

## Arterial blood pressure

Its the pressure of the blood on the wall of the artery.

ضغط الدم سيكون دائما رقمين ، مثلاً 110/70

الرقم الكبير يبقى systolic و الصغير diastolic طب يعني ايه؟

### \*Systolic blood pressure:

Its the maximum pressure reached during systole of the heart.

هو اقصى ضغط للدم ف الشرايين اثناء ال systole و دا المدى الطبيعي بتاعه سيكون 90-150 mmHg .

### \*Diastolic blood pressure:

Its the minimum pressure reached during diastole .

هو اقل ضغط للدم ف الشرايين اثناء ال diastole و المدى الطبيعي بتاعه سيكون 60-90 mmHg .

\* كل شخص جسمه سيكون متعود على ضغط معين ، يعني ممكن شخص يكون ضغطه العادي 100/60 و عايش طبيعي ، بس بالنسبة لشخص ثاني الضغط دا واطي .

### \*pulse pressure:

Its the difference between the systolic and diastolic pressure.

ضغط ال systolic ناقص ضغط ال diastolic بيساوي ال pulse pressure و المدى الطبيعي بتاعه 30-50 mmHg .

من اسمه الضغط دا هو اللي بيحدد مدى احساس بالنبض ف الشرايين ، لو عالي النبض هيكون واضح والعكس .

### \*Mean systemic pressure or Mean systemic arterial pressure:

Its the average pressure in the arteries throughout the whole cardiac cycle.

هو متوسط ضغط الدم ف الشرايين خلال ال cardiac cycle .

و لأن ال cardiac cycle مش مقسومة بالنص و systolic و diastolic ف بالتالي مقدرش احسب متوسط الضغط عن طريق اني اجمع و اقسم على اثنين .

بما اننا نعرف ان ال cardiac cycle ال 1/3 systole و ال 2/3 diastole يبقى اقد احسب متوسط الضغط كدا :

بيكون حوالي 90mmHg .

### Calculation

$$MAP = (CO) \times (SVR) + (CVP)$$

CO = cardiac output

SVR = systemic vascular resistance

CVP = central venous pressure

### Estimation

$$MAP = DBP + \frac{1}{3} (SBP - DBP) \text{ or } MAP = \frac{[SBP + (2 \times DBP)]}{3}$$

### \*Physiological variations in ABP:

#### \*Age:

-new borns: 80/40                      4years: 100/65  
-20 years: 120/70                      60years: 150/90

#### \*Sex:

Below 45, females have lower ABP than males .

After 45, ABP rises in females like males due to hormonal changes.

#### \*race:

Americans and europeans have higher blood than other races due to the stressful life and style of food (fast food).

#### \*Emotions:

Strong emotions rise the ABP due to sympathetic stimulatior.

#### \*Muscular exercise:

Muscular exercise increase the systolic and decrease the diastolic. (**Increase the pulse pressure**).

#### \*Gravity:

Pressure is usually measured in the brachial artery because its at the same level of the aorta. Vertical distance from the heart affect the ABP . each 1 cm below the heart increases the **mean** systemic pressure by **0.77mmHg** and vice versa.

بسبب ان الجاذبية ممكن تكون مع او عكس اتجاه سريان الدم ، فيتأثر على متوسط الضغط بمعامل 0.77 mmHg زيادة لكل 1 CM تحت مستوى القلب و العكس صحيح.

### \*Factors affecting the ABO and the pulse pressure:

ABP =cardiac output x total peripheral resistance = stroke volume x heart rate x total peripheral resistance

#### 1-Stroke volume :

Increased stroke volume increases the systolic more than the diastolic, and increase the pulse pressure.

#### 2-Heart rate :

Increased heart rate increases diastolic pressure and decrease the pulse pressure.

### 3-Peripheral resistance:

Increased peripheral resistance elevates the diastolic pressure more than systolic , so the pulse pressure decreases.

### 4-Elasticity of the aorta and arteries:

In cases of atherosclerosis(تصلب الشرايين) systolic pressure increases and diastolic pressure decreases , so pulse pressure increases.

لما تقل مرونة الـ aorta و الشرايين اثناء الـ systole المفروض تتمدد لكن التمدد دا مايبحصلش في حالة تصلب الشرايين فبيزيد الـ systolic pressure ، و اثناء الـ diastole المفروض تنكمش الشرايين تاني و ايضاً دا مايبحصلش ف حالة تصلب الشرايين فبيقل الـ diastolic pressure ، و بيترتب على دا زيادة الـ pulse pressure بشكل كبير و النبض بيكون واضح ع الشرايين.

### \*Regulation of ABP:

- Rapid mechanism : nervous control
- slow mechanism : hormonal control
- intermediate mechanism: capillary fluid shift mechanism.

### Nervous control of ABP:

A- pressor area                      B-depressor area  
Found in Medulla                  Found in the  
medulla central & dorsal to pressor area

#### \*pressor area:

Its responsible for increasing ABP

هي مسؤولة عن زيادة الـ ABP عن طريق الـ 3 عوامل ذكرناهم هما :

- peripheral resistance
- heart rate
- stroke volume

#### A- vasoconstrictor centre:

It sends impulses for both arteries and veins by **sympathetic fibers** continuously during rest.

- It produces vasoconstriction of arteries that increases the **peripheral resistance** ———> increase the ABP.
- It produces vasoconstriction of veins that increases the venous return , the cardiac output increases ———> increase the ABP.

### B-cardiac stimulatory centre:

It sends impulses to both atria and ventricles via **sympathetic fibers**.

-It increases the **heart rate** that increases the cardiac output ----> increase the ABP

- it increases the force of contraction that increases the **stroke volume** , the cardiac output increases ----> increase the ABP

### \*depressor area:

It acts by inhibiting the pressor area

بتشتغل عن طريق انها توقف شغل ال pressor area

### A- vasodilator centre:

It sends impulses to the vasoconstrictor centre to decrease the vasoconstrictor tone----> vasodilatation ---->decrease the ABP.

**N.B.** There is no parasympathetic fibers for dilatation of the wall of blood vessels ( except for external genitalia).

### B-Cardiac inhibitory centre:

\_ Sends impulses to atria, it inhibits the heart rate only!! , it does not decrease the stroke volume because ventricles are not supplied by parasympathetic fibers.

ال ventricles مش رايحلها parasympathetic fibers و بالتالي ال inhibitory centre بيقتل ال heart rate بس مالوش دعوة بال stroke volume.

Receptor for regulation of these center:

### -Arterial baroreceptors:

They are found in the wall of the aortic arch and carotid sinus. They are stimulated by stretching of the wall of the carotid sinus or aortic arch by blood.

\* Baroreceptors of aortic arch are innervated by ----> vagus nerve(X).

\* Baroreceptors of the carotid sinus are innervated by ----> carotid sinus nerve ( branch of glossopharyngeal nerve IX)

### \*Function of baroreceptors:

The action of baroreceptors is stimulating of depressor area, and inhibiting the pressor area.

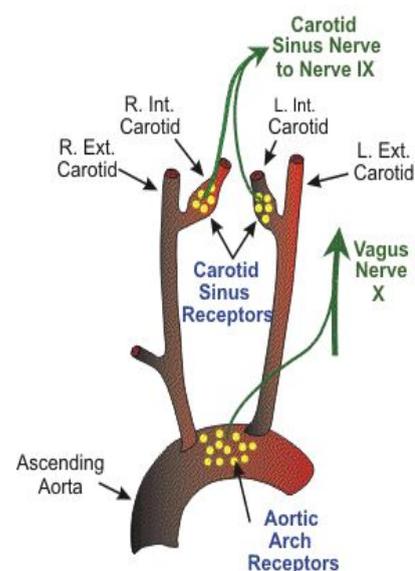


Figure 1. Location and innervation of arterial baroreceptors.

-when ABP increases:

baroreceptors send **more impulses** stimulating of depressor area , and inhibiting the pressor area. So ABP decreases.

-when ABP decreases:

Baroreceptors **impulses decrease** so the impulses stimulating of depressor area , and inhibiting the pressor area decrease and ABP increase to the normal level.

التي بيتغير هو كمية ال impulses امش الفعل بتاعها يعني هي دايم لما بتشتغل بتقلل ال blood pressure بس لما نبقى عايزين نزوده هي بتشتغل اقل و لما نبقى عايزين نقلله هي بتشتغل اكثر

### \*\*Carotid sinus syndrome:

Its the hypersensitivity of the carotid sinus. So slight pressure of the skin over the carotid sinus Leads to marked decrease in ABP, and fainting. اغماء.

ال carotid sinus بتكون حساسة زيادة عن الطبيعي و اي ضغط بسيط ع الجلد ف منطقة ال carotid بتسبب استجابة واضحة من ال baroreceptor و انخفاض ال ABP.

### \*Capillary fluid shift mechanism:

زيادة ضغط الدم في ال capillaries بيدفع السوائل لخارج الوعاء الدموي (filtration)، الضغط دا بيسمى hydrostatic pressure.

-Increased ABP—→ hydrostatic pressure increases—→ increased filtration—→ decrease blood volume—→decrease venous return and cardiac output —→ decrease the ABP

بيقل ال blood volume ف يقل ال venous return and cardiac output

-decreased ABP—→ hydrostatic pressure decreases—→ decreased filtration—→ increase blood volume—→increase venous return and cardiac output —→ increase the ABP

### 3-Role of kidney and endocrine (hormonal regulation):

- Its the most important mechanism , it has a long term effect.
- it regulates extracellular fluid volume to regulate ABP

#### 1- renin-angiotensin mechanism:

Decreased ABP —→ renal ischemia—→ secretion of renin in blood—→ formation of angiotensin I from angiotensinogen —→ angiotensin I is converted into angiotensin II by

**Angiotensin converting enzyme(ACE)** —→ increase the ABP

زي ما احنا عارفين ان Angiotensin II ليها وظيفتين:

a-vasoconstriction

b- sodium-water retention

عشان کده بتزود ال ABP

2-Atrial mechanoreceptors:

They are atrial stretch receptors that are sensitive to stretch of the right atrium.

- Hemorrhage (decrease blood volume) ----> Decrease of ABP --> decrease the stretching and decrease the impulses of these mechanoreceptors --> increase the secretion of **ADH**(Antidiuretic Hormone / Vasopressin) & **aldosterone**.

The function of these hormones is Sodium-water retention. (**Vasopressin** also causes vasoconstriction)