

Venous circulation

The circulatory system may be divided into:

(1) Low pressure side.

- 1- Venous vessels.
- 2-Rt. side of the heart
- 3-pulmonary circulation
- 4- Left side of the heart during diastole

(1) high pressure side.

- 1- Left ventricle during systole
- 2-Arteries
- 3- Arterioles.
- 4- Capillaries.

Veins are thin-walled-non pulsatile vessels which can be highly distended and collapse; they are supplied by sympathetic fibers. They are affected by chemical substances that affect arteriolar diameter.

❖ Functions of the veins:-

(1) Veins as transport vessels

- Veins conduct blood from tissues to the heart **with minimal energy loss as** they offer little resistance to blood flow.
- The pressure in the veins in the recumbent position is 10 mmHg, and zero mmHg in the right auricle- Thus the drop of pressure is 10 mmHg.

(2) Veins as a capacitance vessels

- The capacity of the venous system is 200 times greater than the capacity of the arterial system.

- So, veins can accommodate large volume of blood with mild increase in pressure.

- So, veins are called capacitance vessel.

N.B: Capacitance = $\frac{\Delta V}{\Delta P}$

Central venous pressure (CVP)

It is the pressure in the right atrium and big vessels connect to it

It is = 0-5 mmHg

It is increased with hypervolemia and decreased with hypovolemia

(Mean Circulatory Pressure)

It is the mean pressure in the vascular system when the blood stop flowing, it is about 7-8 mmHg.

Its level is controlled by the relation between the blood volume and the capacity of the cardiovascular system

❖ Factors affecting venous return:-

1- Venomotor tone

- The veins receive sympathetic V.C fibers which discharge continuously to the veins giving the venomotor tone.
- That is sufficient to make the veins in the lower limbs rigid enough to prevent over pooling of blood when the person changes his position from supine to erect position.
- If the venomotor tone is decreased, the blood pools and orthostatic hypotension occurs

2- Muscle activity and venous valves (Muscle pump)

- The veins in lower limbs are surrounded by skeletal muscles, when these muscles contract as in walking; they squeeze the veins and push the blood toward the heart.
- As the veins contain valves, they allow the flow of blood in one direction only toward the heart and the blood does not return back.
- The valves also reduce the effect of gravity.
- In condition of **varicose veins the valves become incompetent, so the flow of blood toward the heart is decreased.**

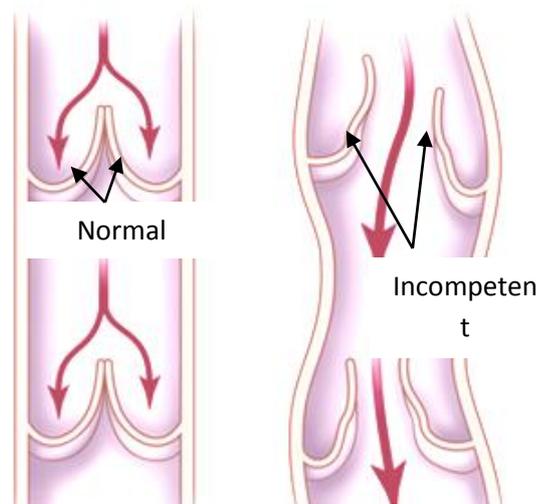


Fig.(62): Normal and incompetent veins

3- Respiratory movements (Thoracic pump)

- During inspiration, CVP drops from 6 to 2 mmHg aiding V.R.
- Also during inspiration, the diaphragm descends & inter -abdominal pressure rises, pushing blood toward the heart.

Lymphatic Circulation.

As the filtration at the arteriolar end of the capillaries is greater than that at the venular end, the excess fluids in the interstitial tissue spaces are drained by the lymphatic vessels that drain almost tissues of the body except the C.N.S and bones.

The fluid drained is called the lymph and it is transported through the lymph vessels, which are blind vessels called lymph capillaries. **These lymph capillaries unit together to form large vessels which finally end by two trunks.**

1-The thoracic duct.

It drains the lymph from the lower limbs, abdomen, left arm, left half of the thorax, and left side of the head and neck. It opens in the venous system at the junction of **the left subclavian and internal jugular vein.**

2-The right lymph duct.

It drain the lymph from the right arm, right half of the thorax, right side of the head and neck, it opens into the venous system at the junction of **right subclavian vein** and internal jugular vein.

Lymph Nodes.

These are collections of reticuloendothelial cells along the course of the lymphatic vessels.

Structure of lymph capillaries.

They have no basement membrane and wide fenestrations.

Its permeability is much more than the blood capillaries.

The large lymphatic vessels have valves that allow the unidirectional flow of lymph.

Functions of lymphatic system.

1-It drains the excess amount of fluids filtered at the arteriolar end of the capillaries back to the circulatory system.

2-The lymphatic system is considered as a part of the reticuloendothelial system that shares **in the defensive mechanisms of the body.**

3-It carry the large molecules that are collected in the interstitial tissue spaces by cytopempepsis and prevent its collection, as its collection leads to increased osmotic pressure of the fluids in the interstitial tissue spaces leading to accumulation of fluids and edema occurs.

Lymph flow.

The lymph flow is about 4 liters /day and its rate of flow is increased in all conditions that increase the rate of flow from the capillaries.

Composition of lymph.

1-It is colorless isotonic fluid ,its pH is 7.4

2-It becomes milky after fat absorption due to the presence of fat globules.

3-Its structure is similar to plasma except that the lymph protein is 2 gm/dl

4-It contain small amount of lymphocytes, prothrombin, and fibrinogen

5-It contain no platelets and small amount of calcium so it clots slowly.

Factors which maintain lymph flow.

1-Skeletal muscle contraction increases the lymph flow as it compresses over the lymph vessels.

2-Lymph flow is increased by contraction of the plain muscles in the wall of lymphatic vessels.

3-Valves in the lymph vessels allow the lymph to flow in one direction

4-The negative intrathoracic pressure sucks the lymph toward the thorax.

5-Respiratory movements: during inspiration the intrathoracic pressure becomes more negative and the lymph flow toward the thorax is increased.