

Vessel Structure and Function

How do capillaries differ structurally from arteries and veins

Capillaries are different from other vascular structures in that they are made of only a single endothelial cell layer sitting on a very thin basement membrane - there are no other tunics, layers, or muscle.

Why is their structure important

The minimalist nature of capillaries allows them to be freely permeable to many substances (gases, fluids, and small ionic molecules).

Vessel Structure and Function

What structural feature of veins maintains blood flow to the heart despite the low pressure of blood in the veins

Valves

What type of patho can occur when the above fail

Varicose Veins

Capillary Beds: Two Types of Vessels

What is the vascular shunt

metarteriole

What is its purpose

Directly connects terminal arteriole and postcapillary venule

What are the true capillaries

10 to 100 exchange vessels per capillary bed. Branch off metarteriole or terminal arteriole

Capillary Exchange

What is capillary exchange

The movement of substances between the blood and interstitial fluid

List three ways substances may pass to and from capillaries

•Diffusion•Transcytosis•Bulk Flow (Filtration and Reabsorption)

Capillary Exchange

What is bulk flow

Passive process in which large numbers of ions, molecules, or particles in a fluid move together in the same direction with the fluid

What determines fluid movement

Movement is from an area of high pressure to one of low pressure

Why is it important

Important for regulation of relative volumes of blood and interstitial fluid

What forces determine bulk flow direction

Hydrostatic and Osmotic forces

Who are they named after

Starling Forces

Regulation of BP and Flow

How is control of BP and flow accomplished

Control is accomplished through several negative feedback systems. BP controlled by adjusting HR, SV, TPR, and blood volume

How do the fast-acting (short-term) systems work

Counteract fluctuations in blood pressure by altering peripheral resistance and CO

Give example

keeps you from passing out from the drop in blood pressure in the brain when you get out of bed

How do the slow-acting (long-term) systems work

Counteracts fluctuations in blood pressure by altering blood volume

Give an example of when distribution of BF is required

when you exercise, a greater percentage of total flow is diverted to skeletal muscle

Vessel Structure and Function

What are the 5 main blood vessel types

Arteries, Arterioles, Capillaries, Venules, Veins

Vessel Structure and Function

What is the job of veins?

Vessel Structure and Function

List the three tunics of arteries and veins and their make-up

Tunic Intima, Media, Externae

Compare and contrast features between the two

Arteries-endothelium, subendothelium, Internal elastic membrane, External elastic membrane, Vasa Vasorum

Veins-Endothelium, subendothelial layer, Vasa Vasorum

Vessel Structure and Function

The body contains three types of capillaries:

-Continuous capillaries (least permeable)

The most common

Endothelial cells form a continuous tube, interrupted only by small intercellular clefts.

-Fenestrated capillaries (fenestra = windows)

Found in the kidneys, villi of small intestines, and endocrine glands

These are much more porous.

-Sinusoids (most permeable)

Form very porous channels through which blood can percolate, e.g., in the liver and spleen.



Vessel Structure and Function

What is an anastomosis

a union of vessels supplying blood to the same body tissue

Why are they important

Should a blood vessel become occluded, a vascular anastomosis provides collateral circulation (an alternative route) for blood to reach to and return from tissue.

List example in the powerpoint

A great example is the genicular anastomosis

Where are anastomosis commonly found

Common at joints, in abdominal organs, brain, and heart

Where are they not found

None in retina, kidneys, spleen

Capillary Exchange

What is diffusion

The movement of a substance from an area of high concentration to an area of low concentration

What chemical properties affect what can diffuse to and from capillaries

Water-soluble substances and Lipid-soluble substances

In all capillaries, excluding the brain, diffusion is the most important means in net solute exchange between the plasma and interstitial fluid

Fluid Exchange - Starling Forces

–Filtration

•the movement of fluid (plasma) through the walls of the capillary and into the interstitial fluid.

•Two pressures promote filtration:

–Blood hydrostatic pressure (BHP) generated by the pumping action of the heart

–Interstitial fluid osmotic pressure (IFOP) is due to the presence of dissolved solutes in the interstitial fluid.

Regulation of BP and Flow

List and discuss the three methods of regulation of BP

–Neural control–Hormonal control–Autoregulation

Neural Regulation

What CNS structure is involved in neural control

Cardio Vascular center

What are the two parts of the vasomotor center

•Vasoconstrictor center•Vasodilator center

Through what neurons do they relay commands

Sympathetic neurons

Neural Regulation (cont)

What part of the ANS is this part of

Sympathetic

What is vasomotor tone and why is it important

This sets the resting level for systemic vascular resistance

Vessel Structure and Function

What is the job of arteries?

carry blood away from the heart

List the three types

Large Elastic Arteries, Medium Muscular Arteries, Arterioles

Vessel Structure and Function

In what blood vessel type is the most percentage of the blood found?

Systemic veins and venules

Vessel Structure and Function

What is the function of arterioles?

Regulate blood flow to the capillaries

Why are they important in regulating local blood flow and overall BP

They are the primary "adjustable nozzles" across which the greatest drop in pressure occurs

Vessel Structure and Function

Describe how arterioles feed blood into capillaries (list features)

The terminal end of an arteriole tapers toward the capillary junction to form a single metarteriole

At the metarteriole-capillary junction, the distal most muscle cell forms the precapillary sphincter which monitors and regulates blood flow into the capillary bed

Vessel Structure and Function

What receives blood from the capillaries?

Venules

Vessel Structure and Function

What receives blood from the capillaries?

Venules

What do these structures empty into

Veins



Blood Flow Through Capillary Beds

What are the precapillary sphincters

Precapillary sphincters are bands of smooth muscle that regulate blood flow into true capillaries

What do they do to affect capillary exchange

regulate blood flow

What are two things that can affect their contractile state

chemical conditions and vasomotor nerves

Why is slow capillary flow important

Slow capillary blood flow allows adequate time for exchange between blood and tissues

Capillary Exchange

What is transcytosis

Movement of a small quantity of material through the endothelial cell using a pinocytotic vesicle

How is it performed

Small membrane enclosed bubble transporting substance within cell

Why is it performed

Used mainly for large lipid-insoluble (water-soluble) molecules that cannot cross capillary walls by other means

List examples

Insulin enters the blood stream this way

Fluid Exchange - Starling Forces

–Reabsorption•the movement of fluid from the interstitial fluid back through the walls of the capillary and into the plasma.

•Two pressures promote reabsorption:

–Blood colloid osmotic (or oncotic) pressure (BCOP)

•due to the presence of plasma proteins too large to cross the capillary wall

–Interstitial fluid hydrostatic pressure (IFHP)

•The fluid pressure of the interstitial fluid

–normally close to zero but can become a significant factor in states of edema.

Neural Regulation of BP

List the two types of neural reflexes for control of BP and flow

–Baroreceptor reflex–Chemoreceptor reflex

Vessel Structure and Function

What is the job of capillaries?

site of nutrient and gas exchange



Vessel Structure and Function

What are tunics?

Layers on the wall of a blood vessel

Vessel Structure and Function

What is the function of the large elastic arteries and give example

storing mechanical energy during ventricular systole and then transmitting that energy to keep blood moving after the aortic and pulmonary valves close.

Best exemplified by the garden hose-sized aorta

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By **jjovann**
cheatography.com/jjovann/

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