General Auscultation of Large Animals

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Auscultation is defined as the act of listening for sounds within the body (11). It is used chiefly to detect sounds connected with the lungs, heart, pleura, and areas of the abdomen. Until recent years, immediate auscultation, that is placing the ear directly on the part, was the common means of detecting sounds. Today a stethoscope is usually employed in routine auscultation examinations.

Although Laennec is usually credited with the original use of auscultation, Robert Hooke (1635-1703) nearly a century and a half earlier included in his writings the following: "There may also be a possibility of discovering the internal motions and actions of bodies—whether animal, vegetable, or mineral, by the sound they make; that one may discover the works performed in the several offices and shops of a man's body, and thereby discover what instrument or engine is out of order—in plants one might discover by the noise of pumps for raising the juice, the valves for stopping it—methinks I can hardly forbear to blush when I consider the most part of men will look upon this—I have been able to hear plainly the beating of a man's heart—to their becoming sensible they require—that the organ be made more nice and powerful to sensate and distinguish them." (43).

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In order to use auscultation to its greatest advantage an understanding of some of the basic phenomena of sound is essential. Sound is mechanical wave motion in an elastic medium. One complete sinusoidal wave from crest to crest is termed a cycle. The frequencies of audible sound waves lie between about 20 cycles per second (c./s.) and 20,000 c./s., while audible heart sounds range from about 50 c./s. to 650 c./s. The production of sound waves requires a mechanical disturbance (the source) and an elastic medium through which the disturbance can be transmitted. Generally speaking the denser the transmission medium the better the transmission. Thus bronchial sounds will be heard better through consolidated lung than through lung affected with generalized emphysema.

The intensity of a sound is defined as the power a sound wave transmits through a unit area normal to the direction of propagation. Intensity is related to loudness in that loudness is, generally speaking, a physiological assessment of intensity. It should be remembered that intensity decreases by the square of the distance, thus a small change in the distance of the stethescope head from the sound source will greatly affect the intensity. A musical sound is composed of a complex group of sound waves with some semblance of regularity; a noise has no semblance of regularity and consists of a series of random displacements. Sounds heard in routine auscultation are usually noises.

Careful auscultation of the heart is essential for a thorough physical examination. The first sound is heard best over the cardiac apex while the second sound is more audible over the base of the heart. Closure of the tricuspid valves is best discerned over the right precardium, closure of the mitral, over the left precardium. The semilunar closure is heard more posterior on the left precardium than is the pulmonary closure. From a practical point of view, however, it is necessary to move the stethescope to three or four positions over the area of the heart in order to determine if abnormal sounds are present as many of them are very localized. While auscultating the heart, intensity, rate, rhythm, and quality of the sounds should be noted as well as careful observation as to whether or not abnormal sounds are present. Interpretation of the heart sounds is performed by keeping in mind the ventricular volume curve. (Figure 1). The intensity of the first heart sound is influenced by many factors, among which are: (a) the position of the valves at the onset of ventricular systole, which is usually determined by the length of time elapsing between atrial and ventricular

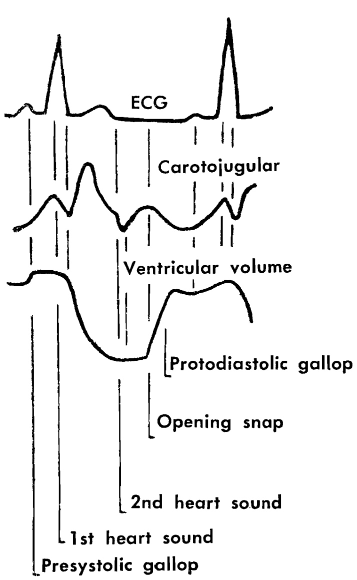

Figure 1. Ventricular Volume Curve.

contraction, (b) the rate of rise of ventricular pressure and (c) the presence or absence of structural disease of the mitral valve. Aside from such factors as obesity, emphysema, and effusions of the chest, all of which affect the intensity of both the first and second sounds, the intensity of the second sound is usually related to the pressures in the aorta and pulmonary artery. Accentuation of the second sound is also a normal phenomenon with increasing age especially if lesions of arteriosclerosis are present.

Generally, the heart rate is an indication of the metabolic rate of the animal. Toxemia, pain and various forms of anoxia plus any condition which causes severe circulatory collapse are common causes of an increased cardiac rate. Cardiac rhythm, however, is an indication of the state of the impulse conduction mechanism of the heart. In many cases abnormalities in rhythm require the use of an electrocardiogram for positive diagnosis on the basis of auscultation alone.

Sinus arrhythmia is observed commonly in domestic animals. It is characterized by a quickening of the heart during inspiration and a slowing during expiration. It has no clinical significance. Auricular fibrillation is also fairly easy to diagnose on auscultation because it is the only common condition which has a well marked tachycardia with gross irregularity of rhythm. Another disturbance of conduction occasionally found is the so-called heart block. This condition may occur in any one of three major degrees. A first degree block is an electrocardiographic diagnosis; a second degree block is characterized by the dropping of the odd ventricular beat. The third degree block is usually characterized by a slow heart rate with the first sound varying in intensity; the history shows periodic syncopy. Gallop rhythms are usually serious in other animals but are heard frequently in the adult bovine and usually have no clinical significance for the latter.

The discernment of heart murmurs is often important in making a diagnosis and especially important in making an accurate prognosis. Once a murmur is heard it must be determined whether it is functional and of little significance or whether it is structural and of major importance. For practical purposes, all diastolic murmurs are functional in nature (19) and are rarely heard in large animal medicine. Systolic murmurs, on the other hand, are much more frequent and are usually of some clinical significance. Auscultation of cardiac murmurs combined with careful palpation over the precardial area is often of value as a murmur will often be very faint on auscultation but a thrill will be present on palpation. The latter usually occurs in those conditions of relatively large pathological abnormality.

In recent years phonocardiography has been used in diagnostic medicine to differentiate various murmurs. The value of phonocardiography in clinical work lies in its ability to record for objective analysis the transient sounds and murmurs to which the hearing mechanism of different observers adds or subtracts subjective variants (14). Present day phonocardiography has developed mainly through improved instrumentation with low-noise level amplifiers and satisfactory filters. Usually an electrocardiogram, phonocardigram and a carotid pulse are all recorded together so that the sound recordings can be significantly correlated with the activities of the heart. Figure 2 is an example of such a recording; it shows a diamond shaped aortic murmur typical of aortic stenosis.

Although phonocardiography is a valuable teaching aid for the fine distinction of various murmurs, careful auscultation by a clinician will, in most cases, result in an accurate diagnosis of the cardiac abnormality heard.

Differentiation of functional murmurs

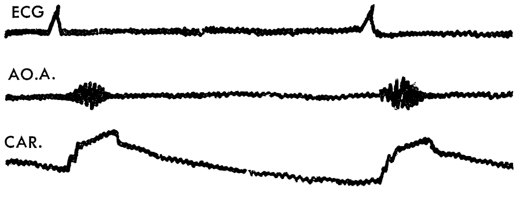

Figure 2. Electrocardiogram, phonocardiogram, and carotid pulse. The phonocardiogram is from the aortic area. The diamond shaped aortic murmur and the shape of the carotid pulse indicate aortic stenosis (14).

from those caused by structural lesions is very important though often difficult. The so-called haemic murmur, a functional murmur found in animals suffering from anemia, debilitation, toxemia, etc., is usually very soft and waxes and wanes with respirations. It is usually discernible only after very careful auscultation. The murmur caused by stenosis of the aortic semilunar valves is characterized, however, by a harsh systolic murmur most audible over the dorsal posterior area of the heart base. A diastolic murmur heard in the same area and accompanied by a high pulse wave and the absence of a thrill is characteristic of aortic semilunar insufficiency. Stenosis and insufficiency of the pulmonary semilunar valves produce similar murmurs only on the right side just posterior to the heart base and of course do not disturb the pulse. Stenosis of the left atrioventricular valves is characterized by a diastolic murmur over the apex of the heart on the left side with the length of the murmur rather than the intensity as an indication of its severity. A systolic murmur most audible in the same area is probably due to insufficiency of the mitral valves with little to no change in the pulse. Stenosis and insufficiency of the tricuspid valves of the right side give murmurs similar to those due to mitral pathology. One exception is that the former are more audible over the right side than over the left and usually has a more pronounced jugular pulse.

Systematic auscultation of the lung area of the thoracic wall will often be of definite aid in arriving at a diagnosis. Figure 3 shows such a systematic approach where each number indicates an area over which the stethoscope should be placed.

Sounds heard in the lung are of numerous types. Roughly, they may be broken down as follows: bronchial tones, vesicular murmurs, and rales — both dry and moist. Bronchial tones are produced as air moves in the bronchi somewhat in the same fashion as sounds are made in a closed organ pipe. Rales on the other hand are bronchial tones plus the sounds produced as a result of material in the bronchi. Moist rales occur when excess fluids such

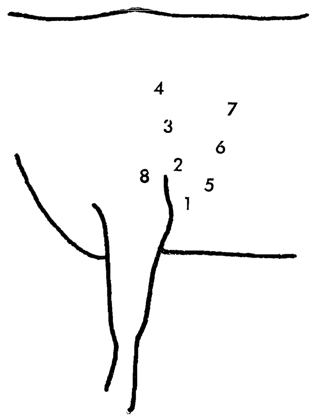

Figure 3. Systematic auscultation of the thorax.

as mucus and other forms of exudate and transudate are present in the bronchi. Dry rales result when tenacious materials and fairly dry exudates occur in the same passages and usually indicating some degree of chronicity. Vesicular sounds, once thought to be transmitted from the area of the pharynx (31), are created as air moves in and out of the alveoli from the tiny bronchioles. Vesicular and bronchial sounds are those heard upon auscultation of a normal lung.

When lung pathology is present, combinations of the other sounds usually occur. Early bacterial bronchial pneumonia is usually characterized by increased vesicular sounds followed by moist rales. As the lesions regress, dry rales become more prominent. It is always wise to keep in mind, however, that all three main types of sounds, with several gradations of each, may often be found in the lungs of one patient during one examination. Haematogenous bacterial pneumonia will often produce lung abcesses. If these are fairly large, they may be isolated on auscultation as there is a central area of little or no sound surrounded by areas of rales.

Parasitic lungworm pneumonias also cause a bronchitis but here differential diagnosis depends on the location of the first pathological sounds. This form of bronchitis is usually complicated by secondary pneumonia. Virus pneumonia, on the other hand, if not contaminated by a secondary bacterial pneumonia, is characterized by slight bronchitis and bronchiolitis with an eventual increased intensity of bronchial sounds due to consolidation of the parenchyma of the lung. Generally speaking, bronchial and virus pneumonia occur initially in the anteroventral areas of the lung whereas parasitic lungworm pneumonias are first evidenced in the diaphragmatic lobes.

Pleuritic friction sounds are usually dry, of varying harshness, and occur when two layers of dry inflammed pleura rub together. They are usually present in pneumonias although often for only a short time during the course of the disease. Pulmonary emphysema and oedema are common diagnoses on auscultation of the thorax. In pulmonary oedema there is a reduced vesicular sound due to the alveoli not being able to distend with air. Too, if the oedema is extensive and generalized, the pulmonary sounds have a moist quality. Emphysema is characterized by some loss of normal lung sounds due to poor conduction plus evidence of faint crepitation.

Various peristaltic sounds are often heard during auscultation of the thorax. This is especially true in cattle where sounds originating from swallowing, regurgitation, and reticular movements are quite pronounced. Care should be exercised, however, in differentiating these sounds from those resulting from a diaphragmatic hernia. The latter sounds usually have a tympanitic quality due to partial stenosis of the herniated gut at the diaphragmatic tear, causing an accumulation of gas.

As with auscultation of the heart, obesity, pneumothorax and pleural effusions will affect the intensity of the pulmonary sounds. Thorough auscultation of the pulmonary area, however, will often aid in an accurate diagnosis of any condition.

Auscultation of the abdomen is a valuable tool in large animal medicine. Routine auscultations are carried out on the right and left paralumbar fossae and midway down the posterior portion of the rib cage on both sides.

Ruminal sounds heard in the left paralumbar fossa consist of two parts. The first sound is similar to bubbling fluid while the second is similar to distant thunder. At least one ruminal movement should occur every three minutes or ruminal stasis can be suspected. The normal rumen rolls about three times per minute. Reticular contractions can often be detected low down in the seventh intercostal space on the left side. These sounds are usually bubbly in character and may be very faint in obese subjects. The hollow tinkling sounds heard just posterior to the middle and distal thirds of the last rib on the left side are usually considered pathognomonic for displacement of the abomasum. Care should be used in the interpretation of these sounds however, in order not to confuse them with bubbles of gas rising in the ruminal ingesta. The former sounds have a much more hollow quality than the latter.

Intestinal sounds are frequently heard in the right paralumbar fossa. These are usually faint fine sounds and only perceivable following careful use of the stethoscope in this region. Increase in frequency and intensity of intestinal sounds is often the result of an inflammed intestinal tract. Little is known of the exact origin of intestinal noise except that it originates from the bowel (2). Abnormal intestinal sounds are most frequently heard as a result of obstructions of paralytic ileus. Tympanitic sounds usually indicate bubbles rising in a partially fluid filled viscous such as anterior to an obstruction. It must be emphasized, however, that sounds similar to these are heard in the normal abdomen. An example of the latter is the tympanitic drops heard as fluid drops from the ileocaecal valve into the fundus of the caecum of the horse.

In the practice of medicine, whether it be large animal, small animal, or human, a prerequisite to an accurate diagnosis is a careful and complete physical examination of the patient. Auscultation is one of the important tools used in such an examination. The interpretation of the sounds heard then depends on an understanding of the basic medical sciences such as pathology and physiology, as well as experience. Experience is gained by diligent practice; thus the more a clinician applies the use of his stethoscope to medical practice, the more will he benefit from its use.

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