# الكبسولة

# PHYSIOLOGY Lecture 10

Cardiac output( COP) is the amount of blood the heart pumps per minute

Cop= SV X HR

Stroke volume (SV): the amount of blood ejected by the heart with each beat

HR: the no of heart beats per minute

End Diastolic volume (EDV): the volume of blood in the ventricle at the end of diastole

## Arterial blood pressure (ABP)

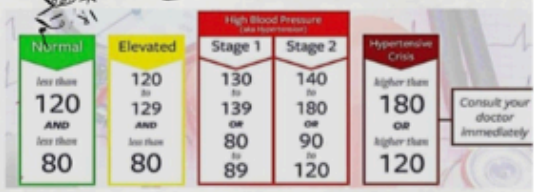
1-ABP: pressure of blood on arterial wall

2-sytoic blood pressure—diastolic blood pressure

3-Hypertension. Stage 1 stage 2

4-Mean Arterial blood pressure = 93-100 mmHg

5-Hypotension. 100/60




## Factors Affecting VR:

VR (Venous Return)

### 1-venous pressure gradient:

***-The peripheral venous pressure:***

-It is the B.P. in peripheral veins.

-It is 7-8 mm Hg.

***-The central venous pressure***

- It is the pressure in the right atrium.

- It is 0-2 mm Hg.

### 2- Respiratory movements (Respiratory pump)

- VR ↑ with inspiration & ↓ with expiration.

### 3-Skeletal muscle contraction (muscle pump)

### 4-Gravity :

### 5-Diameter of B.Vs:

*A- Diameter of arterioles:* ↑ VR

*B- Diameter of capillaries:* ↓ VR

*C- Diameter of veins:* ↓ VR

### 6-Blood volume:

↑ blood volume ⇒ ↑ VR.

↓ blood volume ⇒ ↓ VR.

## Physiological factors Affecting ABP:

1) Age: • ABP ↑ with advanced age due to arteriosclerosis.

2) Sex: ABP is lower in females by 5 mm Hg.

• At menopause ⇒ ABP is higher in females by 5 mmHg due to:

4) Body built: ABP is usually higher in obese persons than normal. Obese persons are liable to have hypertension more than normal weight persons.

5) Meals: ABP ↑ slightly after meals.

6)Emotions: ⇒ ↑ ABP.

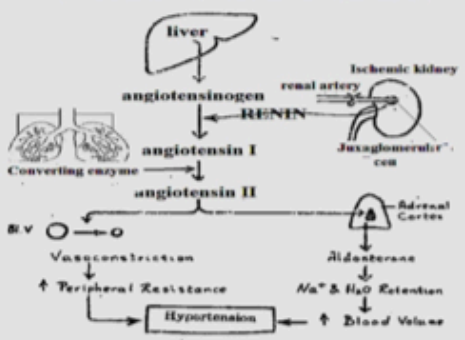
7) Exercise : ⇒ ↑ ABP.

8) Sleep: Quite & deep sleep ⇒ ↓ ABP (due to vagal stimulation)

9) Diurnal variation (circadian rhythm): ABP is normally lowest in early morning & highest in the afternoon.

10) Gravity: The pressure in any vessels below the heart level is increased and that in any vessels above the heart level is decreased by the effect of gravity.

## Renin- Angiotensin System:




هو أساسي في تنظيم الضغط وسوائل في الجسم

**Stimuli for renin secretion**

1. Low blood pressure
2. Low ECF volume
3. Sympathetic stimulation
4. Low plasma sodium

# الكبسولة

# PHYSIOLOGY Lecture 11

Normal respiratory rate is 12-16 cycles/minute

Inspiration +expiration+expiratory pause

Pause disappears with hyperventlation

*في حالات التنفس السريع نفس الرياضة

## Pulmonary pressure

1-Atmospheric pressure zero = 760 mmHg

2-intrapleural pressure (always negative

-7 mmHg during inspiration

-3 mmHg during expiration

3-intrapulmonary (intra alveolar)

-1 mmHg during inspiration

+1 mmHg during expiration

# Respiratory muscles

## Muscles of inspiration

*active لانه العضلات بتنقبض

* بدي ازيد المساحة العمودية لتجويف الصدر على شان يقل الضغط مما يسمح بدخول الهواء

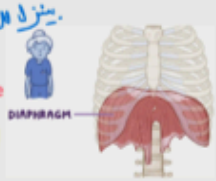
### 1-Main muscles

**A-Diaphragm**

Supplied by the phrenic nerve (origin from C3 to C5)

Contraction =descent

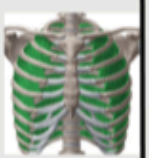
Leads to enlargement of thoracic cavity vertically




**B-External intercostal muscles**

contraction =elevation and eversion

Leads to enlargement of the thoracic cavity horizontal and anteroposterior



### 2-Accessory muscles

2-Accessory Muscles: -Act only in forced inspiration.
-They are sternomastoid (elevates the sternum), scaleri (elevates the 1st rib), seratus posterior superior and seratus posterior inferior (elevate the remaining ribs).

act only in forced expiration

## Muscles of expiration

* بدي اقلل المساحة على شان ازيد الضغط

*Passive relaxation

A-Abdominal Wall Muscles:
(i.e. abdominal recti, transverses abdominis, internal and external oblique muscles). Contraction leads to compression of abdominal contents which increases the intra-abdominal pressure and elevates the diaphragm upward

B-Internal Intercostal Muscles:
Contraction of the internal intercostal muscles leads to depression and inve of the ribs.

**2-Expiration:**

**A-In Normal Resting Expiration:**

-Normal expiration is the passive process. It is produced by relaxation of inspiratory muscles. Drop of the thoracic cage and elevation of diaphragm increase of intrapulmonary pressure to (+1 mm Hg) & rush the air out the lungs.

**B- In Forced Expiration:**

The expiratory muscles contract strongly so, more depression and inversion of ribs more decrease in the thoracic cavity and rush more volume out of the lungs.

**1-Inspiration:**

**A-In Normal Resting Inspiration:**

Respiratory center → phrenic and external intercostal nerves→ contraction diaphragm and external intercostal muscles → expansion of the chest wall in all directions→ distention of the lung and decrease of intrapulmonary pressure to (–1 mm Hg) & rush the air into the lungs.

**B- In Forced Inspiration:**

The main and the accessory muscles contract strongly so, greater increase in the thoracic cavity and rush more volume to the lungs.

Dr Khaled Abdel-Sater

الكبسولة

# PHYSIOLOGY Lecture 12

## Factors Affecting Diffusion of Gas

### 1-pressure Gradient

$O_2$ (100 mmHg) - (40 mmHg) = 60 mmHg

$CO_2$ (46 mmHg) - (40 mmHg)= 6 mmHg

### 2-Surface Area of the pulmonary membrane 70 $m^2$

### 3-Thickness of the pulmonary membrane 0.6 µ

### 4-The Diffusion coefficient for each gas

***A- Diffusion Coefficient for $O_2$:***

= 21 ml/ min/mm Hg. the diffusion coefficient for $O_2$

11 X 21= 230 ml/min.

***B- Diffusion Coefficient for CO2:*** =20 time > $O_2$.

فرق الضغط بعد الأخذ بعين الاعتبار المقاومة الفيزيولوجية

الكثر ذائبية

## Hypoxia

decreased of $O_2$ supply or utilization

**1-Hypoxic**
decrease of arterial $O_2$ tension

**2-Anemic**
decrease of content or function of Hb

**3-stagnant**
decrease of blood flow to the tissues

**4-Histotoxix**
inability of the tissue to $O_2$ utilization

### CYANOSIS

It is the bluish discoloration of the skin and mucous membrane due to increased amount of reduced hemoglobin above 5 gm capillary blood.

### RESPIRATORY DEFINITIONS

**DYSPNEA**
It is awareness of difficulty in breathing.

**ORTHOPNEA**
This is the difficulty breathing in lying in bed but not in standing or sitting positions due to compression of the diaphragm by the viscera.

**APNEA** الاختناق
It is the temporary stoppage of respiration.

## $O_2$ TRANSPORT BY BLOOD

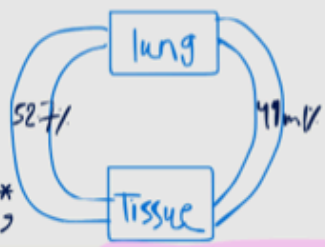
**Forms of $O_2$:**

gases in chemical form have no pressure

Tissues need (=250 ml/min)

| ITMES | A- Physical Solution | B- Chemical combination |
|---|---|---|
| Nature | The molecules of $O_2$ are dissolved in plasma. | The molecules of $O_2$ are in combination with Hb |
| Value | It about 3% | It about 97% |
| O2 supply to tissue | 10 ml/min. | 240 ml/min. |
| importance | It determines $O_2$ pressure, so it determines the direction & rate of diffusion of gas in chemical combination from or to blood. | It is main $O_2$ supply to the tissue. |

## co2 Transport by blood




* اضافة وحذف

**-Tidal $CO_2$:** This is the volume of $Co_2$ that to each 100 ml of arterial blood from tissue. $Co_2$ content in arterial is 49 ml in venous blood is 52.7 ml % so the ti is 3.7ml %.

## Forms of Co2

- Bicarbonate (HCO3) = 65% of CO2
- Chemical combination with Hb (carbaminohemoglobin) 25%
- Physical solution, the molecules of CO2 dissolved in plasma =10%