Dynamic Chiropractic

DIAGNOSIS & DIAGNOSTIC EQUIP

Understanding Heart Sounds, Part II

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In part one, I briefly discussed the S1 through S4 heart sounds. This article will discuss murmurs. Audible murmurs are, by simple definition, caused by turbulent blood flow through a narrow (stenosed) or abnormally functioning (regurgitating) valve. They are distinguished from basic heart sounds by their longer duration and are classified by their timing within the cardiac cycle; their location of maximum intensity; their patterns of radiation; their pitch or tonal quality; their configuration, and their intensity. Each of these characteristics will be addressed.

Perhaps the most diagnostic classification of murmurs lies in their timing, i.e, where they fall with the cardiac cycle. For example, one must determine whether the murmur is systolic or diastolic. This is important because "innocent" murmurs may occur in systole whereas diastolic murmurs are never innocent.[1]

A systolic murmur occurs between S1 and S2; a diastolic murmur occurs between S2 and S1 as illustrated in the chart below:

Systolic murmur - S_1 / murmur / S_2
Diastolic murmur - S_2 / murmur / S_1

As I stated earlier, murmurs are caused by turbulent blood flow through a stenosed valve or abnormally functioning valve that allows for regurgitation. If we keep in mind the fact that a stenosed valve is open but the opening is narrowed, whereas a regurgitating valve is, for all practicality, closed, but allowing blood to regurgitate, this will make determining the source of the murmur easier. A quick review of the cardiac cycle will be helpful. If S1 is due to the closure of the mitral/tricuspid valves and S2 the closing of the aortic/pulmonic valves, let us determine where these events fall in relation to murmurs. If a systolic murmur falls between S1 and S2, it falls between a time when the mitral/tricuspid valves are closed while the aortic/pulmonic valves are open. It looks something like the chart below:

S_1	murmur	S_2
M/T	A/P	A/P
valves	valves	valves
closed	open	closed

Since the aortic and pulmonic valves are open, any murmur originating from them is due to turbulent blood flow through a stenosed valve.

Examples are murmurs of aortic and pulmonic stenosis. At the same time, the mitral and tricuspid valves are closed, thus any murmur originating from these valves is due to their incompetency, thus allowing for regurgitation of blood: for example, murmurs of mitral or tricuspid regurgitation. Functional or innocent murmurs also occur during systole as a result of high blood velocity which

may occur during exercise, pregnancy, or in patients with anemia.[2]

The logical assumption is that the opposite rule applies to diastolic murmurs. Consider the chart below:

S_1	S_2	murmur	S_1	S_2
	A/P	M/T	M/T	
	valves	valves	valves	
	closed	open	closed	

Since the mitral and tricuspid valves are open, murmurs originating from either of these valves are the result of stenosis. Likewise, the aortic and pulmonic valves, being closed, cause murmurs of regurgitation. To summarize, systolic murmurs are the result of aortic stenosis, pulmonic stenosis, mitral regurgitation, or tricuspid regurgitation. Diastolic murmurs are the result of aortic regurgitation, pulmonic regurgitation, mitral stenosis, or tricuspid stenosis. Murmurs of nonvalvular origin include those produced by atrial septal defects or ventricular septal defects.

Murmurs are further classified by which phase of systole and diastole they occur in. For example a mid-systolic murmur will begin slightly after the onset of S1 but terminate before the onset of S2, whereas a pansystolic or holosystolic murmur will begin with S1 and continue through to the onset of S2.[3] They often occur as a result of regurgitation through a mitral of tricuspid valve.

Diastolic murmurs are also divided into early, mid, and late diastolic murmurs, depending on where they occur in relation to S1 and S2.

Configuration of a murmur refers to the intensity of the sound over a period of time. The musical terms crescendo, decrescendo, and crescendo-decrescendo are used to describe first a murmur that increases in intensity, then one that decreases in intensity, and finally one that rises to a peck then falls in intensity. The later term is sometimes also referred to as a "diamond" shape murmur.

Location of maximum intensity refers to the area from which the murmur originates and consequently is the loudest. It usually correlates with one of the common auscultatory points mentioned in Part I. For example, if a murmur is loudest at the second interspace on the right of the sternum, the aortic valve is most likely in some way responsible for the murmur. A murmur of aortic stenosis would originate in this area and may radiate to the carotid arteries.[4] Radiation usually occurs in the direction of blood flow. A murmur of mitral valve prolapse may radiate into the left axilla.

Pitch is used to describe the tonal quality of the murmur be it high pitched or low pitched. For those of us not musically inclined, a simple way to distinguish pitch is to determine whether the sound is heard best with the diaphragm of the stethoscope, i.e., high pitched, or with the bell, i.e., low pitched. Murmurs of mitral or tricuspid stenosis are best heard with the bell.[5]

The classification of murmurs by intensity is probably the most subjective category of classification. Intensity is, to a degree, related to the volume of blood flow. In the U.S., the Levin scale of I-VI is used. Unfortunately what one person may hear as a grade II may indeed be a grade III when auscultated by a more experienced examiner. A grade I murmur is considered very faint, a grade II quiet, with each grade getting progressively louder. A grade VI, although I have never heard one, is described as being audible with the stethoscope off the chest.

Changes that occur in the murmur in relationship to the respiratory cycle are important in giving a clue to the nature of the murmur. For example, murmurs originating from valves whose anatomical location lies within the right side of the heart tend to intensify with inspiration: these include murmurs of tricuspid stenosis or regurgitation, or pulmonic stenosis/regurgitation.

To summarize the classification of murmurs, let us look at a common disorder such as aortic stenosis. It would most likely tend to cause a low-pitched, mid-systolic, crescendo-decrescendo murmur that may radiate into the carotid arteries. This murmur would not increase in intensity since, even though the auscultatory point lies on the right side of the stenum, this is anatomically a left sided valve.6

By mastering an understanding of both normal and abnormal heart sounds, we can obtain a more complete picture of our patient's total health status.

References

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