

## Examination techniques

we must do the following in order:

1- Inspection

2 - Palpation

3- Auscultation

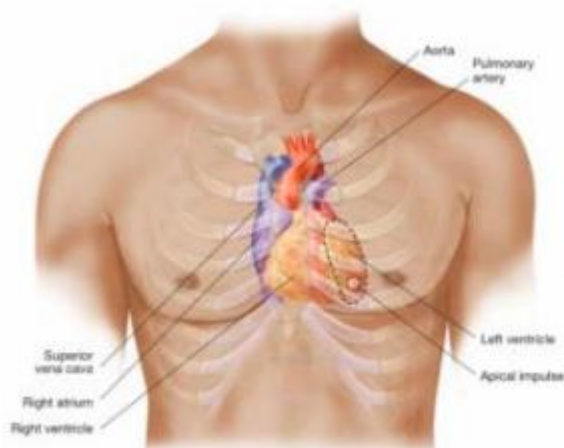
percussion has no place in heart examination!

### Inspection

- Stand on the **right** side of the patient
- The patient should be in **supine** position
- The patient's **upper** body and **head** should be elevated by **30 degrees**
- **Exposure**: the patient may have pain on the left side of the chest, but for example it is caused by shingles, which is a skin problem and we need to see the surface of the chest, or another example, previously, if the patient had open heart surgery, the scar is clear on the chest surface, which we can detect.



In observation, we must see what **level the heart is at**. When we look at the heart from the front, we **mainly** see the **right ventricle** and we see a small part of the **left ventricle** because it is located more in the **back**, and we see a **small part** of it in the **apex**, which is where we have the **maximum impulse or PMI**. The heart is mainly located in the **middle** of the chest and **under the sternum**. The **pulmonary artery** is first on the **left side of the aorta**, and then the aorta goes around, so in the surface anatomy, the **aorta** is on the **right** side and the pulmonary artery on the left side.



**RV:** the most anterior part of the heart

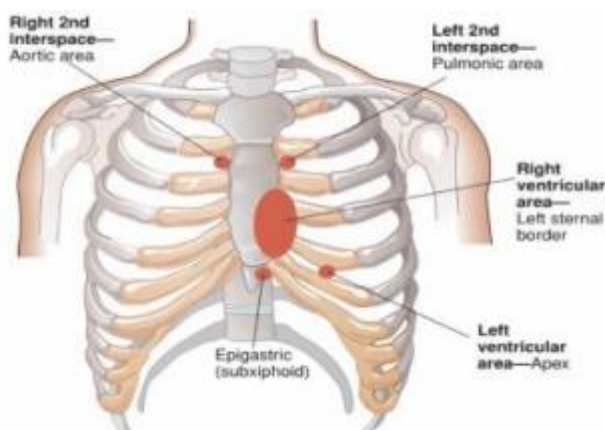
**LV:** left border

Apex (**PMI**): Inf Tip of LV

Landmarks:

- 1- **Aorta:** the **second intercostal space** on the **right side of the sternum**
- 2- **Pulmonary:** the **second intercostal space on the left side of the sternum**
- 3- **right ventricular area** for examination, **palpation and auscultation:** the **third and fourth intercostal spaces on the left side of the sternum.**
- 4- **Apex:** **4th or 5th intercostal space** of the **left midclavicular line** (**below the nipple in men**) (**7 to 9 cm lateral to the midsternal line**)
- 5- **Epigastric:** subxiphoid inclined to the left

Among these, **Apex** can be seen on the **skin** because of its **movements**, and the movement becomes clear by **shining/flash light**.



Touch/palpation

We have to palpate each and every hole and area.

- **Apex**
- **Right ventricle**
- **Pulmonary space**
- **Aortic space**

In palpation, we look for **Heave or Lift**. We place the pads of our fingers in the intended cavity and if we feel a **rhythmic impulse** and feel the **movement** of our fingers, it is called **Heave**. It indicates the enlargement of that cavity, for example, due to **aneurysm**.

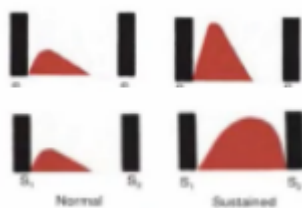
In the **Thrill examination**, we use the **heel/palm of the hand** and **feel the vibration** due to the **turbulent flow** and it is due to the fact that at that point there is a **return or constriction** that caused this flow and we must listen carefully to that area and look for **soufflés and murmurs**.

When touching PMI, it is **not always palpable**, even if it is healthy, such as obesity or breasts in women, etc. In order to better palpate the PMI or see it better, we ask the patient to **turn to the left** and take a **deep breath** and **hold his breath for a few seconds**, and this will help the **left ventricle** to be **closer to the chest** and **make the PMI more accessible**.



Regarding **PMI palpation**, we should mention these things:

- 1 **Location**: Is it in the right place or not?
- 2- **Diameter**: Normally, it is the **size of a square with a side of 1 to 2.5**
- 3- **Amplitude**: The **intensity** of the impact is **normal or hyperkinetic**, which can be a sign of disease, of course, can also be seen in **young athletes**.
- 4- **Duration**: Between **S1 and S2**, PMI should be **palpable** in the **first two thirds of systole**. Here we get help from auscultation at the same time as palpation.



A **change** in any of these 4 items can be a sign of **pathology**; For example, **displacement** to the **lateral** side can **indicate LVH or LV dilation**. For example, in patients with heart failure, the heart enlarges and moves to the left, or if the PMI **diameter** is **greater than 2.5**, it can indicate **LVH or AS (aortic valve stenosis)**.

### Auscultation

We went through two stages of the examination. It was decided that when a patient comes and we want to examine the heart, we must stand on the right side of the patient and ask the patient to lie down. We must observe **elevation of 30 degrees** and expose and observe, palpate and go to the next step and do the auscultation.

In the heart, in a cycle that happens: blood regularly enters the ventricles from the atria and from the ventricles into the aorta and pulmonary arteries. The **closing of the mitral and tricuspid valves causes a S1 sound** and the **closing of the semilunar valves (aortic and pulmonary valves) causes a S2 sound**.

Note: The sound of S1 and S2 is due to the closing of the valves, not their opening.

The interval between **S1 and S2 is systole**. (This is how we differentiate between systole and diastole)

Where we should look for the **sound** of these **4 valves** is the surface anatomy that we talked about.

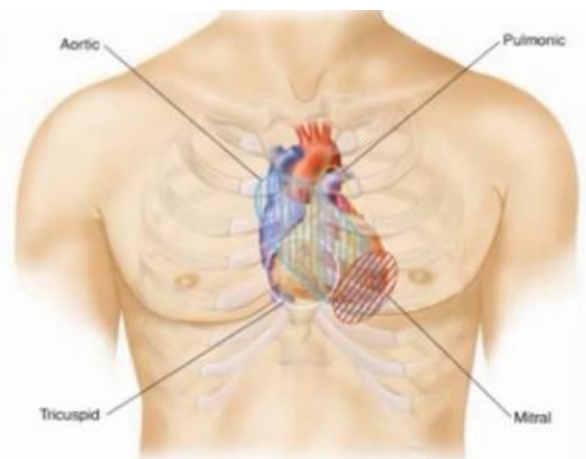
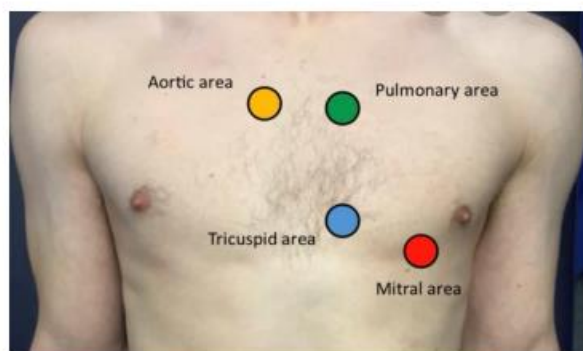
**Aortic centre:** It is located in the **second intercostal space on the right side**. For better auscultation, ask the patient to **lean forward while sitting** and do a **complete exhale**.

**Pulmonary centre:** It is located in the second intercostal space on the left

**Mitral centre:** It is located at the **intersection** of the **intercostal space with the mid-clavicular line (cardiac apex)**. For better hearing, ask the patient to lie on the left side.

**Tricuspid centre:** It is located in the **fifth intercostal space** next to the sternum.

In **mitral and tricuspid**, **S1 is longer/louder** than S2 and in **aorta and pulmonary** **S2 is longer/louder**.



## stethoscope

We use a stethoscope for **auscultation**. If we look at the part of the stethoscope from above that we put in our ears, we will see that it has a slight slope and we must hold it so that the slope is towards the front and it is placed in our ear canal so that the sounds can be heard by us.

The stethoscope head consists of two parts: **diaphragm** and **bell**

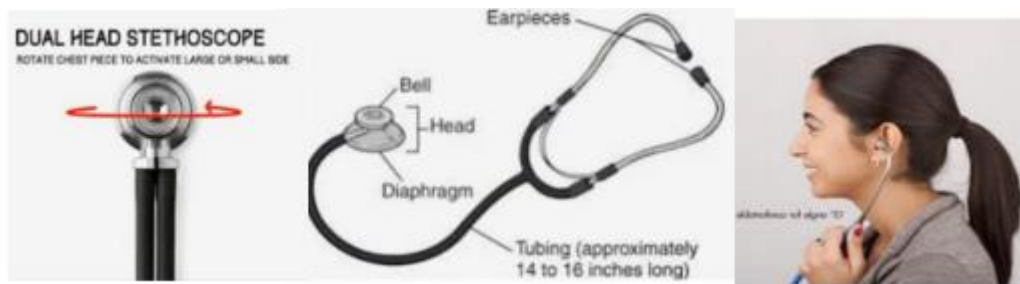
Diaphragm: the large part of the stethoscope that many of us know the stethoscope by it and is used for **hearing high pitch sounds**. Most sounds are high pitch, such as **S1-S2, mitral valve insufficiency sound, aortic valve insufficiency sound**.

Bell: It is for listening to **low pitch sounds** like **S3-S4, mitral valve stenosis**

How do we know if we are using the bell part of the stethoscope or the diaphragm?

The head part of the stethoscope can be rotated and when you hold the body of the stethoscope, you can flash left and right. when we look at the stethoscope from the **bell side**, a **hole** can be seen in the middle like in the picture above on the left, when we rotate it, if it is closed, it means that it is not

on the Bell side, but on the diaphragm side - and if it is opened, it means that it can be used from the diaphragm side of our stethoscope.



To test, we put the stethoscope in the ear and give a small blow to the diaphragm. If we hear the sound set on the diaphragm, then always before placing the stethoscope on the patient's heart, we **must check** that it is not on the bell and do not mistakenly think that the patient's heart is not beating and there is no sound and having a problem.

#### Auscultation pattern

First of all, we must observe the **correct position of the patient** and auscultation must be done in a **quiet room**. The **auscultation areas of the 4 valves** on the chest are like the **letter Z**.

We **start** from the **apex** of the heart and move this **Z upwards**, which is called the **base of the heart**, or **start** from the **base of the heart** and move towards the apex. Always try to **follow this Z pattern** because it makes your work orderly, you don't forget a part and the person who observes your examination realizes that you have mastery in your work.

note: When **auscultating**, listen with **both the diaphragm and the bell**

**Two other maneuvers** should be performed for the **auscultation of the patient**. We must auscultate all patients in **two other positions** **except** the **supine position**. If it is a disease that we have more doubts about, we should definitely do it with more determination.



Maneuver for **mitral stenosis**: We ask the patient to lie in **left lateral decubitus** and **exhale deeply** so that the **heart is close to the chest**, and we auscultate the **PMI with the bell part** of the stethoscope to **hear mitral valve stenosis**.

Maneuver for **aortic regurgitation**: We ask the patient to **sit and bend forward** so that the **arteries are close to the chest**, and then we auscultate. This maneuver is very good for hearing **aortic valve insufficiency**. (Top left image)



How to distinguish **systole from diastole?**

At the same time as we put the **stethoscope on the chest**, we put the **2nd and 3rd finger of the left hand** (which is for examining the pulse) on the **patient's carotid**, and the **sound we hear before the carotid pulse** is **S<sub>1</sub>**, and the **sound that is immediately after the carotid pulse** is **S<sub>2</sub>** and the **interval between S<sub>1</sub> and S<sub>2</sub> is systole**.

Tips for **determining heart murmurs**

For heart murmurs, we have to explain some features:

- 1- The murmurs, we hear is related to which part of the cardiac cycle? Is it in systole or diastole?
2. In which part of the chest is the murmur? so that we can identify which heart valve is involved.
- 3-Do we have to perform a special maneuver to hear the murmur better? For example, let's tell the patient to go left lateral or sit and bend forward.
- 4- We should determine the shape of the murmur, for example, crescendo or decrescendo?
- 5- grade must be determined.
- 6- What is the relationship with S<sub>1</sub> and S<sub>2</sub>? Does it cover S<sub>1</sub> and S<sub>2</sub>? Does it start after S<sub>1</sub> and end before S<sub>2</sub>? Each of which has a differential diagnosis.
- 7- It is emphasized that auscultation should be done in a calm and quiet environment.

## **Tips for Identifying Heart Murmurs**

- Time the murmur—is it in systole or diastole? What is its duration?
- Locate where on the precordium the murmur is loudest—at the base, along the sternal border, at the apex? Does it radiate?
- Conduct any necessary maneuvers, such as having the patient lean forward and exhale or turn to the left lateral decubitus position.
- Determine the shape of the murmur—for example, is it crescendo or decrescendo, is it holosystolic?
- Grade the intensity of the murmur from 1 to 6, and determine its pitch and quality.
- Identify associated features such as the quality of S<sub>1</sub> and S<sub>2</sub>, the presence of extra sounds such as S<sub>3</sub>, S<sub>4</sub>, or an OS, or the presence of additional murmurs.
- Be sure you are listening in a quiet room!

**Systolic murmurs**

It is between the **S<sub>1</sub> and S<sub>2</sub> sound**.

**Midsystolic** murmur:

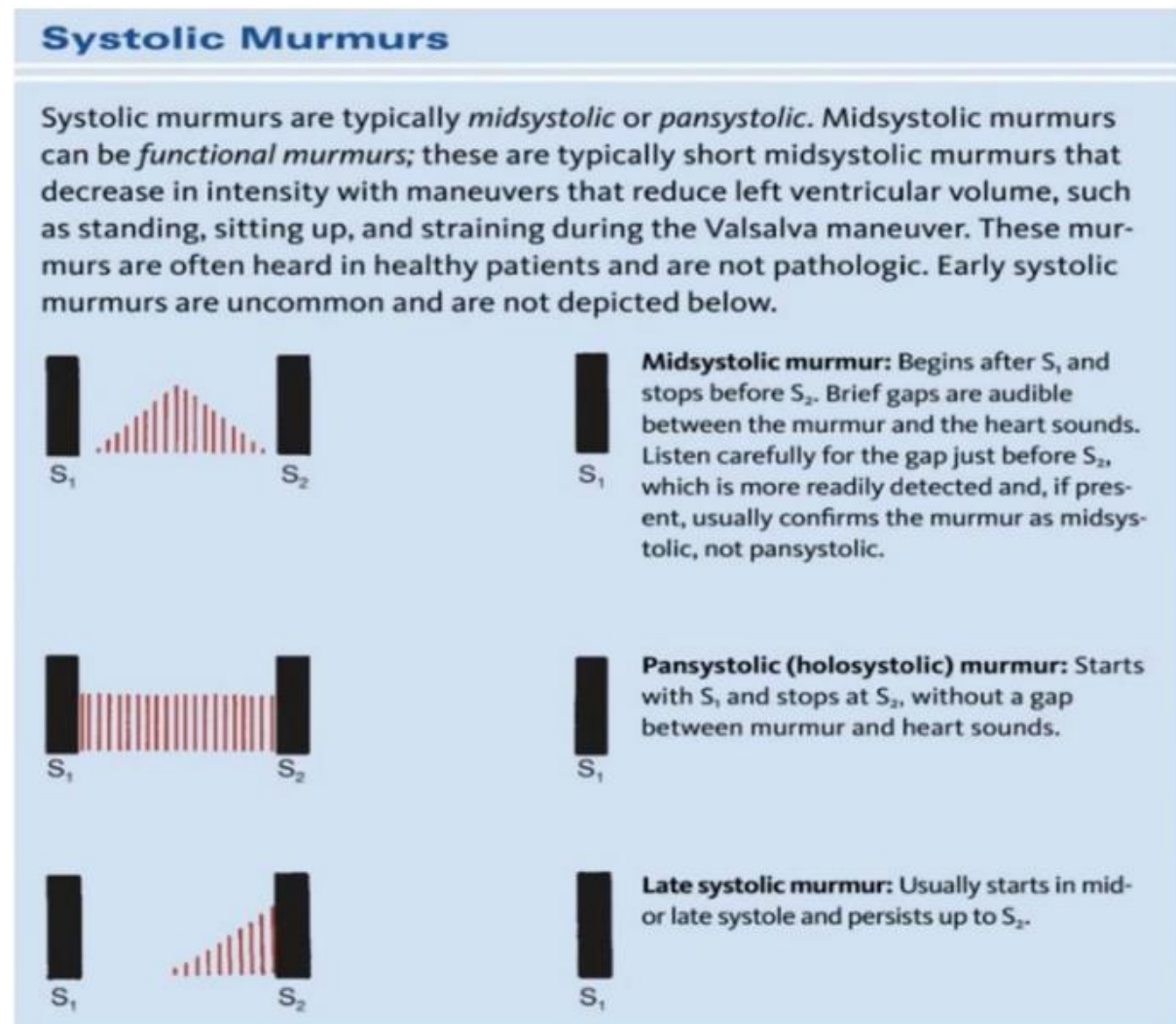
It is **crescendo-decrescendo**, which means it is **increasing-decreasing** and does **not cover S1 and S2**. If this murmur is heard in the **aorta** centre, it is in favor of **aortic stenosis**.

**Pansystolic (holosystolic)** murmur:

It starts at the **same time as S1** and **continues until S2** and has a **flat state**.

**Late** systolic murmur:

It starts from the **middle of systole** and has an **increasing state**.



### Diastolic murmurs

They start **after S2 and continue until the next S1** and can be **early** diastolic, **mid**-diastolic or **late** diastolic.

Early diastolic:

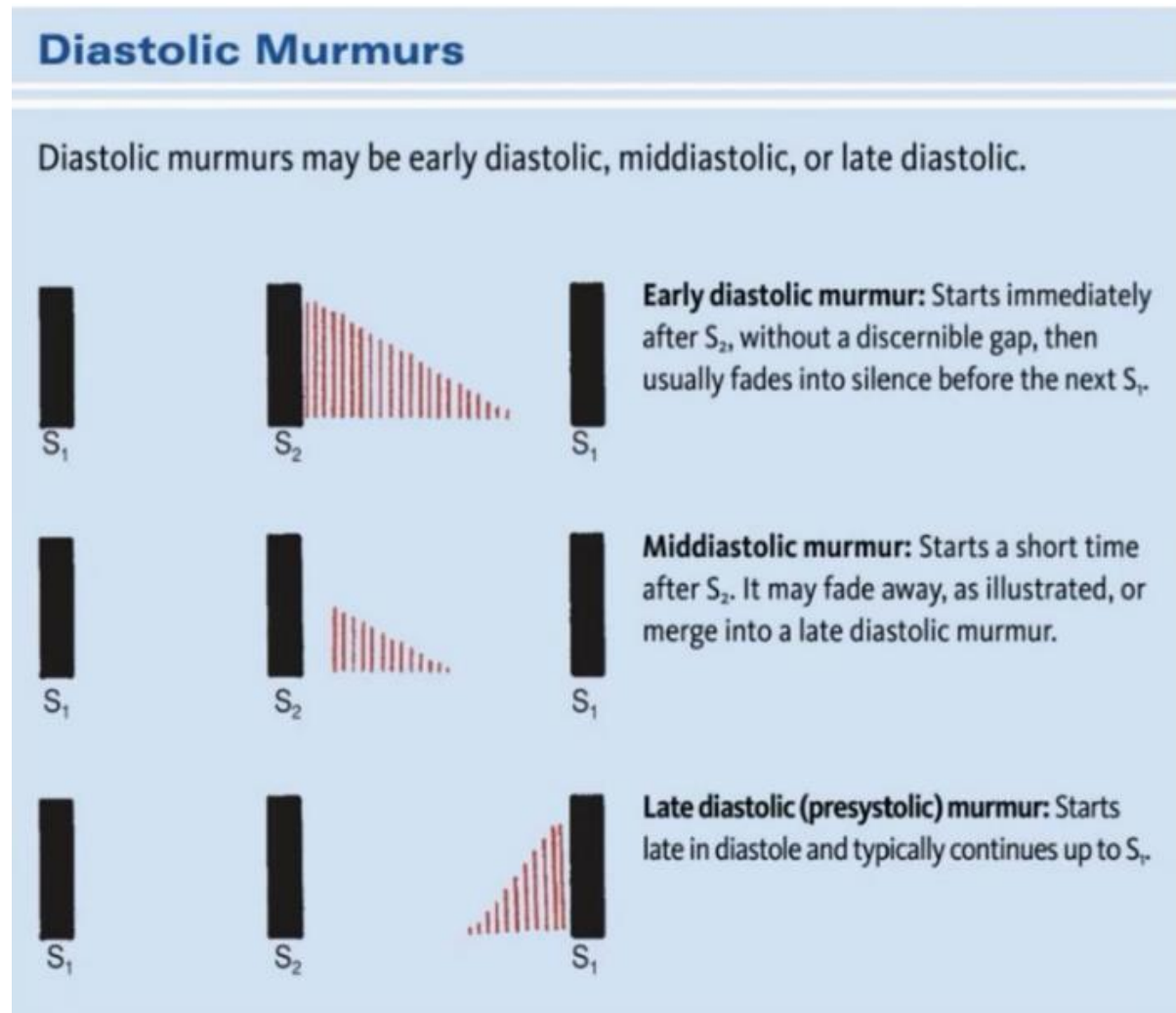
It starts **immediately after S2** and has a **decreasing state**. For example, a **decrescendo diastolic** murmur is heard in the **aortic** space of the patient, which is in favor of the murmur of **aortic valve insufficiency**.

Middiastolic:

It starts with a distance from S<sub>2</sub> and is crescendo.

Late diastolic:

It is the end of diastole and has an increasing state.



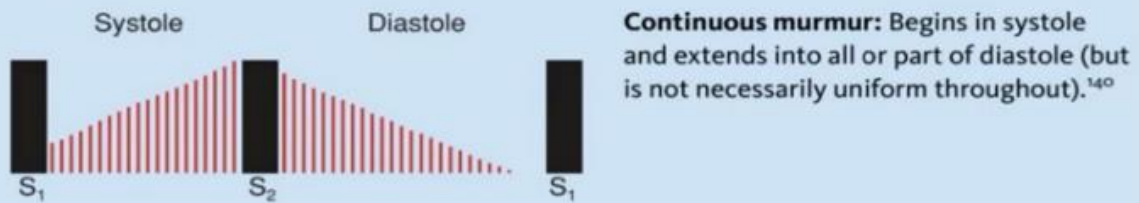
### Continuous murmurs

Murmurs that start after S<sub>1</sub> and continue in diastole



## Continuous Murmurs

Some congenital and clinical conditions produce continuous murmurs.



### Gradations of Murmurs

#### Grade 1

They are **murmurs** that are usually **very hard to hear** and to hear them you have to be **very professional** and have **auscultated to many patients**. There is little **valvular disorder** or the **disorder is acute** (because it is acute, we hear it with **low intensity**) these are **murmurs that reach our ears** in a **very small amount**.

#### Grade 2

We hear **better than 1st grade**, but it is still difficult.

#### Grade 3

The murmurs that **can be heard** and **students** who have **no experience can hear**.

#### Grade 4

The intensity of this murmur is **equal to grade 3**, with the difference that we **feel a thrill**. If we felt the thrill in the **palpation stage**, **murmur grade must be 4 or higher**.

#### Grade 5

If it is **too loud/long** (accompanied with **thrill**)

#### Grade 6

If it is **very loud**, it can be heard **without a stethoscope** by bringing the ear close to the patient's body (**along with the thrill**).

## Gradations of Murmurs

Grade	Description
Grade 1	Very faint, heard only after listener has “tuned in”; may not be heard in all positions
Grade 2	Quiet, but heard immediately after placing the stethoscope on the chest
Grade 3	Moderately loud
Grade 4	Loud, with <i>palpable thrill</i>
Grade 5	Very loud, with <i>thrill</i> . May be heard when the stethoscope is partly off the chest
Grade 6	Very loud, with <i>thrill</i> . May be heard with stethoscope entirely off the chest

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<sup>1</sup> که میگوییم گریید 1/6 ، 4/6 ، ... است.