Heart sounds



BY

Dr. Nour A. Mohammed

Associate Professor Of Physiology

Faculty Of Medicine, Mutah University

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HEART SOUNDS

 The audible sounds are caused by either closure of valves or turbulent flow (murmurs) and never caused by opening of valves.

The normal heart sounds are heard using stethoscope.
 Also, they can be recorded by phonocardiograph.



CAUSES

- 1. First component: valvular (main cause):
- Sudden closure of A.V. Valves (mitral & tricuspid).

2. Second component: muscular

vibration of the aortic and pulmonary artery wall or a result of rushing of blood into them during maximum ejection phase.

- **Phases:** 1- Isometric contraction phase
 - 2- 1st part of maximum ejection phase.
- **Duration:** 0.14 0.16 sec.
- Characters: Audible by stethoscope, low pitched, soft, long duration &
- Its frequency is 25-100 cycle/sec

Site of best hearing:

- □ Mitral component: in the 5th left intercostal space at the mid-clavicular line (at apex)..
- Tricuspid component:
- lower end of the sternum.



Causes

 sudden closure of the semilunar valves (aortic & pulmonary artery).

Phase: isometric relaxation phase.

Duration: 0.1 sec.

Characters: Audible by stethoscope, high pitched, sharp

Vibration & its frequency is 100 - 200 cycle/sec.

Site of best hearing

Aortic component: second right space near the sternum.

Pulmonary component: second left space near the sternum.



Pulse palpable



- ✓Normally, the aortic valve closes slightly earlier than the pulmonary valve leading to split of the second heart sound.
- ✓ Because, the right ventricle is weaker than the left ventricle (so, having a longer systole).
- Normally, the splitting is very close, so, aortic and pulmonary sounds are heart as one sound.

During inspiration

(physiological splitting)

There is ↑ venous return to the right side of the heart (due to -ve intra-pleural pressure) —> ↑ filling of the right ventricle —> the right ventricle will need more time to evacuate itself, so, the pulmonary valve closure will be delayed.

- The lung will expand (during inspiration) and retains more blood in its vessels, so, the blood going to the left ventricle will decrease, and aortic valve will close earlier than normal.
- So, during inspiration S2 splits into 2 distinct components (physiological splitting).
- It is heard almost only at the pulmonary area (because closure of aortic valve is audible allover the precordium).



Pathological splitting

Wide splitting

Heard in conditions that delay right ventricle (RV) emptying lead to delay pulmonary sound (e.g., Pulmonary stenosis) \rightarrow exaggerated normal splitting.

Paradoxical splitting

Heard in conditions that delay aortic valve closure (e.g., Aortic stenosis) \rightarrow The closure of pulmonary valve before the aortic valve

Wide Splitting

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Paradoxical Splitting



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The third heart sound

- **Cause:** ventricular vibration (initiated by rushing of blood into the ventricle).
- Phase: maximum (rapid) filling phase.
- Duration: 0.05 sec.
- Characters: In adults, Non audible by stethoscope (recorded by phonocardiograph)
 - N.B.: It can be heard in children & young individuals

low pitch (soft), very faint

Site of best hearing: Mitral area (apex) for the filling of left ventricle & at left lower sternal border for the filling of right ventricle.

The Fourth Heart Sound

Cause: Atrial contraction.

Phase: Atrial systole phase.

Duration: 0.04 sec

Characters: Non- audiable under normal conditions ,but recorded by **phonocardiograph**

The first heart sound occurs at the beginning of systole

- * The second heart sound occurs **at beginning of diastole**
- * The interval between 1st and 2nd heart sound indicates the systolic period.
- * The interval between 2nd and 1st heart sound indicates the diastolic period.



Areas of auscultation of heart sounds

- •There are 4 main areas of auscultation of heart sounds:
 - The fifth left intercostal space at mid-clavicular line (apex)
 → Mitral valve area (M).
 - The fifth intercostal spaces at the left lower sternal border
 → Tricuspid valve area (t).
 - The second left intercostal space near the sternal border
 → Pulmonary valve area (p).
 - The second right intercostal space near the sternal border
 → Aortic valve area (a).







