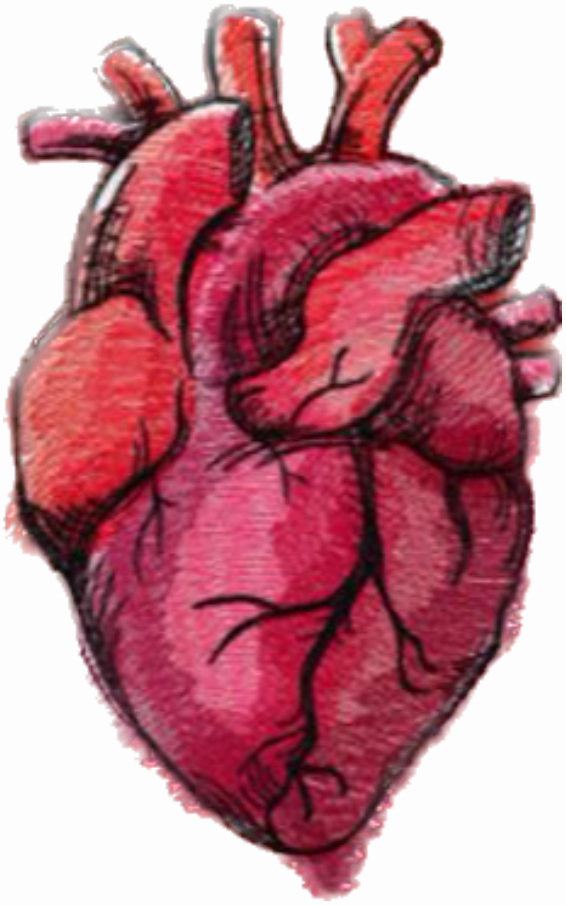
النادي الطبي

CARDIOVASCULAR SYSTEM



SUBJECT : Blood pressure regulation

LEC NO. : Physiology lab two

DONE BY : Mahmoud Al Qusairi

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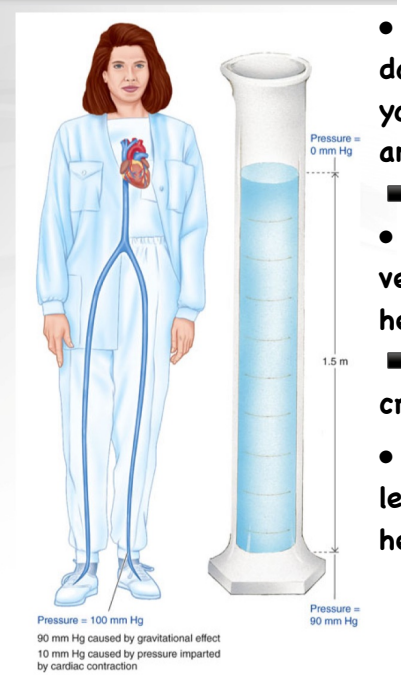
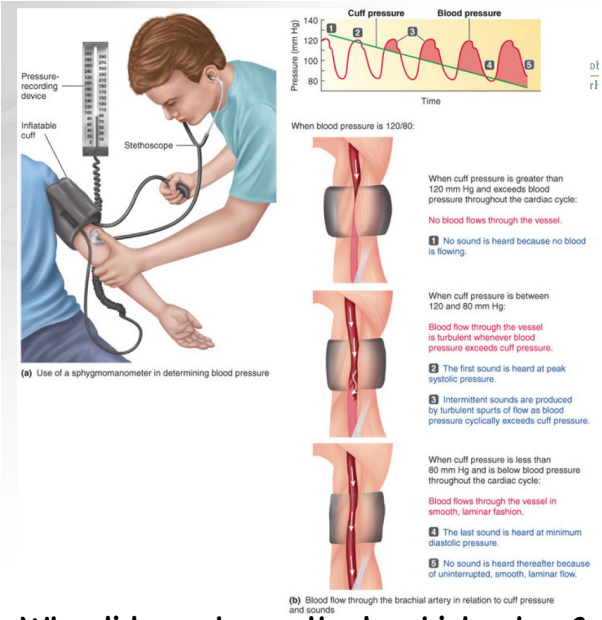
Cardiovascular system

SCAN ME!



- The vessels are tubes and the blood is a fluid. So when the person lies down , the effect of gravity will be the same all over the body so wherever you take the BP will be correct & accurate ...usually we take it from the arm and we can take it from the thigh.
  - But when we stand up what happens ?
- The fluid (blood) will go down to the lower extremities particularly the veins , so the BP won't be the same all over the body ...as we go from the heart to the feet the BP increases .
  - BP in the feet = Normal BP(at the level of the heart)+ the pressure created by the column of the blood from the heart level to the feet .
- And if you go up above the level of the heart , the BP decreases , less by the pressure created by the column of the blood (from the heart to the level where you take the pressure in).



How do we measure the BP ?

✓ By using sphygmomanometer (auscultatory method)because you generate oscillations in the wall of the blood vessel,and these oscillations can cause sound and you will be able to listen to this sound.

- Alteration BF from laminar smooth(silent flow)to the turbulent(noise flow(Korotkoff sound))(the blood hit the wall of the vessel)and you detect what point you will hear the bruits (not murmurs).
- We inflate the cuff on the brachial artery until the blood flow stops totally in the brachial artery, so the blood is shut down. When the pressure in the cuff is above the highest pressure in the brachial artery (120), the flow will stop.

Why did we choose the brachial artery?

Because it's close to the skin and it has a pulsation which you can feel and noise generated in brachial artery will be strong so, can be hear from the skin surface

Mercury sphygmomanometer the most accurate device while the electronic or digital sphygmomanometer will not give you the same value every time when you use it (so,you have be very caution to accept the pressure values that if is done by a electronic or digital sphygmomanometer

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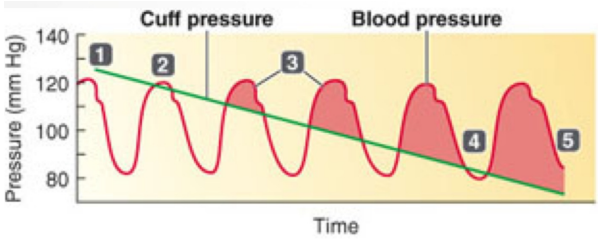

The green line represents the pressure in the cuff.
In the first and second peaks ***the pressure in the cuff is above the maximum pressure in the blood vessel.so,the blood vessels are totally closed (no blood can pass)

In the third peak we deflate the cuff , when the pressure inside the vessel become slightly above (Ex: 120)the pressure in the cuff (Ex:119.5)...the vessel will open very slightly ..the blood will move through this narrow orifice at a high speed , it will be a turbulent flow(cause oscillations in the wall of the brachial artery)so it will cause a sound in other part of the brachial artery (create a turbulent flow).

- When the amount of the blood is very small , the sound will be weak and will be tapping → here we record the systolic pressure
- We keep deflating the cuff ,as the pressure in the cuff decreases more and more, the vessels will open ,more and more blood will pass , still the flow will be turbulent ...the noise (voice , Korotkoff sound) will become stronger (drumming)and then when we keep deflating the cuff ,as the pressure in the cuff decreases more and more, the (drumming) will become (swishing sound)(weak sound because the velocity of blood flow will decrease with every HB .
- As you open the cuff more and more , more blood will pass through , now the velocity of the blood will start decreasing back to normal.
- Sound will change to muffled (like far train sound),if you can detect this point her the reading will be the diastolic pressure but since you will not be able to detect the change in the sound from swishing to the muffled>you continue decrease in the pressure until the blood vessel opens wide as it's in the normal condition and the sound generated will disappear because the flow will get back to normal flow (laminar silent flow) ....here we record the diastolic pressure
- From tapping→ drumming→swishing → muffled →and then disappear 🫠
- And then suddenly disappears (when the vessel is completely opened(when the pressure in the cuff equals pressure in brachial artery which has a valve of 80mmHg,which is the lowest possible value in brachial artery , the flow will back to normal (laminar smooth flow))....here we record the diastolic pressure .

##The first appearance of the sound in the case of systolic pressure value and when the sound is disappeared it indicates to diastolic pressure value .

There is a drawback in this method***can you trust the value if anybody can measure it
Audial method should be very easy to measure ,accurate and able to use by anyone to measure the BP
But can anyone measure BP and you trust the value →off course not
You have to train the person well before you can trust the pressure values he gives you

There are 3 drawbacks:

1)The person should be laying down 2)The person will do the measurement should be well trained
3) That we can't use the same cuff to all people (we must have these sizes(most important one)(see last page)

There are advantages:

1)can use it several times during the day
2)I can train input to measure it accurately
So,these two very good advantages which make sphygmomanometer (auscultatory method good method

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Cardiovascular system

SCAN ME!

Effect of posture in BP

We measure the pulse rate and BP
Firs thing the patient lies down and rest for 5 minutes and at the end of these 5 minutes you take a value (pulse rate =70/BP=120/80)which is the normal values at resting
Then ask the patient to stand up suddenly and measure the pulse rate and BP immediately on standing up →you will find the following (pulse rate =100/BP=60/30) and then Measure again after 5 or 10 minutes of standing(pulse rate =72/BP will get back to 180/82)
Pulse rate will go up (from 70 to 110)when stand up
BP will drop sharply (from 120/80 to 60/30)
When stand up for 5 min the value will get back to normal

- The vessels are tubes and the blood is a fluid. So when the person lies down , the effect of gravity will be the same all over the body so wherever you take the BP will be correct & accurate ...usually we take it from the arm and we can take it from the thigh.

■ But when we stand up what happens ?

- The fluid (blood) will go down to the lower extremities particularly the veins ,(BP will drop sharply)so the BP won't be the same all over the body ...as we go from the heart to the feet the BP increases

→(venues return will drop sharply →CO will drop sharply →BP will drop very sharply)

The baro-receptor reflex mechanism will start immediately ,as soon as one beat shows low BP the bark-receptor will tell the vaso-motor center in the brain the BP is low,and this reflex Immediate within seconds → the vast-motor center will increase its activity →sympathetic will increase →pulse rate will increase →heart rate will increase →CO will increase
At the same time the sympathetic will cause venoconstriction(the most important factor in the CO)→venues return will increase →SV will increase →CO will increase
Sympathetic will cause vasoconstriction in the arterioles →resistance will increase →BP will increase
↓ BP→baro-receptor→cardio vascular center→↑ sympathetic & ↓ para- sympathetic activity

■ Sympathetic will affect:

1. Heart→↑ HR→↑ force of contraction→↑ CO→↑ BP
2. BV (particularly arterioles - because they are heavily innervated) → vasoconstriction→↑ TPR→↑ BP
3. Veins→venoconstriction→tiny venoconstriction shifts large amounts of blood to the heart→↑ venous return→↑ SV→↑ CO→↑ BP

As soon as we stand up →the BP drops →immediately the regulatory mechanisms will start to work to adjust the pressure back to normal →so if person stand up for 5 min the BP and pulse rate will almost back to normal because the regulatory adjusting mechanisms are very fast

As long as the person is healthy and autonomic nervous system is normal and vasoconstriction-motor center activity is normal and baro-receptor response is normal →the condition will get back to normal very quickly (within 5min)

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Cardiovascular system

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	Pulse rate	BP
Resting valves (values after 10 min resting	75	118/81
Exercise (little but severe) within first min	190	190/20
within third min	110	150/25
within fifth min	100	130/30
Within seventh min	75	125/50
within tenth min	72	121/55

@The systolic pressure is mainly effected by heart rate and SV(effected by CO)

@The diastolic pressure is mainly effected by TPR

Exercise →sympathetic activity will be elevated →heart rate will be increased +Venoconstriction →venues return will be increased →CO will be increased →systolic pressure will be increased

Within 5 to 7 minutes (once the person stops exercise) →the sympathetic will subside (almost get back to normal) →systolic pressure will get back to normal →pulse rate will get back to normal with 5-7 minutes

#Quickly,the factors which are influenced by autonomic nervous system (sympathetic and parasympathetic)they would recover within 5-7 minutes →that's why the pulse rate and systolic pressure get back to normal within 5-7 minutes

@Diastolic pressure decreases because of vasodilation

#Why do you have vasodilatation although sympathetic activity high???

Vasodilatation is produced by local metabolic products which are produced in the exercising muscles (Remember:The local metabolic factors can overcome the autonomic nervous system activity)

Exercise → accumulation of lactic acid from anaerobic respiration →elevation of hydrogen ions concentration →elevation of carbon dioxide →all these factors will produce vasodilatation that occur in the blood vessels within the muscles →diastolic pressure will be decreased

Direct Effect of Acidosis:

- The increased production of lactic acid lowers the pH of the blood and tissues (acidosis). Lower pH (increased H^+ concentration) can directly cause smooth muscle relaxation in the walls of blood vessels, leading to vasodilation.

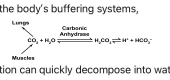
Carbon Dioxide and Vasodilation:

- Elevated levels of CO_2 cause vasodilation. CO_2 diffuses into vascular smooth muscle cells and forms carbonic acid (H_2CO_3) via the enzyme carbonic anhydrase:
- Carbonic acid dissociates into H^+ and bicarbonate (HCO_3^-):
- The resulting H^+ can lead to smooth muscle relaxation and vasodilation.

وَقُل رَّبِّ زِدْنِي عِلْمًا

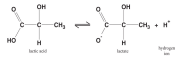
Buffer Systems and CO_2 Production:

- The increase in H^+ concentration triggers the body's buffering systems, primarily the bicarbonate buffer system:



- Carbonic acid (H_2CO_3) formed in this reaction can quickly decompose into water and carbon dioxide:

(H^+). Lactic acid ($C_3H_6O_3$) dissociates into lactate ($C_3H_6O_3^-$) and H^+ in the cellular environment:



- This dissociation releases free hydrogen ions, increasing the H^+ concentration in the cell, leading to a decrease in pH (acidosis).

Diastolic pressure recovery💔 is slow ,even after 10 minutes the diastolic pressure didn't recover 100% because this metabolites need some time to push out ,not like heart rate →as soon as sympathetic activity decreases the heart rate will go down

TPR will remain low for longer period of time because it effected by local metabolic changes until the metabolites are wash off and the oxygen gets back to normal and carbon dioxide gets back to normal then the vessel will constrict back to normal size and TPR will increase back to normal and the diastolic pressure will recover back to normal

Recovery of diastolic pressure is slower than the recovery of systolic pressure

(See last page)***

- In hearing the sound, we depend on korotkoff sound that generate in the brachial a → transfer through the fat tissue and hear it from the surface of the body → in obese people this sound will dissipate in the fat tissue, and you will not hear the tapping, you will hear the drumming(because it a strong sound so, can penetrate the fat tissues to reach the surface of the body)and think it's a tapping, then the pressure will be under-estimated(lower than normal value).
- Diastolic pressure will be over-estimated (higher than normal value)because the sound will disappear earlier than etude(because the swishing sound is weak so will disappear earlier than etude)
- How you solve this problem ?

#If we measure for obese person, we will use a special cuff; which is wider (not longer), so that when we put it on the arm, you will close longer distance of the brachial artery(proper compression), then the sounds will be stronger → the tapping will be stronger that can penetrate the fat tissues to reach the surface of the body and can be heard by stethoscope.

@There are 3 sizes of cuff:

If we have a child, we will use a 6 cm cuff (narrow).

If we measure for obese person, we will use a 15 cm cuff

Normal size about 12 cm cuff for us