Anatomy extra notes/1

- The blood circulation:

There are the systemic and pulmonary circulations..

In the systemic circulation, the blood is carried from all over the body – except the lungs – through the superior and inferior vena cava to the right atrium, ((then it goes to the right ventricle where it's pumped through the pulmonary trunk to the lungs where the blood gets rid of its content of CO2 and has its supply of O2, then the blood is returned back to the left atrium through four pulmonary veins → the pulmonary circulation)), from the left atrium the blood moves to the left ventricle then it's pumped through the ascending aorta back to the systemic circulation.

- A comparison between the right ventricle and the left ventricle:

	Right ventricle	Left ventricle
The valves	The blood passes from the right atrium to the right ventricle through an opening called "**the right atrioventricular orifice**".. this opening is controlled by a valve, **the right atrioventricular valve.** Formed by three parts, this valve is also called **the tricuspid valve.**	The blood passes from the left atrium to the left ventricle through an opening called **"the left atrioventricular orifice"**.. this opening is controlled by a valve, the l**eft atrioventricular valve**. Also known as **bicuspid valve or mitral valve.**
The outlet to the ventricle	**Pulomary trunk**, At the beginning of the pulmonary trunk there's a valve, **the semilunar pulmonary valve**.	**the ASCENDING aorta**, At the beginning of the ascending aorta there is the **semilunar aortic valve**.
The inlet to the ventricle	The tricuspid valve	The bicuspid "mitral" valve
The wall of the ventricle	Thin, it's a low pressure pump	Thick, much thicker than the right ventricle, it's a high pressure pump

** the reason the wall of the left ventricle is thicker than that of the right ventricle simply is because the right ventricle pumps the blood only to the lungs, while the left ventricle pumps the blood to the whole body. In fact, the resistance in the systemic circulation is much higher than that in the pulmonary circulation, the left ventricle needs to have a thicker wall in order to pump the blood in a much stronger pattern to get over the systemic resistance.

In the systemic circulation the blood passes through the ascending aorta → the arch of the aorta → the descending aorta,, and so on until it branches into smaller arteries. now as the arteries get smaller and smaller, resistance increases due to that.

Valves:

The valves are composed of a connective tissue surrounded by an epithelial layer, the maintain the unidirectional flow of the blood, from the atrium to the ventricle for example.

Now The pulmonary veins are valve-less!!,,

And since the valves are thin and weak in their structure they are susceptible to endocarditis and stenosis. A stenosis in the bicuspid valve causes the blood to be retained in the left atrium, when this happens the blood flows back to the lungs through the pulmonary veins, a case known as "pulmonary congestion", in which the alveoli of the lungs are filled with blood instead of air causing dyspnea or orthopnea.

Orthopnea: the case is worsened by sleeping on the back, because the blood flows back to the lung even more easily!

In the case of the tricuspid valve stenosis, the blood is retained in the right atrium > flows back to the IVC and SVC > to the liver and spleen > to the veins > to capillaries > edema.

The systolic pressure results from the pumping of the ventricles → during the systole the blood is pumped out of the ventricles..

the diastolic pressure results from the resistance while the arteries are getting smaller → during the diastole the ventricles are filled with blood..

the blood flow is controlled by the following factors:

1) The pressure gradient:

- **the pressure gradient is the main moving force for the blood flow in the body** .. e.g: when the pressure in the left ventricle is higher than that in the aorta the semilunar aortic valve opens allowing the blood to pass to the aorta.
- In the systemic circulation the normal blood pressure is abt **120/80** , being 120 mm Hg on the systolic and 80 mm Hg on the diastolic.
- The hydrostatic blood pressure is responsible for the movement of plasma outside the capillaries, while the colloid osmotic pressure of the capillary proteins is responsible for the return of the plasma inside.
- Even in the walls of the veins for example there is some resistance, but the resistance in the arterioles is the greatest, they are called the **major resistant vessels.**

2) vasodilatation and vasoconstriction by the smooth muscles in the walls of the blood vessels:

- In the hypersensitivity reactions – for example sensitivity to drugs – or in the anaphylactic shock, the histamine is released causing vasodilatation, this causes the peripheral resistance to fall, as a result the blood pressure falls down too, blood is not sufficiently reaching the vital organs like the brain or the kidneys, this might lead to death!
- In the sympathetic stimulation, the blood vessels are constricted through the beta receptors on the smooth muscles of the blood vessels walls which interact with the noradrenaline, blood pressure becomes high.
- Also the metabolites control the blood flow to the organs through vasodilatation and vasoconstriction, for example when the muscles are working hard, lactate is secreted, lactate causes vasodilatation. Also K+ has the same effect as lactate.

**some notes:

- In the atrial septal defect the blood moves from the left atrium to the right atrium during systole – not diastole - because of the pressure gradient between the left and right atriums, while in diastole there's no gradient so no movement of the blood.
- In patent ductus arteriosus the blood will flow from the aorta to the pulmonary trunk, also because the pressure in the systemic circulation is more than that in the pulmonary circulation.
- By the end of the diastole the blood volume in the ventricle is 130ml, and by the end of the systole – after contraction and pumping of blood – the blood volume remaining in the ventricle is 50ml.

((The end diastolic volume)) – ((the end systolic volume)) = the blood pumped from the ventricle per each beat

130 – 50 = 80ml → also known as the stroke volume.

- Example on the +ve inotropic substances: a medicine called digoxin.. it increases the contractility of the heart by stimulating the sympathetic nervous system.
- Example on the –ve inotropic substances: a medicine called barbiturate.
- TPR: Total Peripheral Resistance. And it's coming mainly from the arterioles, the major resistant vessels.
- So from the equation in the handout, the mean arterial blood pressure depends on the cardiac output and the TPR , it also depends on the blood volume. And to maintain the blood volume in the cases of blood loss, we give the patient saline solution immediately in case we don't know the blood group type, this will keep the blood pressure from falling down until we know the blood type!

  Focus!! Msh kollo 3nd el 3rab saboon :p