

Very Important (Topic)

Heart Sounds

Murmurs

Fb/Nurse Info



Heart sounds:

- The mechanical activities of the heart during each cardiac cycle, cause the production of some sounds, which are called heart sounds.

Factors involved in the production of heart sounds are:

- The movement of blood through chambers of the heart.
- The movement of cardiac muscle.
- The movement of valves of the heart.

First heart sound:

- It is produced during isometric contraction and earlier part of ejection period.
- It resembles spoken word 'LUBB'.

Characteristics:

- It is long, soft, low pitched sound.
- Duration of this sound is 0.10 – 0.17 sec

Causes:

- It mainly occurs due to sudden closure of atrioventricular valves.

First heart sound and ECG:

- It coincides with peak of 'R' wave of ECG

First heart sound, "lub", occurs when atrioventricular valves close



Second heart sound, "dup", occurs when semilunar valves close



ADAM

Second heart sound:

- It produces during the onset of diastole.
- It resembles the spoken word 'DUBB'

Characteristics:

- It is short, sharp and high pitched sound.
- Duration of this sound is 0.10 – 0.14 seconds.

Causes:

- It mainly produces during sudden closure of the semilunar valves.

Second heart sound and ECG:

- It coincides with the 'T' wave of ECG.

Third heart sound:

- It is produced during rapid filling period of the cardiac cycle.

Characteristics:

- It is short and low pitched sound.
- Duration of this sound is 0.07 – 0.10 seconds.

Causes:

- It is produced due to the vibrations which set up in ventricular wall, due to rushing of blood in to ventricles during rapid filling phase.

Third heart sound and ECG:

- It appears between 'T' and 'P' waves of ECG.

Fourth heart sound:

- It is produced during atrial systole and considered as physiologic heart sound.

Characteristics:

- It is short and low pitched sound.
- Duration of the sound is 0.02 – 0.04 seconds.

Causes:

- It occurs due to vibrations which set up in atrial musculature during atrial systole.

Fourth heart sound and ECG:

- It coincides with interval between end of 'P' wave and onset of 'Q' wave in ECG.

S1 – Mitral and tricuspid valve closure. Heard best over the mitral area (Figure 2).

S2 – Aortic and pulmonary valve closure. Heard best over the aortic and pulmonary areas (Figure 2). A slight splitting between closure of the pulmonary and aortic valves is normal.

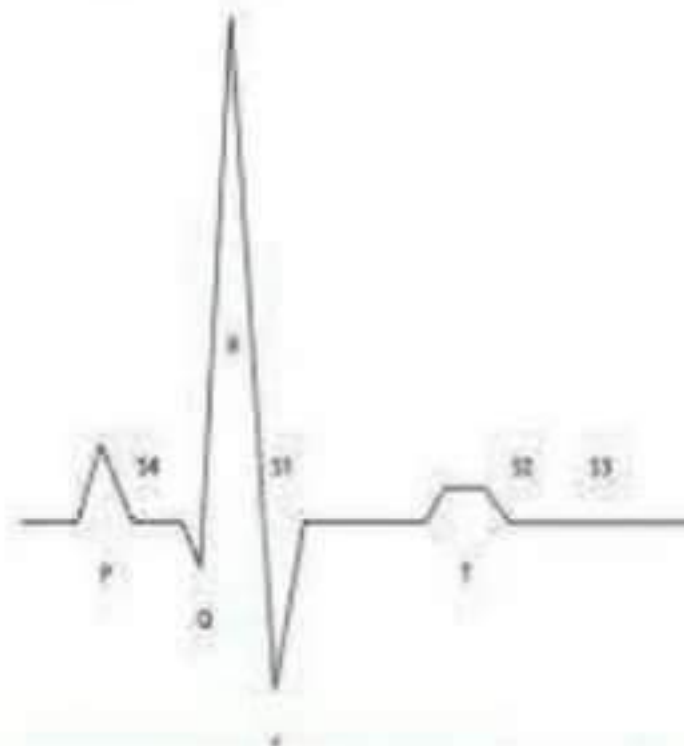
S3 and S4 – Low frequency diastolic sounds associated with ventricular filling.

P wave – Atrial depolarization (contraction).

PR interval – Electrical impulse travels from the sinoatrial node to the ventricular muscle fibers.

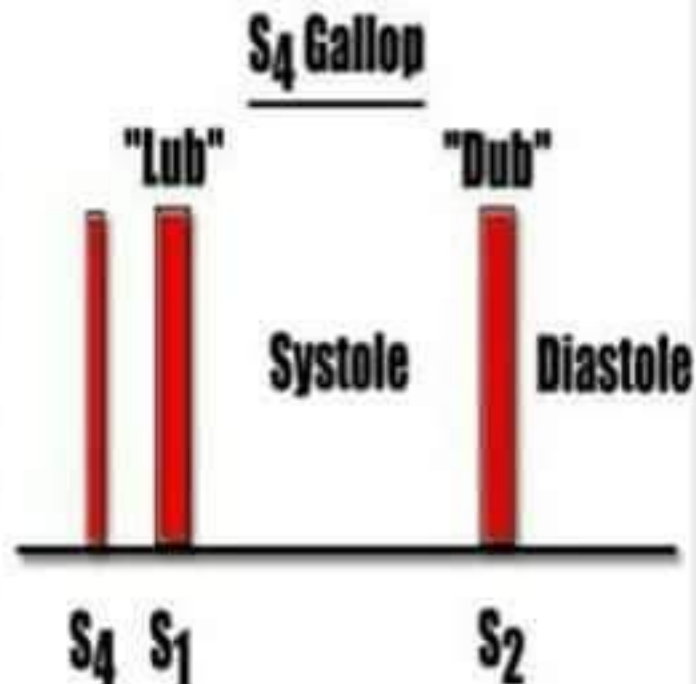
QRS complex – Ventricular depolarization (contraction), atrial repolarization.

T wave – Ventricular repolarization.



Triple heart sound:

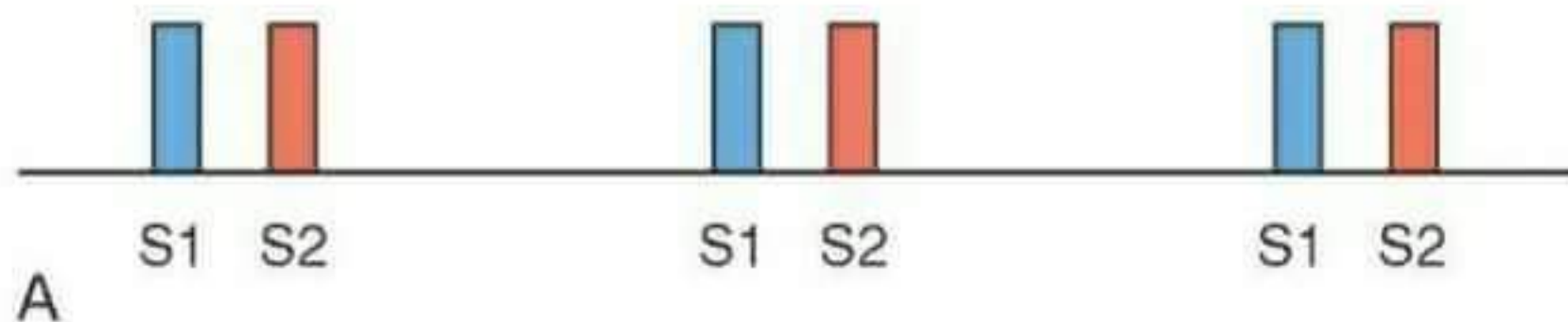
- In some conditions like myocardial infarction and severe hypertension, the intensity of third and fourth heart sounds increases and they could be heard as a single sound along with the first and second heart sound. This is known as triple heart sound.



Importance of the heart sounds:

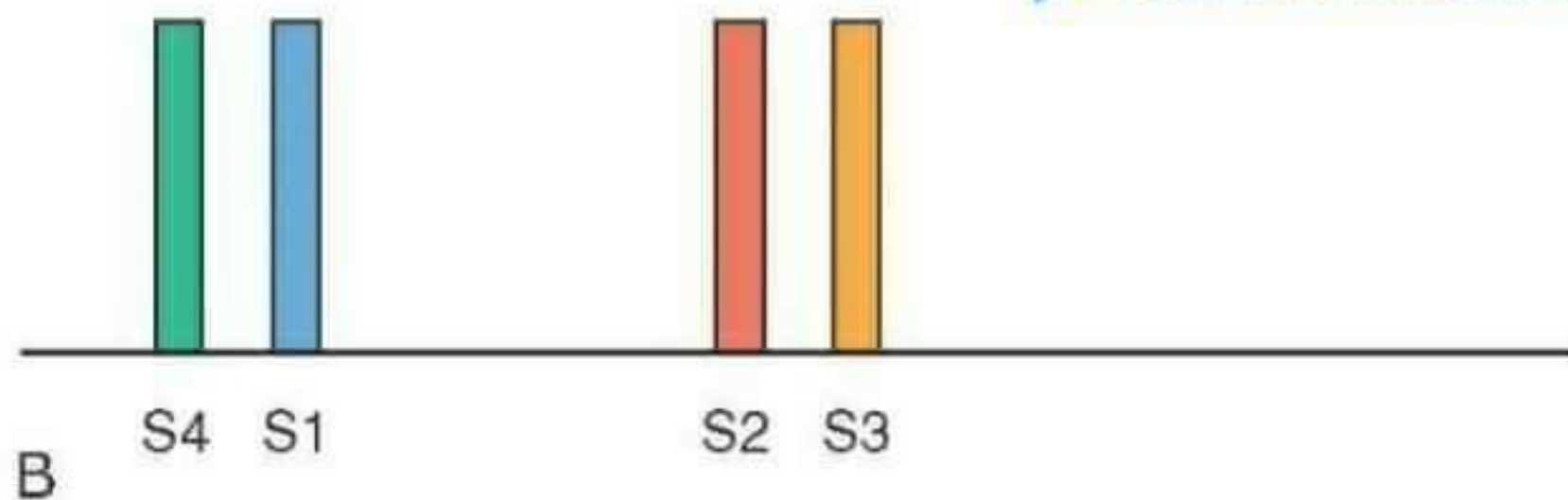
- Heart sound generally alters during cardiac diseases involving the valves of the heart. That's why heart sounds are having important diagnostic value.

NORMAL HEART SOUNDS

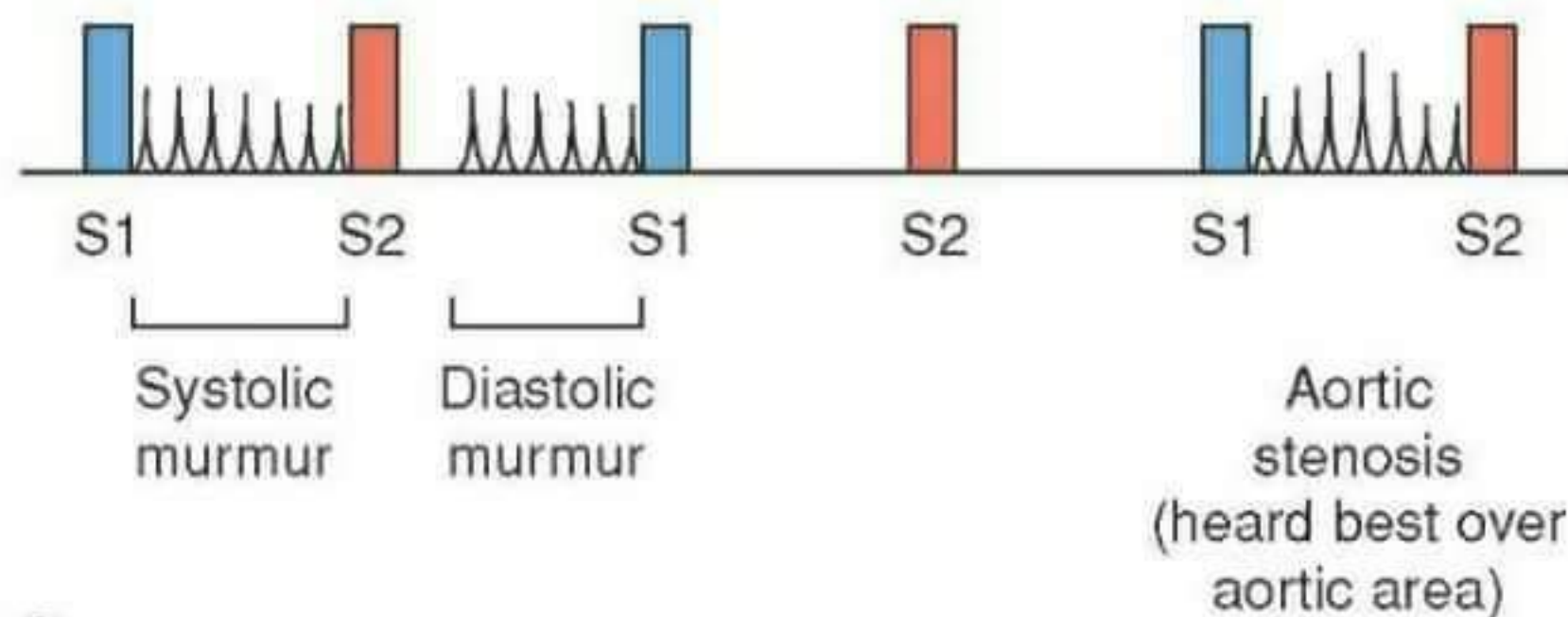


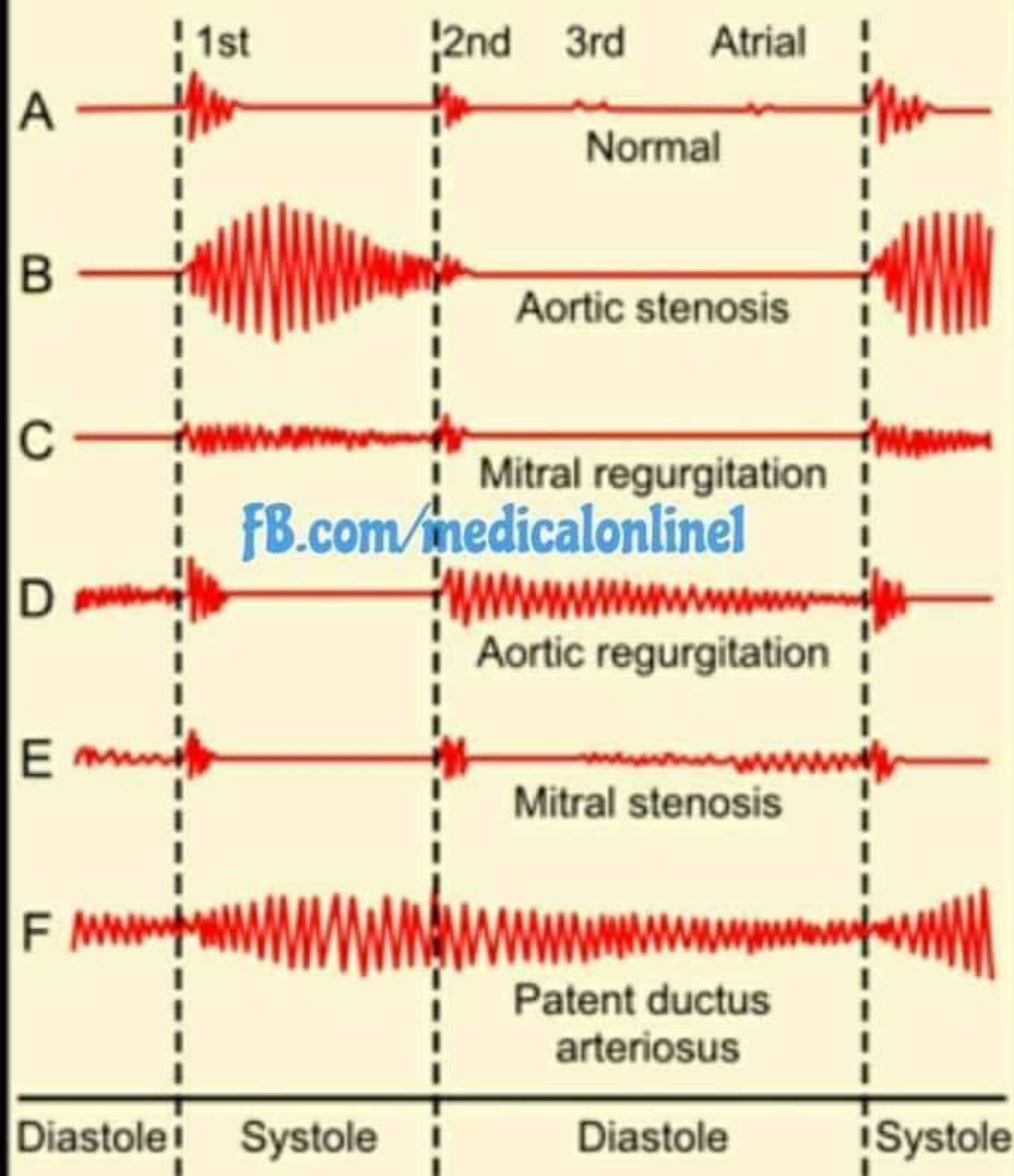
EXTRA SOUNDS

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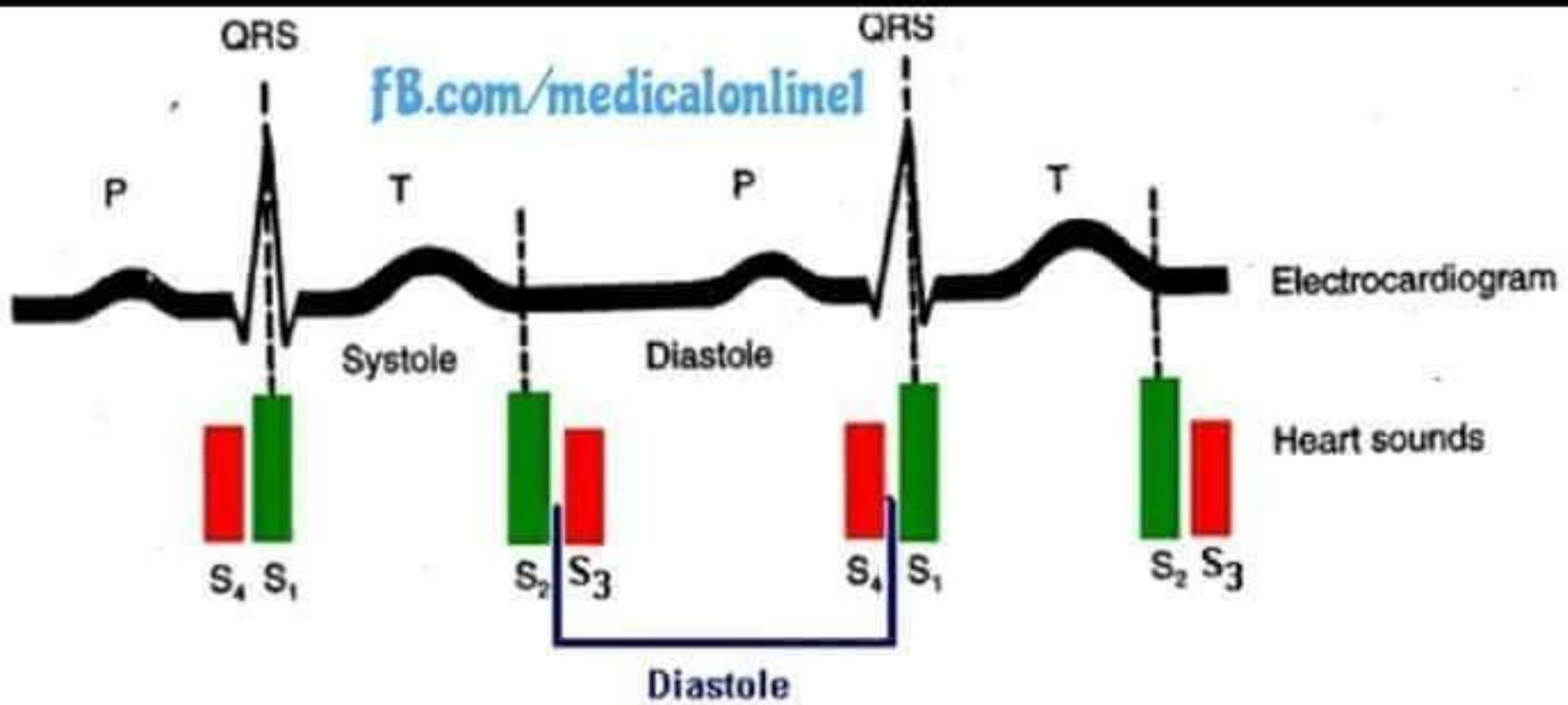


MURMURS





Phonocardiograms from normal and abnormal heart sounds



Methods to study heart sounds:

- There are three methods to study heart sounds:

1. By using stethoscope
2. By using microphone
3. By using phonocardiogram

Stethoscope:

- The chest piece of the stethoscope is placed over 4 areas of the chest, which are called auscultatory areas. The auscultatory areas are as follow:

1. Mitral area or bicuspid area:

- Situated in the left V intercostal space about 3 inches from midline. This is the area of apex beat. Mitral valve sound best heard near this region.

2. Tricuspid area:

- Present over xiphoid process. Tricuspid valve sound best heard near this region.

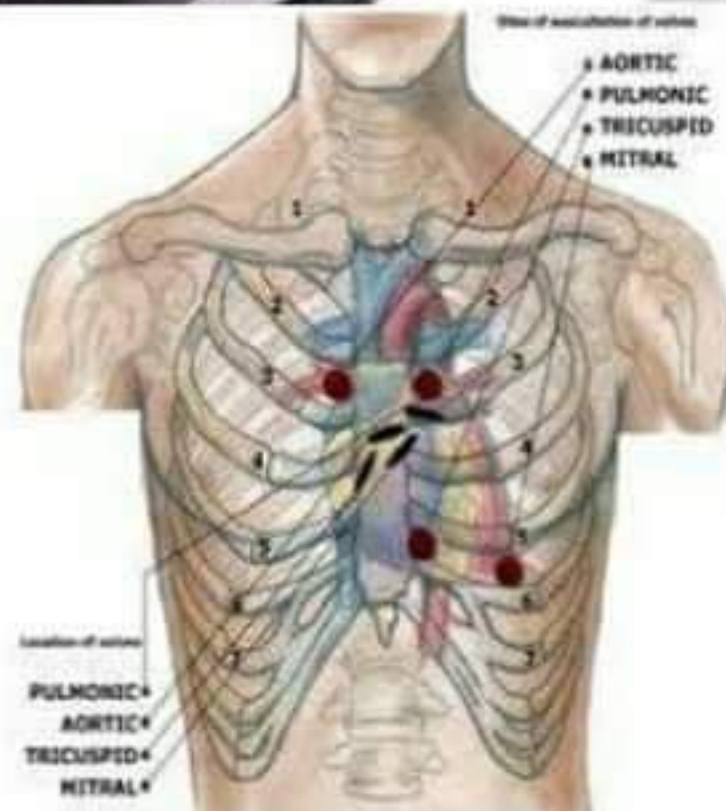
3. Pulmonary area:

- Present over the left II intercostal space close to the sternum. Semilunar valve sound best heard near this region.

4. Aortic area:

- Situated over right II intercostal space near to the sternum. Semilunar valve sounds are best heard near this region.

- First heart sound is best heard in mitral and tricuspid area where second heart sound is best heard in pulmonary and aortic areas.



Microphone:

- Highly sensitive microphone is placed over the chest and heart sounds are amplified by using amplifier that can be heard by using loud speaker.
- First, second and third heart sound can be heard by this method.

Phonocardiogram:

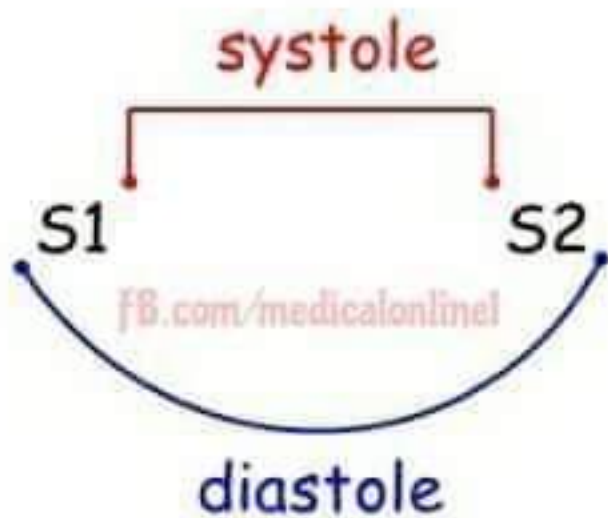
- It is a graphical record of the heart sound and the technique which here we use to record the heart sound is known as Phonocardiography.
- It is done by placing electronic transducer over the chest. This transducer is connected to a recording device like polygraph.
- All four heart sound can be heard by using phonocardiogram.



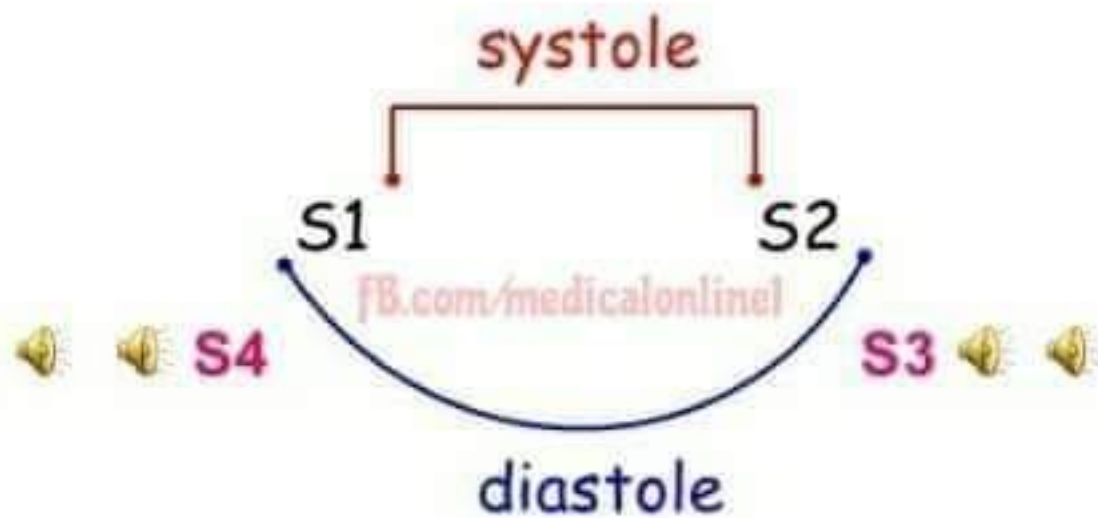
Phonocardiogram



Systolic vs. Diastolic

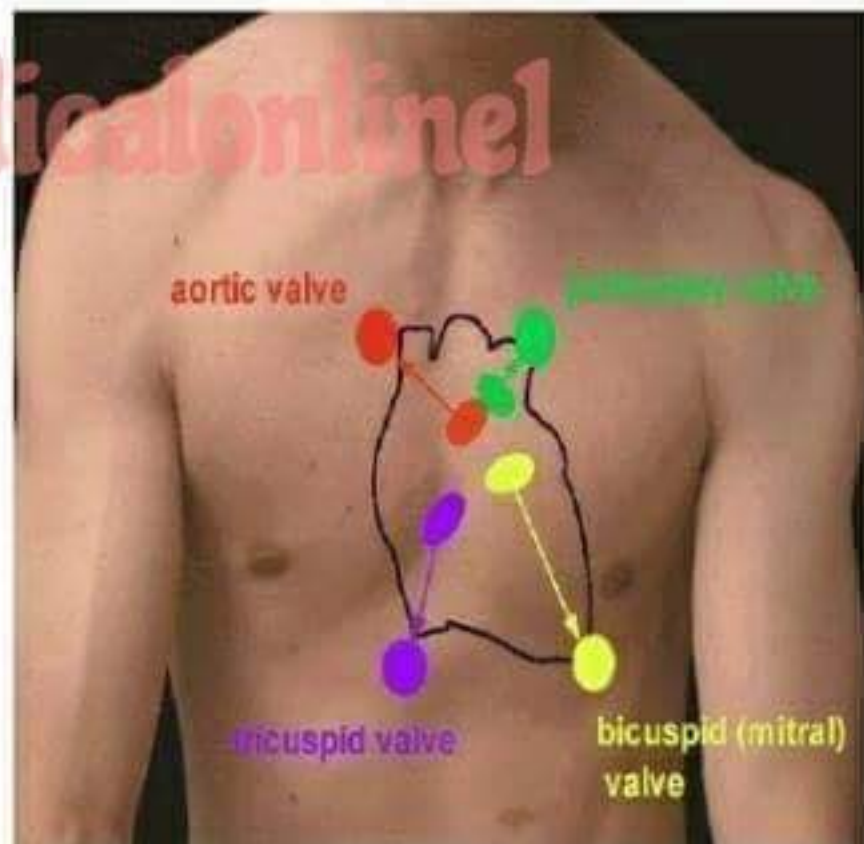


Gallops



S1 (lubb)

- The 1st heart sound, marks the beginning of systole (end of diastole).
- Related to the closure of the mitral and tricuspid valves.
- Loudest at the apex and lower left sternal border.



The first heart sound can usually be heard easily with both the bell and the diaphragm

Abnormal S1

- **Loud First Heart Sound**

- Hyperdynamic (fever, exercise)
- Mitral stenosis
- short AV intervals like Wolff-Parkinson-White syndrome

- **Soft First Sound**

- Low cardiac output (rest, heart failure)
- Tachycardia
- Severe mitral reflux (caused by destruction of valve)
- long PR interval

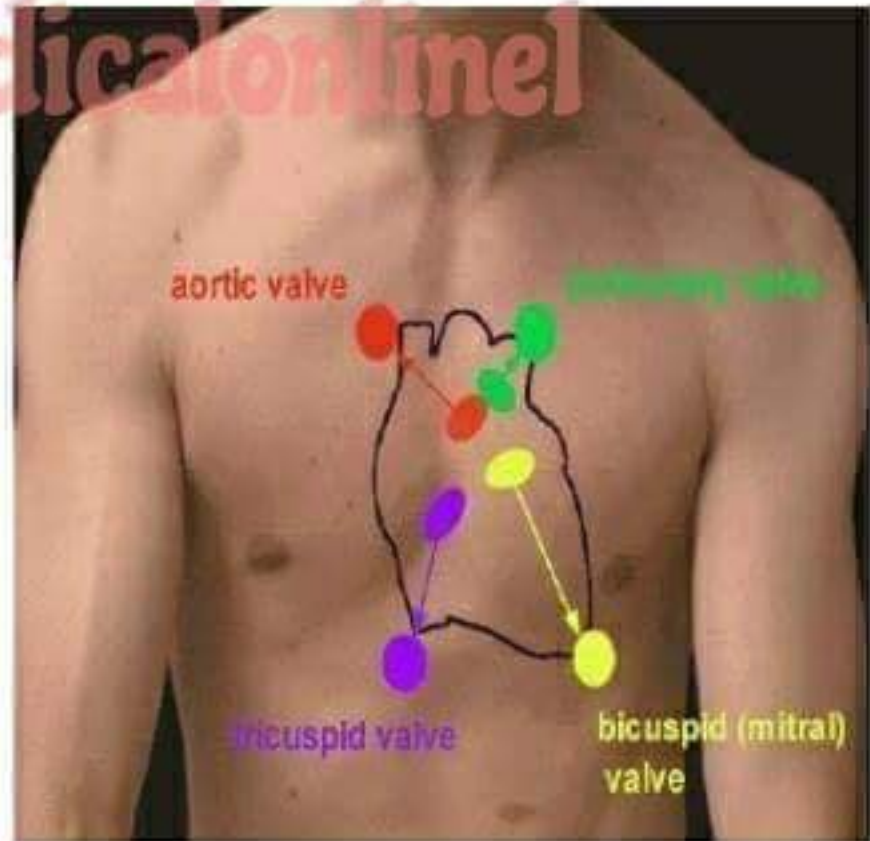
- **Variable Intensity of First Sound**

- Atrial fibrillation
- Complete heart block



S2 (dub)

- The 2nd heart sound, marks the end of systole (beginning of diastole).
- Related to the closure of the aortic and pulmonic valves.
- Loudest at the base.



For the second heart sound the diaphragm is invaluable, with the stethoscope usually best placed at the base

Abnormal S2

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- **Loud Second Heart Sound (aortic)**
 - Systemic hypertension
 - Dilated aortic root
- **Soft Second Heart Sound (aortic)**
 - Calcified aortic stenosis
- **Loud Second Heart Sound (pulmonary)**
 - Pulmonary hypertension



S3 Heart Sound 🔊 🔊

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- Heard in early diastole
- Lub-dub-by cadence similar to "Kentucky" SLOSH'-ing-in
- It can be thought of as a sound which is generated when the ventricle is forced to dilate beyond its normal range because the atrium has overloaded volume. As seen in **congestive heart failure, which is the most common cause of a S3.**
- May be normal physiological finding in patients less than age 30.

S3 is low frequency and thus best heard with the bell of the stethoscope at the apex while the patient is in the left lateral decubitus position. .



S4 Heart Sound



- Low frequency sound in late diastole
- Le-lub-Dub cadence similar to "Tennessee" a-STIFF'-wall
- Caused by the atrial kick into a noncompliant ventricle
- Seen in patients with stiffened left ventricles, resulting from conditions such as hypertension, aortic stenosis, ischemic or hypertrophic cardiomyopathy, acute MI.
- In patient with mitral regurgitation, suggestive of acute onset of regurgitation due to the rupture of the chorda tendinae that anchor the Valvular leaflets.

It is heard best with the bell of the stethoscope at the apex.



Murmurs

- Blood flow through a structure normally closed during systole (mitral or tricuspid valves).
Regurgitation
- Blood flow through a valve normally open in systole but abnormally narrowed (e.g. aortic or pulmonary). Stenosis
- Increased blood flow through a normal valve
High flow states like... pregnancy, fever, anemia, hypothyroidism
- Due to structural cardiac abnormality and increased flow
 - ventricular septal defect
 - atrial septal defect
 - mitral regurgitation



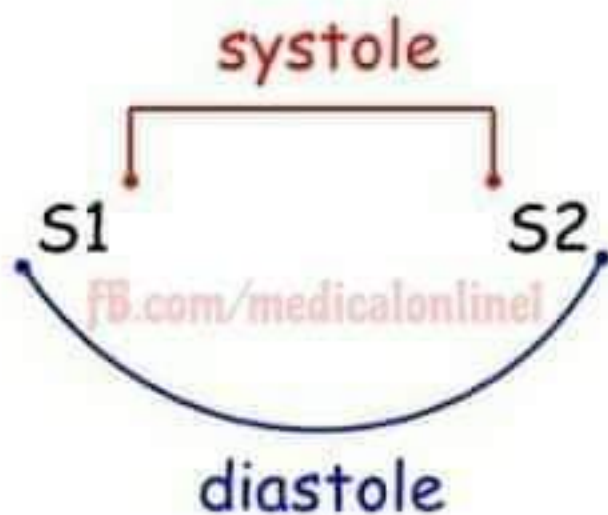
Murmur Assessment

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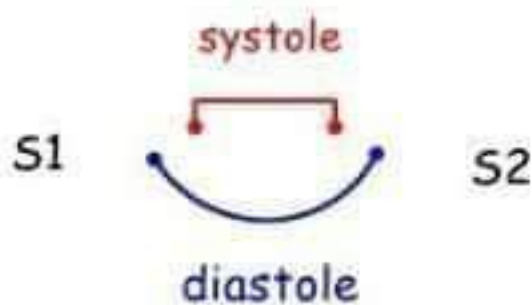
1. note where it is heard best and where it radiates to
2. try to discern if the murmur occurs in systole or diastole by timing it against S1 and S2
3. Note the sound of the murmur, is it blowing or grating?
4. Note the intensity of the murmur



Murmurs Made Easy



Murmurs 1 2 3



1. Systolic or Diastolic?
2. Blowing or Grating?
3. Open or Closed?



Murmurs 1 2 3

AORTIC STENOSIS

- | | |
|---------------------------|----------|
| 1. Systolic or Diastolic? | Systolic |
| 2. Blowing or Grating? | Grating |
| 3. Open or Closed? | Open |



What is it?
(What's my Aortic Valve doing?)



Murmurs 1 2 3

MITRAL INSUFFICIENCY

- | | |
|---------------------------|----------|
| 1. Systolic or Diastolic? | Systolic |
| 2. Blowing or Grating? | Blowing |
| 3. Open or Closed? | Closed |



What is it?
(What's my Aortic Valve doing?)



Murmurs 1 2 3

AORTIC INSUFFICIENCY

- | | |
|---------------------------|-----------|
| 1. Systolic or Diastolic? | Diastolic |
| 2. Blowing or Grating? | Blowing |
| 3. Open or Closed? | Closed |



What is it?
(What's my Aortic Valve doing?)



Murmurs 1 2 3

MITRAL STENOSIS

- | | |
|---------------------------|-----------|
| 1. Systolic or Diastolic? | Diastolic |
| 2. Blowing or Grating? | Grating |
| 3. Open or Closed? | Open |



What is it?
(What's my Aortic Valve doing?)



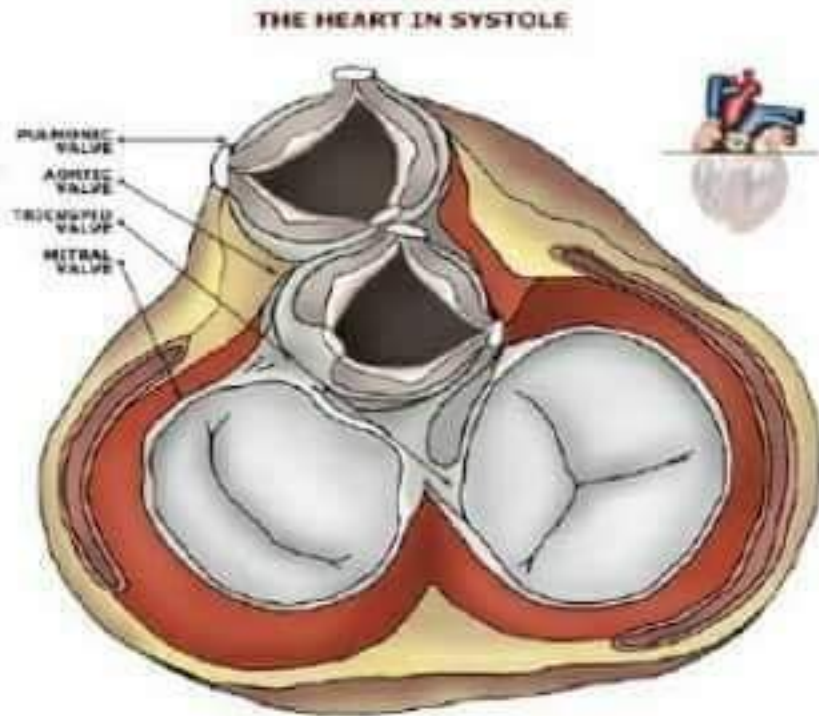
Systolic Murmurs

• Valvular

- Mitral regurgitation 📢
- Tricuspid regurgitation
- Aortic stenosis 📢
- Pulmonic stenosis 📢

• Nonvalvular

- PDA
- VSD 📢 📢



Systolic Valvular Murmurs

- **Mitral regurgitation**

- high pitch pansystolic (holosystolic) murmur with blowing quality
- best heard at the apex
- radiation into the axilla.
- plateau shaped
- May follow MVP

- **Mitral valve prolapse (MVP)**

- resulting in a mid-systolic click
- after the click, a brief crescendo-decrescendo murmur
- usually best at the apex