

# Cardiovascular System

## Anatomy

### This sheet contains extra notes only

\*Aortic arch:-

-It is present outside the pericardium.

-it starts and ends at the same level.

-it has two surfaces:-

1-superficial surface----→anterior and to the left

2-deep surface-----→posterior and to the right

- If a patient has an aneurysm in the arch of the aorta, it could press on the trachea and cause dyspnea or press on the esophagus and cause dysphagia.

- **Superior relation of the arch of aorta:-**

1-brachiocephalic(anterior)--→it divides later into right subclavian and right common carotid

2-left common carotid

3-left subclavian (posterior) -→at the end of the arch

1+2+3-→they are branches of the arch

4-left brachiocephalic vein-→it unites with right brachiocephalic to form superior vena cava and it is situated anterior to the branches of the arch.

5-remnants of thymus

- **inferior relation of the arch of aorta:-**

-bifurcation of the pulmonary trunk:-

-it divides into right and left pulmonary arteries, each artery goes to the corresponding lung

-the right pulmonary artery is longer and to reach the hilum of the lung it has to pass posterior to **ascending aorta** and **superior vena cava**.

-behind each pulmonary artery is the corresponding bronchus.

- **Ligamentum arteriosum** (Used to be ductus arteriosum in embryo)-→it connect the beginning of the left pulmonary artery and the lower surface of the arch of aorta <**distal to its last branch**> and it carries poorly oxygenated blood

- The duct opens after the branches of the arch so the poorly oxygenated blood won't pass through any of the branches and reach the brain. Instead it will go to the lower half of the body which can tolerate this poorly oxygenated blood.

### **-left bronchus:-**

the left bronchus passes anterior to the descending aorta and to the esophagus

-two small nerves pass anterior to the Ligamentum arteriosum( sympathetic and parasympathetic) that form -→superficial cardiac plexus(**inferior to the arch**)

-these sympathetic and parasympathetic nerves are cervical(arising from the sympathetic chain in the neck and from the vagous nerve.)--→because in the embryo the heart was in the neck and then it descend to the thorax.

### **•The effect of the sympathetic and parasympathetic on the heart:-**

Stimulation of sympathetic will:-

1-increase the heart rate----→tachycardia

2-increase the force of contraction---→positive inotropic

3-increase the cardiac output and the blood pressure

\*it increase the blood pressure by two means:-

1-increase cardiac output

2-increase peripheral resistance

-strong stimulation of parasympathetic will cause **bradycardia** , **decrease the cardiac output** and **decrease blood pressure** so the patient may end up with **shock**.

-Parasympathetic has a little supply to the ventricles so it has a minor effect on the regulation of blood flow

-At the site of bifurcation of the trachea (deep to the arch)-→the deep cardiac plexus is formed(sympathetic and parasympathetic ).{ **inferior to the arch**}

### **\*pulmonary trunk:-**

-Lateral to it is the **ascending aorta** and lateral to the ascending aorta is the **superior vena cava** .

-It runs upward and slightly to the left

-It ends by dividing into right and left pulmonary artery , and each is passing anterior to its corresponding bronchus.

-At the point of the bifurcation of the pulmonary trunk ,the left artery is at lower level than the right one.

### **\* The surface marking of the cardiac valves:**

-To draw lines on the chest of the patient in order to determine the site of a valve depending on its anatomical position.

- The auscultatory area: the area where we hear the sound of the valve.

- At each heart beat we can hear two sound , the first result from the **closure of the AV valves** (at the early beginning of systole) , and the second result from the **closure of the pulmonary and aortic valves**.

- Sometimes we might hear splitting of the second sound of the heart ,why?

During deep inspiration the intrathoracic pressure become negative , so the vein will dilate and thus increasing the venous return which result in increasing the cardiac output in the right ventricle more than the left and this cause delay in the closure of the pulmonary valve.

{more venous return--→ prolonged systole--→ prolonged diastole-→ delay in the closure of pulmonary valve--→ the two semilunar valves will not close at the same moment resulting in the physiological splitting of the second heart sound.}

### **\*portal circulation:-**

-the portal circulation is found in the liver , kidney , pituitary gland

-the portal vein run between two sets of capillaries :-

1-the capillaries in the wall of the gut

2-the capillaries inside the liver (sinusoidal capillaries)

• -The liver gets a dual blood supply from the hepatic portal vein (80%) and hepatic arteries (20%).

• The liver receives 25% of cardiac output per minute (1200ml)

• Inside the liver, there is a mixing of the blood supplied from hepatic artery (oxygenated) and from hepatic portal vein (deoxygenated).

• The blood leave the liver to the heart by flowing from sinusoidal capillaries into the hepatic veins which opens into IVC.

• The liver has three hepatic veins (right , middle and left)

• The portal vein begins behind the neck of pancreas by union of the **splenic vein** (receive blood from the foregut) and **superior mesenteric vein**(receive blood from midgut).

-the inferior mesenteric(receive blood from hindgut) joins the splenic vein at its end.

---→ so the portal vein will bring the blood from foregut , midgut and hindgut.

-**The lesser omentum**: is a fold of peritoneum that extends from the liver to the stomach and the first part of duodenum, its free margin contains:1- the portal vein (posteriorly)  
2- the bile duct lies anterior to the portal vein and to the right 3- the hepatic artery lies anterior to the portal vein and to the left.

-During a surgery of the liver , if there is a bleeding we should compress the free margin of the lesser omentum closing the portal vein and hepatic artery so no more blood reaches the liver.

-Portal vein enter the liver in porta hepatis and before entering it will divide into **right and left branches**

-The cystic vein drains into the right branch of portal vein.

-The left branch before entering to the liver it will give two branches to the Caudate and quadrate lobes

-Caudate and quadrate lobes anatomically belong to the right lobe but functionally they are considered as a part of the left lobe so they are supplied by the left branch of portal vein.

• **Before the entrance of the left branch to the liver, it receives two ligaments:-**

1. Ligamentum teres which was the left umbilical vein in the embryo
2. Ligamentum venosum which was ductus venosus

-Around ligamentum teres there are paraumbilical veins.

\* **portosystemic anastomosis:-**

• Sometimes we need to connect the portal vein with systemic veins "portosystemic anastomosis" , we make this operation when the patient has liver disease which causes hypertension in the portal circulation that impair blood flow causing hemorrhage for example "esophageal varices" or hemorrhoids

• Peptic ulcer rarely causes vomiting of blood (haematemesis), because bleeding from peptic ulcer occurs in the stomach then this blood reaches the intestine and goes with the stool which appears black in color

- Coughing up of blood is called--→hemoptysis  
while vomiting of blood is called--→haematemesis
- Esophageal varices may result from liver cirrhosis that is resulted from chronic alcoholism or bilharzia/ schistosomiasis (common in Egypt but rare in Jordan )
- At the lower end of rectum ,Superior rectal vein( ascend upward forming the superior mesenteric which joins the splenic-→portal) anastomose with middle and inferior rectal vein that open into internal iliac--→systemic causing hemorrhoids
- Patients with hemorrhoids have blood with stool and later on dilated tortuous veins develop outside the anus
- Asking for liver function test to check if there is portal hypertension ,should not be the first step to examine the hemorrhoids.
- We should examine the patient with PR test or proctoscope to exclude carcinoma of the rectum which may compress the veins causing Hemorrhoids.
- 99% of patients with Hemorrhoids are idiopathic.
- Portosystemic anastomosis at the skin around the umbilicus :-they appear as radiating vessels around the umbilicus ---→**caput medusa**
- Anastomosis at the bare area of the liver:-at the bare area the capillaries are on the diaphragm (no peritoneum) ,so the capillaries of the liver anastomosis with the capillaries.

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