heart sounds:

These are short duration extra heart sounds and include:

Split S₁: asynchronous closure of the AV valves. May be a normal variant in a large breed dog. Other causes include a ventricular premature complex or bundle branch block.

Split S₂: asynchronous closure of the pulmonic and aortic valves. Associated conditions include heartworm disease or other causes of pulmonary hypertension, pulmonic stenosis, aortic stenosis, and atrial septal defects.

Mid-systolic click: high frequency sound in the middle of systole usually associated with early mitral valve disease. May precede a murmur in some animals.

S₃ gallop: low frequency, diastolic sound associated with rapid ventricular filling. Abnormal in the small animal patient and represents ventricular stiffness. Common associated condition is dilated cardiomyopathy.

S₄ gallop: low frequency, diastolic sound associated with atrial contraction. Abnormal in the small animal and represents ventricular stiffness. Common associated condition is hypertrophic cardiomyopathy.

Heart murmurs

A heart murmur is produced by an interruption of laminar blood flow, in other words, turbulent blood flow. The majority of heart murmurs are caused by a lesion in the heart causing turbulence. However some murmurs may be physiologic such as murmurs associated with severe anemia or hemorrhagic shock. **Murmurs are classified by their timing in the cardiac cycle, intensity, location (or point of maximum intensity or PMI), quality (subjective), phonographic configuration and frequency.** (See figures)

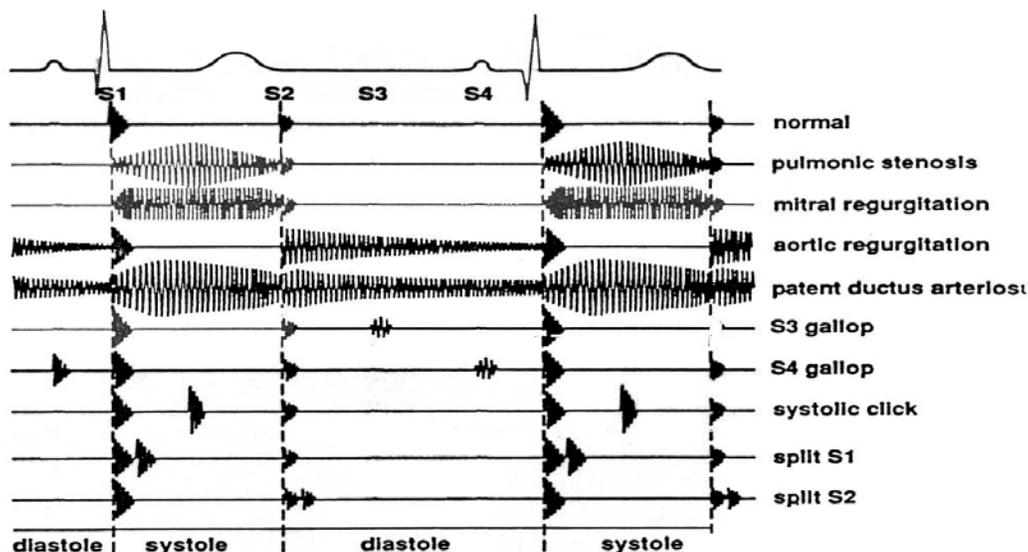
Timing:

Systolic murmur: occurs during systole, (with pulse). These murmurs are heard between the first and second heart sounds. Most murmurs are systolic and associated conditions include mitral and tricuspid valve insufficiency, aortic or pulmonic stenosis and ventricular septal defect.

Diastolic murmur: occurs during diastole (after the pulse), occurs after the second heart sound. Diastolic murmurs are rare and occur most commonly with aortic insufficiency.

Continuous murmur: occurs throughout systole and diastole. PDA is the most common cause of a continuous murmur.

One could further classify the timing of the murmur by commenting on the duration and position in the cardiac cycle such as holosystolic (entire systole), versus early-, mid-, or late systolic murmurs.



Intensity:

This is a subjective determination of the loudness of the murmur. In most cases, murmur intensity doesn't correlate with the severity of the heart disease. They are usually graded on a scale of I – VI

Grade I - very faint murmur requiring concentration and quiet room to be heard

Grade II - soft murmur that is consistently ausculted over only 1 valve area

Grade III - moderate intensity murmur, readily auscultable usually radiating to another valve area.

Grade IV - loud murmur without a precordial thrill, usually radiates to both sides of the chest

Grade V - loud murmur with a precordial thrill (palpating the vibration on the chest wall caused by the murmur)

Grade VI - loud murmur with a precordial thrill and still audible with the stethoscope off the chest wall

Location:

Note the valve area where the murmur is heard best or point of maximum intensity (PMI). Also note where the murmur radiates. In some cases of severe sub-aortic stenosis, the murmur can radiate up the carotid arteries.

Quality:

Regurgitant quality (plateau-shaped) murmurs are the most common and are associated with AV valve insufficiency. (See figure)

Ejection quality (crescendo – decrescendo or diamond shaped) murmurs are associated with aortic and pulmonic stenosis. (See figure)

Machinery quality murmur is a continuous murmur most commonly associated with PDA.

Decrescendo murmur is most commonly associated with ventricular septal defect or AV valve insufficiency.