NAME: EZE KAMSEY PRINCESS

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1. Describe the importance of vasculature in relation to immune system and outbreak of pandemic COVID-19 on the human body

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

1. Arteries: they transport high-pressure blood from the heart to smaller arteries and arterioles

2. Arterioles: connect arteries and capillaries

3. Veins: act as reservoir of blood and transport low-pressure blood from venules to heart

4. Venules: connect capillaries and veins

5. 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 contains 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. 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 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 carryout 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 functioin 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.

2. Subsartorial canal is an important area in the lower limb, discuss

The subsartorial canal also known as the adductor canal or hunters canal is a narrow conical tunnel located in the thigh.

It is approximately 15cm long, extending 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 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.

3. Describe the extraocular and intraocular muscles with their nerve supply

Extraocular muscles

The extraocular muscles are located within the orbit, but are extrinsic and separate from the eyeball itself. They act to control the movements of the eyeball and the superior eyelid.

There are seven 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 contains a collection of smooth muscle fibres – 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 tissue).

Actions: Elevates 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 the sympathetic nervous system.

Muscles of Eye Movement

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

- Recti Muscles

There are four 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 canal at the back of the orbit. From their origin, the muscles pass anteriorly to attach to the sclera of the eyeball.

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

1. Superior Rectus

Attachments: Originates from the superior part of the common tendinous ring, and attaches to the superior and anterior aspect of the sclera.

Actions: Main movement is elevation. Also contributes to adduction and medial rotation of the eyeball.

Innervation: Oculomotor nerve (CN III).

2. Inferior Rectus

Attachments: Originates from the inferior part of the common tendinous ring, and attaches to the inferior and anterior aspect of the sclera.

Actions: Main movement is depression. Also contributes to adduction and lateral rotation of the eyeball.

Innervation: Oculomotor nerve (CN III).

3. 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).

4. 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 group of muscles, they do not originate from the common tendinous ring.

From 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.

1. Superior Oblique

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

Actions: Depresses, abducts and medially rotates the eyeball.

Innervation: Trochlear nerve (CN IV).

2. Inferior Oblique

Attachments: Originates from the anterior aspect of the orbital floor. Attaches to the sclera of the eye, posterior to the lateral rectus

Actions: Elevates, abducts and laterally rotates the eyeball.

Innervation: Oculomotor nerve (CN III).

Clinical Relevance: Cranial Nerve Palsies

The extraocular muscles are innervated by three cranial nerves. Damage to one of the cranial nerves will cause paralysis of its respective muscles. This will alter the resting gaze of the affected eye. Thus, a lesion of each cranial nerve has its own characteristic appearance:

- Oculomotor nerve (CN III) – A lesion of the oculomotor nerve affects most of the extraocular muscles. The affected eye is displaced laterally by the lateral rectus and inferiorly by the superior oblique. The eye adopts a position known as ‘down and out’.

- Trochlear nerve (CN IV) – A lesion of CN IV will paralyse the superior oblique muscle. There is no obvious affect of the resting orientation of the eyeball. However, the patient will complain of diplopia (double vision), and may develop a head tilt away from the site of the lesion.

- Abducens nerve (CN VI) – A lesion of CN VI will paralyse the lateral rectus muscle. The affected eye will adducted by the resting tone of the medial rectus.