

FIGURE 3-3 Abnormal heart sounds can be related to abnormal intensity, abnormal presence of a gallop rhythm, or abnormal splitting of the second heart sound (S_2) with respiration. A_2 , Component of S_2 caused by closure of aortic valve; ECG, electrocardiogram; P_2 , component of S_2 caused by closure of pulmonic valve.

dome during diastole. The frequency, intensity, and timing of the click have diagnostic significance. For example, the shorter the interval between S_2 and the opening snap, the more severe the degree of mitral stenosis, because this is a reflection of higher left atrial pressure. The *pericardial knock* of constrictive pericarditis and *tumor plop* generated by an atrial myxoma also occur in

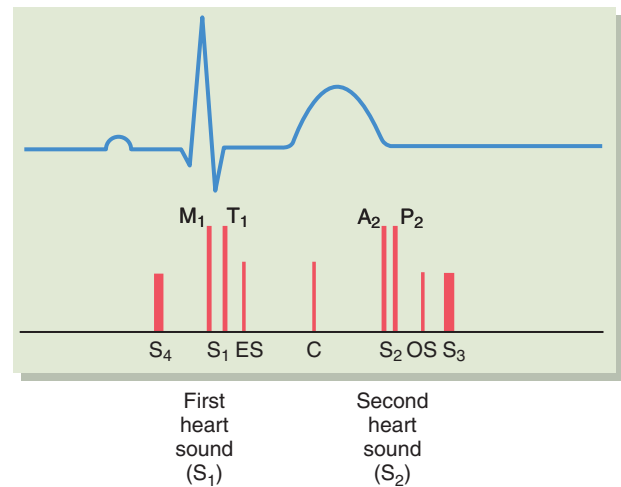


FIGURE 3-4 The relationship of extra heart sounds to the normal first (S_1) and second (S_2) heart sounds. S_1 is composed of the mitral (M_1) and tricuspid (T_1) closing sounds, although it is frequently perceived as a single sound. S_2 is composed of the aortic (A_2) and pulmonic (P_2) closing sounds, which are usually easily distinguished. A fourth heart sound (S_4) is soft and low pitched and precedes S_1 . A pulmonic or aortic ejection sound (ES) occurs shortly after S_1 . The systolic click (C) of mitral valve prolapse may be heard in mid systole or late systole. The opening snap (OS) of mitral stenosis is high pitched and occurs shortly after S_2 . A tumor plop or pericardial knock occurs at the same time and can be confused with an OS or an S_3 , which is lower in pitch and occurs slightly later.

TABLE 3-7 GRADING SYSTEM FOR INTENSITY OF MURMURS

GRADE	DESCRIPTION
1	Barely audible murmur
2	Murmur of medium intensity
3	Loud murmur, no thrill
4	Loud murmur with thrill
5	Very loud murmur; stethoscope must be on the chest to hear it; may be heard posteriorly
6	Murmur audible with stethoscope off the chest

early diastole and may be confused with an opening snap. They can typically be differentiated from an S_3 gallop because they are higher-frequency sounds.

Murmurs

Murmurs are a series of auditory vibrations generated by either abnormal blood flow across a normal cardiac structure or normal flow across an abnormal cardiac structure, both of which result in turbulent flow. These sounds are longer than individual heart sounds and should be described on the basis of their location, frequency, intensity, quality, duration, shape, and timing in the cardiac cycle. The intensity of a given murmur is typically graded on a scale of 1 to 6 (Table 3-7). Murmurs of grade 4 or higher are associated with palpable thrills. The intensity or loudness of a murmur does not necessarily correlate with the severity of disease. For example, a murmur can be quite harsh when it is associated with a moderate degree of aortic stenosis. If stenosis is critical, however, the flow across the valve is diminished and the murmur becomes rather quiet. In the presence of a large atrial septal defect, flow is almost silent, whereas flow through a small