

L7

Heart sounds

The heart sounds heard with a stethoscope are caused by vibrations originating in the heart and the major vessels. The opening and closing of the heart valves contribute greatly to the heart sounds; turbulent flow occurs at these times and the vibrations produced are often in the audible range.

The amount and quality of the sound heard depend on :

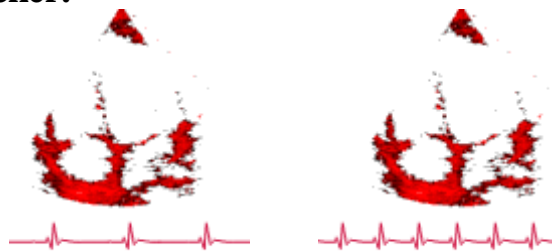
- The design of the stethoscope
- Its pressure on the chest,
- Its location,
- The orientation of the body,
- The phase of the breathing cycle.

Effects of Exercise on the Cardiovascular System

Short Term Effects of Exercise on the Cardiovascular System

Faster heart contractions :

This leads to an increased heart rate and increased circulation, which gets oxygenated blood to your muscles quicker.



heart at rest

heart working hard

- Exercise uses up a lot of energy, which the cells derive from oxidizing glucose. Both glucose and oxygen have to be delivered by the blood. This means that the heart has to work harder to pump more blood through the body. More forceful heart contractions with each heartbeat, which leads to a greater amount of blood being pumped throughout the body.

Can be described by this equation:

$$\text{Blood Flow (cardiac output (Q))} = \text{heart rate} \times \text{stroke volume}$$

Cardiac output (Q) is the volume of blood pumped per minute out of the left ventricle of the heart to the body.

Stroke volume (SV) is the volume of blood pumped out of the left ventricle of the heart in each heartbeat.

Furthermore, cardiac output is 4.5 to 5 liters per minute while stroke volume is approximately 80 milliliters per heartbeat.

Heart rate for a human being at rest is about 70 beats/min. During vigorous exercise, heart rate can increase dramatically . This will result in an increase in blood flow.

EX/ Calculate the cardiac output in centimeter cubed per minute of a heart that has a stroke volume of 80 cubic centimeters per beat and a heart rate of 70 beats per minute.

Long Term Effects of Exercise on the Cardiovascular System

A fairly well conditioned athlete can see long term cardiovascular effects from exercising in as little as two weeks. People who are just beginning to exercise will see effects in up to four weeks. These effects include:

- The heart and lungs become more efficient as your cardiovascular training increases.
- Decreased resting heart rate, which means your heart doesn't have to beat as often to circulate blood.
- Improved ability to draw in deeper and longer breaths, and take fewer breaths.
- Reduced risk of heart disease.

The physics of some cardiovascular diseases

Because of the many physical aspects of the cardiovascular system, heart diseases often have a physical component. Many of these diseases, for example, increase the work load of the heart or reduce its ability to work at a normal rate.

$W = P \Delta V$ equation of work done •

$T = P R$ Laplace equation

The work done by the heart is roughly the tension of the heart muscle times how long it acts. Anything that increase the work load of the heart. For example

1- Hypertension

Causes the muscle tension to increase in proportion to the pressure, due to Laplace law

$T = PR$ so the high blood pressure causes to increase the work done by equation **$W = P\Delta V$** .

2-Tachycardia

A fast heart rate increases the work load since the amount of time the heart muscle spend contracting increases

3-Enlargement of the heart and reduction in the ability of the heart to provide adequate circulation.

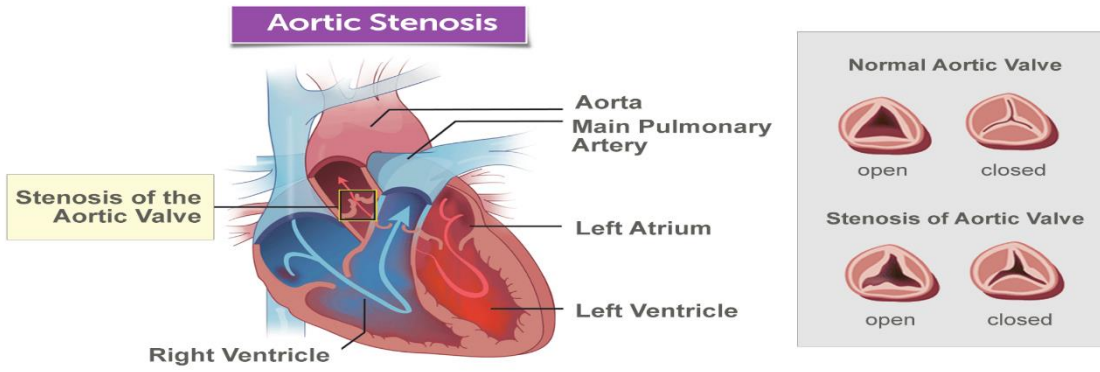
If the radius of the heart is doubled, the tension of the heart muscle must also be doubled if the same pressure is to maintained. Since the heart muscle is stretched , it may not be able to produce sufficient force to maintain normal circulation , the stretched heart muscle is also much less efficient than normal heart muscle.

4. Heart valve defects, types of the Heart valve defects

Stenosis: -

Aortic valve stenosis — or aortic stenosis — occurs when the heart's aortic valve narrows. The valve does not open fully, which reduces or blocks blood flow from your heart into the main artery to your body (aorta) and to the rest of your body.

The valve does not open wide enough. In stenosis, the work of the heart increased because a large amount of work done against the obstruction of the narrow opening, and the blood supply to the general circulation reduced.



Insufficiency (Regurgitation): -

Valvular insufficiency is a cardiac disease characterized by the failure of one or more of the heart valves to close perfectly resulting blood flowing backwards across the valve

The valve does not close well enough. In insufficiency, some of the pumped blood flows back into the heart so that the volume of the circulated blood reduced.

