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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 ‘or ‘bifurcating’ vessels, as 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 superior and inferior venae cavae). 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 systems of the liver contain many immunological active cells acting as a sieve for antigens carried to it via the portal system.

The skin is one of the most important parts of the body because it interfaces 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 and feels a bit sticky. 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. Th
3. is 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.
4. 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 or in worse cases lead to death. The immune system never rests, its cells constantly patrol the circulation. Without the immune system, the body would be overwhelmed 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 function 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.

So, it is advisable to eat good food which contains all classes of food to be able to boost the immune system so as to be able to fight any virus that comes into the body.

1. **SUBSARTORIAL CANAL IS AN IMPORTANT AREA IN THE LOWER LIMB, DISCUSS**

The subsartorial canal (adductor canal) is a narrow conical tunnel located in the thigh.

It extends 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.

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The adductor canal serves as a 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.

1. **DESCRIBE THE EXTRAOCULAR AND INTRAOCULAR MUSCLES WITH THEIR NERVE SUPPLY**

The extraocular muscles are located within the orbit, but are extrinsic and separated from the eye ball itself. They act to control the movements of the eye ball and the superior eye lids.

There are 7 extraocular muscles - The levator palpebrae superioris, superior rectus, inferior rectus, medial rectus, lateral rectus, inferior oblique and superior oblique. Functionally, they can be divided into two groups:

* Responsible for eye movement: Recti and oblique muscles.
* Responsible for superior eyelid movement: Levator palpebrae superioris.

**LEVATOR PALPEBRAE SUPERIORIS**

 The levator palpebrae superioris (LPS) is the only muscle involved in raising the superior eyelid. A small portion of this muscle contain a collection of smooth muscle fibers – known as the superior tarsal muscle. In contrast to the LPS, the superior tarsal muscle is innervated by the sympathetic nervous system.

* **ATTACHMENTS:** Originates from the lesser wing of the sphenoid bone, immediately above the optic foramen. It attaches to the superior tarsal plate of the upper eyelid (a thick plate of connective tissues)
* **ACTIONS**: Elevate the upper eyelid.
* **INNERVATION**: The levator palpebrae superioris is innervated by the oculomotor nerve (CN iii). The superior tarsal muscle (located within the LPS) is innervated by this sympathetic nervous system.

 **MUSCLES OF THE EYE MOVEMENT**

There are six muscles involved in the control of the eye ball itself. They can be divided into two groups; the four recti muscles, and the two oblique muscles.

**RECTI MUSCLES**

There are 4 recti muscles; superior rectus, inferior rectus, medial rectus and lateral rectus.

These muscles characteristically originate from the common tendinous ring. This is a ring of fibrous tissue, which surrounds the optic carnal at the back of the orbit. From their origin, the muscles pass anteriorly to attach to the sclera of the eyeball.

The name recti were derived from the Latin word ‘straight’ – this represents the fact that the recti muscles have a direct part from origin to attachment. This is in contrast with the oblique eye muscles, which have an angular approach to the eyeball.

**SUPERIOR RECTUS**

**ATTACHMENTS**: originates from the superior part of the common tendinous ring, and attaches to the inferior and anterior aspects of the sclera.

**ACTIONS**: Main movement is elevation, also contributes to adduction and medial rotation of the eyeball.

**INNERVATION**: Oculomotor nerve (CN iii)

**INFERIOR RECTUS**

**ATTACHMENTS**: originates from the inferior part of the common tendinous ring, and attaches to the inferior and anterior aspects of the sclera.

**ACTIONS**: main movement is depression. Also contributes to adduction and lateral rotation of eyeballs.

**INNERVATION**: Oculomotor nerve (CN iii)

**MEDIAL RECTUS**

**ATTACHMENTS**: Originates from the medial part of the common tendinous ring, and attaches to the anteromedial aspect of the sclera.

**ACTIONS**: Adducts the eyeball

**INNERVATION**: Oculomotor nerve (CN iii)

**LATERAL RECTUS**

**ATTACHMENTS**: Originates from the lateral part of the common tendinous ring, and attaches to the anterolateral aspect of the sclera.

**ACTIONS**: Abducts the eyeball

**INNERVATION**: Abducens nerve (CN vi)

**OBLIQUE MUSCLES**

There are two oblique muscles- the superior and inferior obliques. Unlike the recti groups of muscles, they do not originate from the common tendinous ring.

Form their origin, the oblique muscles take an angular approach to the eyeball (in contrast to the straight approach of the recti muscles). They attach to the posterior surface of the sclera.

**SUPERIOR OBLIQUE**

**ATTACHMENTS**: Originates from the body of the sphenoid bone. Its tendon passes through a trochlear and the attaches to the sclera of the eye, posterior to the superior rectus.

**ACTIONS**: Depresses, abducts and medially rotates eyeball

**INNERVATIONS**: Trochlear nerve (CN iv)

**INFERIOR OBLIQUE**

**ATTACHMENTS**: Originates from the anterior aspects of the orbital floor. Attaches to the sclera of

Elevates, abducts and laterally rotates the eyeball.

**ACTION**: the eye, posterior to the lateral rectus.

**INNERVATION:** Oculomotor nerve (CN iii)

**WHAT HAPPENS WHEN A NERVE IS INJURED?**

Oculomotor (3rd cranial) nerve injury results in diplopia (double vision) that is greatest when the patient looks laterally. The examination, which separates diplopia on lateral gaze from a third nerve injury from other causes, detects ptosis, lateral deviation of the eye and most important, a dilated pupil- all of the affected eye.

However, one important exception is that third nerve infractions from diabetes “spare the pupil”, that is, the pupil remains reactive to light and the same size as its counterpart.

Abducens (6th cranial) nerve injury also causes diplopia on looking laterally.

Injury to the trochlear nerve causes weakness of downward eye movement with consequent vertical diplopia. The affected eye drifts upward relative to the normal eye, due to the unopposed actions of the remaining extraocular muscles.

**INTRAOCULAR NERVES**

The intraocular muscles include the ciliary muscle, the sphincter pupillae, 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 is lessened which causes it to adopt a more spherical shape to focus on near objects. Relaxation of the ciliary muse 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.

All intraocular muscles are supplied by oculomotor (CN iii) nerve.

**CILIARY MUSCLE**

**ATTACHMENT**: The ciliary muscle and the pupillary constrictor muscle receive fibers from the short ciliary nerves that arise from the ciliary ganglion.

**ACTIONS:** When the ciliary muscle is relaxed, the choroid acts like a spring pulling on the lens via the zonule fibers causing the lens to become flat while when it contracts, it stretches the choroid, releasing the tension on the lens and the lens becomes thicker.

**INNERVATION**: Oculomotor nerve (CN iii)

**SPHINCTER PUPILLAE**

**ATTACHMENT**: The sphincter pupillae is situated in the posterior part of the iris, near the pupil, and consists of smooth muscles.

**ACTIONS:** it is supplied by parasympathetic fibers by the way of the short ciliary nerves, and its contraction results in constriction of the pupil.

 **INNERVATION**: Oculomotor nerve (CN iii)

**DILATOR PUPILLAE**

**ATTACHMENT**: The dilator pupillae consists of smooth muscle anterior to the pigmented epithelium on the posterior aspect of the iris, which constitutes the iridial part of the retina.

**ACTION:** The dilator pupillae is supplied by sympathetic fibers, and its contraction results in dilation of the pupil

**INNERVTION:** Oculomotor nerve (CN iii)