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1. DESCRIBE THE IMPORTANCE OF VASCULATURE IN RELATION TO IMMUNE SYSTEM AND OUTBREAK OF PANDEMIC COVID-19 IN THE HUMAN BODY.

WHAT IS VASCULATURE?

Vasculature is a network of blood vessels connecting the heart with all other organs and tissues in the body.

The vascular system has a crucial role in bringing oxygen and nutrients to every organ and tissue, and removing waste products through a series of blood vessels. In conjunction with the heart which acts as a pump, it forms the cardiovascular system.

There are five classes of blood vessels, namely:

* Arteries and Arterioles(the Arterial system)
* Veins and Venules(the Venous system)
* and Capillaries(the smallest blood vessels, linking arterioles and venules through networks within organs and tissues).

Arteries are described as ‘branching’ vessels, great arteries (such as aorta) branch off into smaller arteries and arterioles. Veins are described as converging or joining vessels as venules and veins join to return blood to the heart through the largest veins (such as the inferior and superior vena cava). Capillaries are in intimate contact with the tissues, providing nutrients and removing waste through their thin walls at cellular level.

FUNCTIONS OF THE FIVE BLOOD VESSELS

* Arteries: they transport high-pressure blood from the heart to smaller arteries and arterioles
* Arterioles: connect arteries and capillaries
* Veins: act as reservoir of blood and transport low-pressure blood from venules to heart
* Venules: connect capillaries and veins
* Capillaries: allow gas exchange, nutrient transfer and waste removal between blood and tissue fluids

THE IMMUNE SYSTEM

The immune system includes primary lymphoid organs, secondary lymphatic tissues and various cells in the innate and adaptive immune systems.

The key primary lymphoid organs of the immune system include the thymus and bone marrow, as well as secondary lymphatic tissues including spleen, tonsils, lymph vessels, lymph nodes, adenoids, skin and liver.

The thymus educates T cells and provides an inductive environment for the development of T cells from hematopoietic progenitor cells. The thymus is largest and most active during neonatal and pre-adolescent periods of development.

Bone marrow is the flexible tissue found in the interior of bones. In humans, red blood cells are produced in the heads of long bones. The red bone marrow is a key element of the lymphatic system, being one of the primary lymphoid organs that generate lymphocytes from immature hematopoietic progenitors cells. Bone marrow and thymus constitute the primary lymphoid tissues involved in the production and early selection of lymphocytes.

LYMPHATIC SYSTEM The lymphatic system is a network of tissues and organs that help rid the body of toxins, waste and other unwanted materials. The primary function of the lymphatic system is to transport lymph, a fluid containing infection-fighting white blood cells, throughout the body.

The lymphatic system primarily consists of lymphatic vessels which are similar to the veins and capillaries of the circulatory system. The vessels are connected to the lymph nodes, where the lymph is filtered. The Tonsils, Adenoids, Spleen and Thymus are all part of the lymphatic system.

There are hundreds of lymph nodes in the human body. They are located deep inside the body, such as around the lungs and heart, or closer to the surface, such as under the arm or groin. The lymph nodes are found from the head to around the knee area.

The Spleen which is located on the left side of the body just above the kidney, is the largest lymphatic organ. The spleen acts as a blood filter. It controls the amount of red blood cells and blood storage in the body, and it helps to fight infections. If the spleen detects potentially dangerous bacteria, viruses or other microorganisms in the blood, it alongside the lymph nodes creates white blood cells called lymphocytes which act as defenders against invaders. The lymphocytes produce antibodies to kill the foreign microorganism and stop infections from spreading. Humans can live without a spleen, although people who lost their spleen to disease or injury are more prone to infections.

Tonsils are large clusters of lymphatic cells found in the pharynx. They are the body’s first line of defense as part of the immune system. They sample bacteria and viruses that enter the body through the mouth or nose.

The liver has a wide range of functions, including immunological effects. The reticuloendothelial system of the liver contains many immunological active cells that acts as a sieve for antigens carried to it through the portal system.

The skin is one of the most important parts of the body because it interconnects with the environment, and is the first line of defense from external factors, acting as an anatomical barrier from pathogens and damage between the internal and external environment in bodily defense.

BLOOD SUPPLY

The blood is a vitally important fluid for the body. It is thicker than water. The temperature of blood is 38°c which is about one degree higher than body temperature. The blood is made up of 55% blood plasma and about 45% of different types of blood cells. The blood plasma is a light yellow liquid. Over 90% of blood plasma is water, while less than 10% is dissolved substances mostly proteins. Blood plasma contains electrolytes, vitamins and nutrients. Over 99% of the solid particles present in the blood are cells that are called red blood cells (erythrocytes) due to their red color. The rest are pale or colorless white blood cells (leukocytes) and platelets (thrombocytes).

Functions of blood

1. Transportation: blood transports oxygen from the lungs to the cells of the body where it is needed for metabolism. The carbon dioxide produced during metabolism is carried back to the lungs by the blood where it is then exhaled. Blood also provides the cells with nutrients, transports hormones and removes waste product which the liver, kidney and or the intestine, for example then get rid of.
2. Regulation: the blood helps to keep certain values of the body in balance. This is done both through blood plasma, which can absorb or give off heat, as well as through the speed at which the blood is flowing.
3. Protection: if a blood vessel is damaged certain parts of the blood cloth together very quickly and make sure that a scrape for instance, stops bleeding. This is how the body is protected against losing blood. White blood cells and other messenger substances also play an important role in the immune system.

Lack of blood supply to the organs of the immune system can cause severe damage to the body, it leads to death in worst cases. The immune system never rests, its cells constantly patrol the circulation. Without the immune system, the body would be engulfed with infections. Therefore, there has to be adequate blood supply for the immune system and other systems in the body to be able to carry out its activities.

WHAT IS COVID-19?

SARS-CoV-2 virus popularly known as coronavirus. Coronaviruses are positive-sense, single-stranded RNA viruses of the family Coronaviridae subfamily Coronavirinae that infect a wide range to produce diseases ranging from common cold to severe/fatal illnesses. Coronavirus disease (COVID-19) is an infectious disease caused by a new virus.

When the disease is contracted, it usually causes

* Respiratory illnesses so the lungs are usually affected first.
* Early symptoms include fever, shortness of breath and cough. These appear as soon as 2 days or as long as 14 days after exposure to the virus.
* Damage can also occur to other parts of the, especially during serious illness.
* Parts of the body that can also be affected asides the Lungs include the stomach and intestines, the heart and blood vessels, liver and kidneys and majority of these sum up to form the body’s immune system.

Now with any infection, the body’s immune system responds by attacking the foreign virus or bacteria. While this immune response can rid the body of the infection, it can also sometimes cause collateral damage in the body.

This can come in form of an intense inflammatory response, sometimes called a “cytokine storm.” The immune cells produce cytokines to fight infections, but if too many are released, it can cause problems in the body .

“A lot of (the damage in the body during COVID-19) is due to what we call a sepsis syndrome, which is due to complex immune reaction.” “The infection itself can generate an intense inflammatory response in the body that can affect the functioning of multiple organ systems.”

TREATMENT

Although there’s no specific treatment or vaccine for the virus, the symptoms of the infected people are treated.

Symptoms of symptomatic positive people are being treated, asymptomatic positive persons are isolated and given proper ventilation while asymptomatic negative persons are advised to isolate themselves in their homes.

If Vasculature is a network of blood vessels connecting the heart with all other organs and tissues in the body then when a person has the virus in them, it can be transferred from the lung to the heart which can result to death but if the person has a good immune system that is able to produce enough lymphocytes which is able to fight viruses and bacteria and there is enough supply of blood around the body then such person should be able to survive the virus.

1. Subsartorial canal is an important area in the lower limb.

The subsartorial canal (Hunter’s canal, adductor canal) is a narrow conical tunnel located in the thigh. It is approximately 15cm long, extending factor from the apex of the femoral triangle to the adductor hiatus of the adductor magnus. The canal serves as a passageway from structures moving between the anterior thigh and posterior leg.

BORDERS

The adductor canal is bordered by muscular structures:

Anteromedial : Sartorius.

Lateral: Vastus medialis.

Posterior: Adductor longus and adductor magnus.

The adductor canal runs from the apex of the femoral triangle to the adductor hiatus –a gap between the adductor and hamstring attachments of the adductor magnus muscle.

CONTENTS

The adductor canal serves as passageway for structures moving between the anterior thigh and posterior leg. It transmits the femoral artery, femoral vein (posterior to the artery), nerve to the vastus medialis and the saphenous nerve –the largest cutaneous branch of the femoral nerve.

As the femoral artery and vein exit the canal, they are called the popliteal artery and vein respectively.

CLINICAL RELEVANCE- Adductor Canal Block

In the adductor canal block, local anaesthetic is administered in the adductor canal to block the saphenous nerve in the isolation, or together with the nerve to the vastus medialis.

The block can be used to provide sensory anaesthesia for procedures involving the distal thigh and femur, knee and lower leg on the medial side. The Sartorius and femoral artery are used as anatomical landmarks to locate the saphenous nerve.

CLINICAL RELEVANCE –Adductor Canal Compression Syndrome

Adductor canal compression syndrome describes entrapment of the neurovascular bundle within the adductor canal. A rare condition, it is usually caused by hypertrophy of adjacent muscles such as vastus medialis.

It is most common in young males, who may present with claudication symptoms due to femoral artery occlusion( more common)or neurological symptoms due to entrapment of the saphenous nerve.

1. Describe the Extraocular and intraocular Muscles with their nerve.

 Extraocular Muscle

The muscles of the eye are integral to its function and motion. Muscles directly associated with the eye include the extraocular muscles which control the external movement of the eye.There are six extraocular muscles that move the globe (eyeball). These muscles are named the superior rectus, inferior rectus, lateral rectus, medial rectus, superior oblique, and inferior oblique.

Upgaze, or turning the eye upward, is primarily the work of the superior rectus muscle, with some contribution by the inferior oblique muscle. Downgaze, or turning the eye downward, is primarily the work of the inferior rectus, with some contribution by the superior oblique.

Abduction, or turning the eye outward toward the ear, is primarily done by the lateral rectus. Adduction, or turning the eye inward toward the nose, is primarily done by the medial rectus.

The eye is rotated medially by the superior rectus and superior oblique, and is rotated laterally by the inferior rectus and inferior oblique. In addition, the levator palpebrae superior which is not seen on the drawing elevates the eyelid. The extraocular muscles are innervated by three cranial nerves (CN), CN III (oculomotor nerve), CN VI (abducens nerves). CN VI and IV are fairly straightforward. The paired right and left CN VI arise from the pons in the midbrain, and send their axons into the orbits to innervate the right and left lateral rectus muscles, respectively. Therefore, CN VI is responsible for abducting each eye. The paired right and left trochlear nuclei are in the midbrain. Their axons, which make up CN IV, exit the midbrain, and send their axons into the orbits to innervate the left and right superior oblique muscles, respectively. Therefore, CN IV is primarily responsible for turning each eye downward when it is already looking inward toward the nose.

CN III is a bit more complicated, as it innervates all of the remaining extraocular muscles. Therefore, each oculomotor nucleus is actually made up of overlapping subnuclei , and each subnucleus send its axon to innervate a specific extraocular muscle. The right and left oculomotor nuclei are located in the midbrain. The axons from the right or left nucleus leave the midbrain and come together to form the body of the right or left CN III. As the nerve enters the orbit, it splits into the superior branch of CN III and the inferior branch of CN III innervates the superior rectus and the levetor palpebrae superioris. The lower branch innervates the medial rectus, inferior rectus, and inferior oblique.

Intraocular Muscles

The intraocular muscles are responsible for pupil accommodation and reaction to light. The intraocular muscles include the ciliary muscle, the sphincter papillae, and the dilator pupillae. The ciliary muscle is a smooth muscle ring that controls accommodation by altering the shape of the lens, as well as controlling the flow of aqueous humor into schlemm’s canal. The ciliary muscle is attached to the zonular fibers which suspend the lens. Upon contraction of the ciliary muscle, the tension on the lens is lessened which causes it to adopt a more spherical shape to focus on near objects.

Relaxation of the ciliary muscle has the opposite effect, optimizing distant focus. The sphincter pupillae and dilator pupillae are also composed of smooth muscle. The sphincter pupillae encircles the pupil and is responsible for the constriction of its diameter, while the dilator muscle is arranged radially and increases the pupillary diameter. There are three primary axes of ocular movements: vertical, transverse,and anteroposterior.

Rotation around the vertical axis result in either adduction (medial movement) or abduction (lateral movement) of the eye .Rotation around the transverse axis causes elevation (superior motion) or depression (inferior motion). The anteroposterior axis enables movement of the superior pole of the eye medially (intorsion)or laterally (extorsion). The rotations around the anteroposterior axis allow the eye to adjust to tilting of the head. The medial rectus muscle is responsible for medial rotation around the vertical axis, and the lateral rectus lateral rotation. The superior rectus muscle primarily elevates the eye and contributes to adduction and intorsion. The inferior rectus depresses and laterally rotates the eye and contributes to adduction and extorsion. The super oblique abducts, depresses and medially rotates the eye, while the inferior oblique abducts, elevates, and laterally rotates the eye. The primary retractor of the upper eyelid is the levator palpebrae superioris, which is a skeletal muscle. The superior tarsal muscle(Muller’s muscle)is comprised of smooth muscle and also contributes to the elevation of the upper eyelid. The retractors are the capsulopalpebral fascia and the inferior tarsal muscle.

The orbicularis oculi is the main protractor (closure) of the eyelids. It is a flat, ring like band of skeletal muscle surrounding the anterior orbit composed of three parts: the orbital portion, the palpebral portion and the lacrimal portion.