Factors determining volume of blood flow

Volume of blood flow is determined by five factors:

1. Pressure gradient is the pressure difference between the two ends of the blood vessel. Volume of blood flowing through any blood vessel is directly proportional to the pressure gradient.

2. Peripheral Resistance: Peripheral resistance means the resistance offered to blood flow in peripheral blood vessels particularly the arterioles. Volume of blood flow is inversely proportional to the resistance.

3. Viscosity of blood

Viscosity is the friction of blood against the wall of the blood vessel. Volume of blood flow is inversely proportional to the viscosity of blood.

4. Diameter of blood vessels: volume of blood flow is directly proportional to the diameter of the blood vessels.

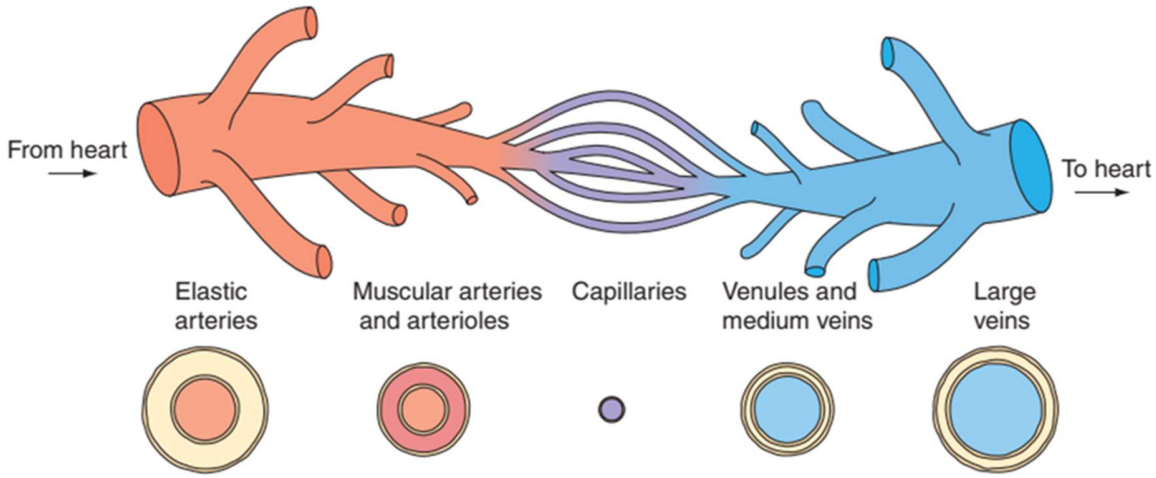
5. Velocity of blood flow: velocity of blood flow is the rate at which blood flows through a particular region of the body. Volume of blood flow is directly proportional to the velocity of blood flow.

Blood Vessels

There are three types of blood vessels: arteries, capillaries, and veins . These are the pipes that circulate blood throughout the body.

Arteries: are the large, thick-walled Blood vessels that carry blood away from the heart to the lungs and tissues. Arterioles are small arteries that deliver blood to the capillaries, and because of their small diameter, they play a key role in vasoconstriction and vasodilatation. The walls of arteries and arterioles consist of layers of endothelium, smooth muscle, and connective tissue. The arteries are adapted to carry relatively high blood pressure away from the heart.

Most arteries and arterioles carry oxygenated blood, except the pulmonary arteries where they transport deoxygenated blood from RV to the lungs.



Blood pressure

The refers to arterial blood pressure is *defined* as the force that is exerted by the blood on the *arterial* wall and also called 'blood pressure. Arterial blood pressure is expressed in different terms:

1. Systolic blood pressure (systolic pressure) is defined as the **maximum pressure** exerted in the arteries **during systole** of heart. Normal systolic pressure: 120 mm Hg (110 mm Hg to 140 mm Hg).

2. Diastolic blood pressure (diastolic pressure) is defined as the **minimum pressure** exerted in the arteries **during diastole** of heart. Normal diastolic pressure: 80 mm Hg (60 mm Hg to80 mm Hg).

Blood pressure is altered in physiological and pathological conditions. Systolic pressure is subjected for variations easily and quickly and its variation occurs in a wider range. While diastolic pressure is not subjected for easy and quick variations and its variation occurs in a narrow range.

Physiological variations

1. Age: arterial blood pressure increases as age advances

2. Sex: arterial pressure is 5 mm Hg, less than in males of same age.

3. Body Built: Pressure is more in obese persons than in lean persons.

4. Diurnal Variation: in early morning, the pressure is slightly low. It gradually increases and reaches the maximum at noon. It becomes low in evening.

5. After Meals: arterial blood pressure is increased for few hours after meals due to increase in cardiac output.

6. During Sleep: usually, the pressure is reduced up to 15 to 20 mm Hg during deep sleep. However, it increases slightly during sleep associated with dreams.
7. Emotional Conditions: during excitement or anxiety, the blood pressure is increased due to release of adrenaline.
8. After Exercise: during exercise, the blood pressure is increased due to increase in rate and force of contraction and stroke volume.

Pathological variations

Pathological variations of arterial blood pressure are hypertension & hypotension.

Factors affecting normal blood pressure:

There are Some factors necessary to maintain normal blood pressure such as:

A. Central factors, which are relating to the heart:
1. Cardiac output 2. Heart rate

B. Peripheral factors, which are relating to blood and blood vessels:
1. Peripheral resistance 2. Blood volume 3. Venous return 4. Elasticity of blood vessels

5. Velocity of blood flow 6. Diameter of blood vessels 7. Viscosity of blood.

All factors directly proportional to arterial blood pressure except elasticity of blood vessel and diameter of blood vessels are inversely proportional to arterial blood pressure.

Capillary circulation

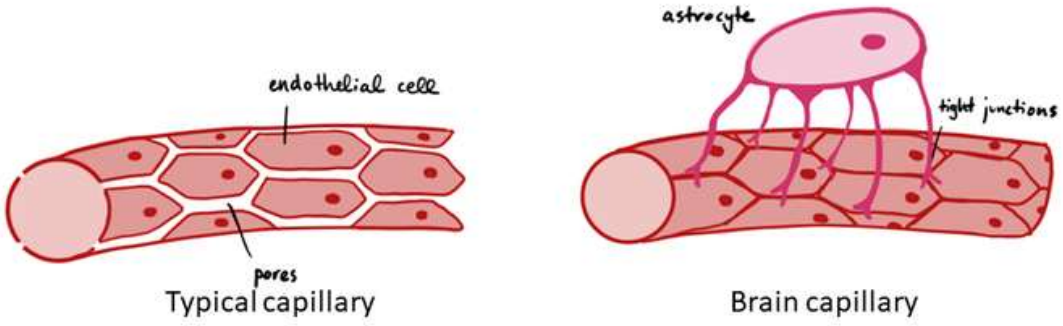
They are small blood vessels connects arterioles and venules. The capillary wall is a single layer of endothelial cells surrounded by a basement membrane, that from a semi-permeable membrane that allow the exchange of nutrients and wastes between blood and tissues. Blood flow in capillaries is very slow allows plenty of time for capillary exchange.

- Blood vessels that do not have the muscular/elastic tissue of other blood vessels.
- Small (smaller than any other blood vessels) and thin-walled (to help substances be transported through organisms).
- precapillary sphincters regulate capillary blood flow.

The 3 types of Capillaries:

1.Continuous capillaries

These are the most common types of capillaries. They contain small gaps in between their endothelial cells that allow for things like gases, water, sugar (glucose), and some hormones to pass through. The continuous capillaries in the brain are an exception. These capillaries are part of the blood-brain barrier, which helps to protect the brain by only allowing the most essential nutrients to cross. That's why the continuous capillaries in this area don't have any gaps between endothelial cells, and their surrounding basement membrane is also thicker.



2. Fenestrated capillaries

Fenestrated capillaries are "leakier" than continuous capillaries. They contain small pores, in addition to small gaps between cells, in their walls that allow for the exchange of larger molecules. This type of capillary is found in areas that require a lot of exchange between your blood and tissues. Examples of these areas include: the small intestine, where nutrients are absorbed from food; the kidneys, where waste products are filtered out of the blood.

3. Sinusoid capillaries

These are the rarest and "leakiest" type of capillary. Sinusoid capillaries allow for the exchange of large molecules, even cells. They're able to do this because they have many larger gaps in their capillary wall, in addition to pores and small gaps. The surrounding basement membrane is also incomplete with openings in many places. These types of capillaries are found in certain tissues, including those of your liver, spleen, and bone marrow (where these capillaries allow newly produced blood cells to enter into the bloodstream and begin circulation).