



Cardiac murmurs



Károly Vörös, Jan Ehlers, Christin Kleinsorgen, Ingo Nolte

*Department and Clinic of Internal Medicine, University of Veterinary Medicine Budapest, István u. 2., 1078 Budapest, Hungary
ice President Witten/Herdecke University, Faculty of Health, Personality Psychology and Diagnostics, Alfred-Herrhausen-Straße
50; D-58448 Witten, Germany*

*ZELDA Centre for E-Learning, Didactics and Educational Research, University of Veterinary Medicine Hannover, Foundation,
Bünteweg 2; D-30559 Hannover, Germany*

Small Animal Clinic of the Veterinary University of Hannover, Foundation, Bünteweg 9, D-30559 Hannover, Germany



[Canine murmurs](#)

[Grading system of canine heart murmurs according to murmur intensity](#)

[Examples of canine heart diseases with cardiac murmurs](#)

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Brief description of cardiac murmurs

Turbulent flow in the heart or in the large vessels adjacent to the heart causes sounds of longer duration, termed cardiac murmurs. Both high velocity and low viscosity of the blood can cause murmurs, as well as flow from a narrow diameter area into a larger area. In a healthy animal, the blood flows through the cardiovascular compartments with laminar flow, where all particles in the blood move in the same direction. In case of turbulence, the flow causes vibrations of the tissues and this will be heard as murmur.

Innocent murmurs are occasionally noted in puppies. Typically, a soft systolic ejection-type murmur is heard over the outflow area. It is caused by the stroke volume, which is relatively larger than the size of the great vessels in puppies, in comparison to adult dogs. Innocent murmurs usually disappear by the age of 4 (to 6) month of age.

Pathological murmurs are caused by interruption of the normally laminar flow in the heart or the adjacent vessels. They can be caused by high velocity flow or by flow from a restricted area into a wider one, creating a turbulent flow.

Types and classification of cardiac murmurs in dogs

To describe cardiac murmurs, six main characteristics are used: the *timing* within the cardiac cycle, the *intensity*, the *point of maximal intensity* (PMI), the pattern of *radiation* across the thorax, the *quality* and the *pitch*.

The timing of a murmur is described as systolic or diastolic or both. Further subdivision includes proto-, meso- and telesystolic, for murmurs occurring in early, middle or late systole respectively, and protodiastolic for early diastolic murmurs. The terminology holosystolic/holodiastolic is used for murmurs occurring between S1 and S2 while pansystolic/pandiastolic refer to murmurs including the two heart sounds. Murmurs heard at the very end of diastole are termed presystolic. A typical, continuous (i.e. systolic-diastolic) murmur, which is also called machinery-like or machinery murmur can be heard during patent ductus arteriosus (PDA).

The intensity (loudness) of a murmur is graded on a semi-quantitative scale from 1 to 6 which is widely accepted in standard veterinary textbooks. As shown in the illustration of gradings above, palpating a precordial thrill and removing the stethoscope belong to the description of murmur intensities. The term precordial thrill (fremitus cordialis) is used for the focal buzzing sensation against the hand when palpating the cardiac area of a dog with a very strong cardiac murmur with its vibrations being transmitted even to the thoracic wall. These descriptions cannot be applied when simply listening to the digitalized heart sounds off-line without examining the patient. However, these parameters were not even used but only the loudness of the murmur when this system was originally introduced into the human cardiology by Levine and Freeman in 1933.

The point of maximal intensity (PMI, Latin: punctum maximum) is first described by determining the left or the right side of the thorax and then either by the number of the relevant intercostal space or by the terms cardiac apex and base. For dogs, the PMI for the pulmonary area is the 3rd to 4th intercostal space on the left side, at the costochondral junction. The aortic area can be best

auscultated if the stethoscope is moved to the 4th-5th intercostal space on the same side, just below the level of the shoulder. Still on the left side, the 5th intercostal space at the level of costochondral junction should be auscultated for the PMI of the mitral area. On the right side, the PMI for the tricuspid area can be found over the 4th intercostal space at the level of the costochondral junction. This type of separation for the points of maximal intensities (Latin: puncta maxima) is applicable for medium-sized and large dogs. In small dogs and cats the terms apical (sternal) or heart base locations can be used.

To be able to properly describe **the radiation** of the murmur, the entire thorax, the thoracic inlet and the areas over the carotid arteries should be carefully auscultated. Radiation can give important information, since it is usually characteristic to the origin of the murmur like in aortic stenosis when the murmur often can be heard in the thoracic inlet above the carotid arteries. The path of the abnormal blood flow should be considered when finding the source of the radiating murmur.

The quality and pitch of a murmur relate to its various frequency components. Murmurs are usually of higher frequency than transient sounds. Noisy or harsh murmurs contain mixed frequencies, this type of murmurs are most common. Musical murmurs are of essentially one frequency with its overtones. The quality and pitch of a murmur is described as soft, harsh or musical. The frequency can be low (50-100 Hz), medium (100-200 Hz) or high (400-500 Hz). Mixed frequency sounds are however the most common heard. These frequency categories are based on phonocardiographic analyses and can only be roughly estimated by auscultation.

If a phonograph (phonocardiogram) is used for sound analysis, the murmur can further be described by its shape. A plateau murmur, like in mitral/tricuspid insufficiency, has a uniform intensity, whereas a decrescendo murmur (e.g. in aortic insufficiency) decreases in intensity. A crescendo-decrescendo murmur is diamond-shape and it will go from soft to high intensity and then tapers off. This is also known as an ejection murmur, since it occurs during blood ejection, e.g. in case of ventricular outflow obstruction. A continuous, machinery-like murmur typical for patent ductus arteriosus (PDA) varies in intensity but is heard throughout both systole and diastole. Rarely is it possible that both holosystolic and diastolic decrescendo murmurs can be heard but it is not considered to be a real continuous murmur. This type of murmur can be produced by a ventricular septal defect (VSD) together with aortic insufficiency. Continuous murmurs can also be confused with the so-called *to and fro* murmurs when a mid-systolic (ejection) and a diastolic decrescendo murmur occur together. A typical cause of this murmur is aortic stenosis with concurrent aortic insufficiency. Although there are minor auscultatory differences among the aforementioned systolic-diastolic murmurs, the safest way to differentiate them and concluding the cardiological diagnosis relies upon phonocardiography or even though on echocardiography.

Literature

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