كلية المستقبل الجامعة

قسم الفيزياء الطبية

المرحلة الثالثة

Medical Physics

Lecture Five

Measurement of Pressure in the Body

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Pressure in the Body :

Next to taking a person's temperature and weight, measuring blood pressure is the most common of all medical examinations. Control of high blood pressure is largely responsible for the significant decreases in heart attack and stroke fatalities achieved in the last three decades.

The pressures in various parts of the body can be measured and often provide valuable medical indicators. In this section, we consider a few examples together with some of the physics that accompanies them.

Organs	Gauge Pressure in mm Hg
Blood pressure in large veins	4 – 15
Eye	12 – 24
Brain and spinal fluid	5 – 12
Inside lungs	-2 to +3
Middle ear	≤ 1
Intestin	10 - 20
Stomach	0 - 20

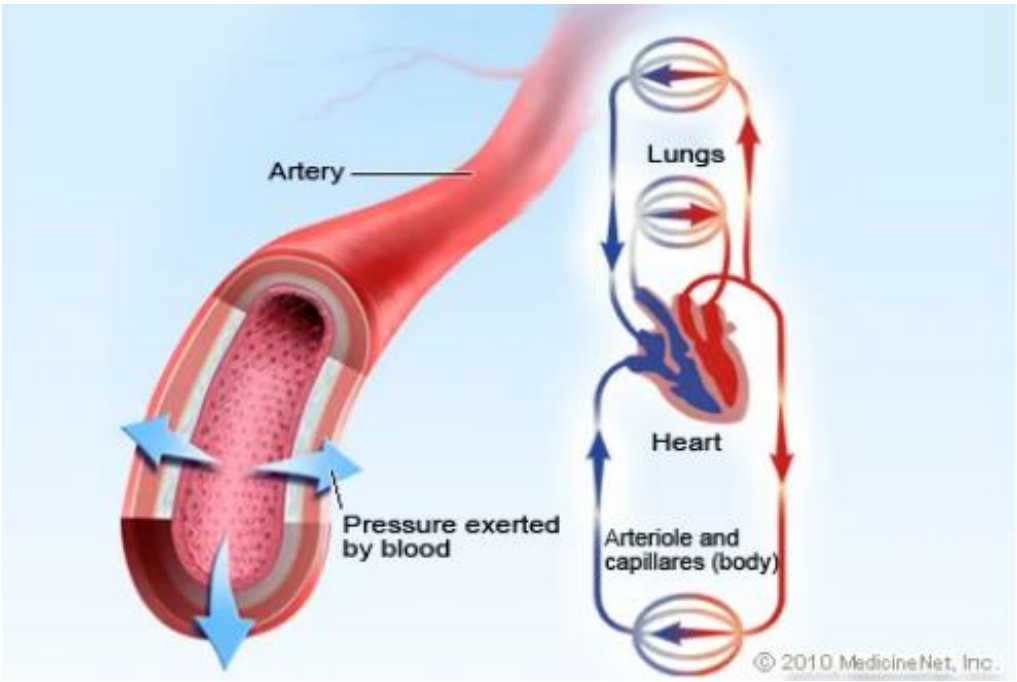
Blood Pressure :

Blood pressure is the force of blood against the walls of the arteries when the heart contracts.

The blood pressure is the pressure of the blood within the arteries. It is produced primarily by the contraction of the heart muscle .

Everyone has blood pressure. While a certain amount of pressure is needed to keep the blood flowing, this pressure can increase if the blood meets resistance in the arteries.

Blood flowing through the arteries at high pressure can damage artery walls. If this pressure is persistently high, this is called high blood pressure or “hypertension”.



How is Blood Pressure Measured ?

Blood pressure is measured in millimetres of mercury (mmHg) and is given as 2 figures:

1- Systolic Pressure : the pressure when the heart pushes blood out .

2- Diastolic Pressure : the pressure when the heart rests between beats .

For example, if your blood pressure is "140 over 90" or 140/90mmHg, it means you have a systolic pressure of 140mmHg and a diastolic pressure of 90mmHg.

Pressure : is defined as the force per unit area in a gas or a liquid.

$$P = \frac{F}{A}$$

P: Pressure

F: Force

A: Area

Blood leaves the heart at about 120 mm Hg but its pressure continues to decrease (to almost 0) as it goes from the aorta to smaller arteries to small veins . The pressure differences in the circulation system are caused by blood flow through the system as well as the position of the person. For a person standing up, the pressure in the feet will be larger than at the heart due to the weight of the blood

$$\mathbf{P = h\ \rho\ g}$$

h : depth or height of liquid in (cm) … (m)

ρ : density of liquid (g/cm^3) ….. (kg/ m^3)

g : 980(cm/sec^2) acceleration of gravity ….. (9.8 m/sec^2)

Classification of Blood Pressure :

1- Ideal blood pressure is considered to be between (110/70 mmHg) and (120/80mmHg).

2- High blood pressure is considered to be 140/90mmHg or higher (Hypertension) .

3- Low blood pressure is considered to be 90/60mmHg or lower .(Hypotension) .

Causes of High Blood Pressure :

1- Not getting enough regular physical activity .

2- Diabetes Militus.

3-Obesity .

Eye pressure :

The clear fluids in the eye ball (aqueous and vitreous humors) that transmit the light to retina (the light sensitive part of the eye), are under pressure and maintain the eye ball in fixed size and shape.

If a partial blockage of the drain system occurs, the pressure increase then restrict the blood the blood supply to the retina then affect the vision.

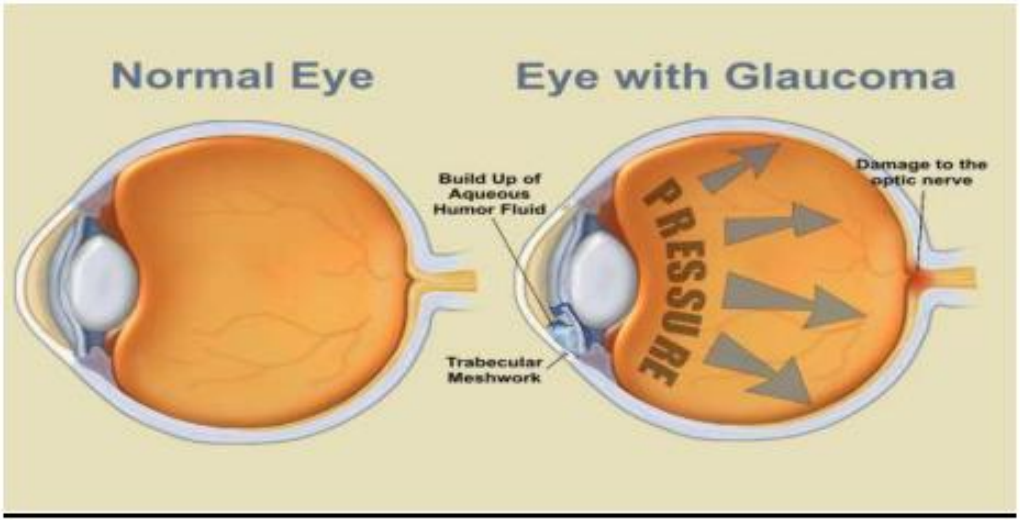
This condition, called glaucoma.

Glaucoma :

a. Moderate ---------- Tunnel vision

b . Severe ---------- Blindness

The pressure in normal eyes ranges from (12 –24) mm.Hg



Pressure in the Skeleton :

The highest pressures in the body are found in the weight bearing bone (joints) .

The pressure in the knee joint may be more than 10 atm .

the surface area of a bone at the joint is greater than its area either above or below the joint. The larger area at the joint distributes the force thus reducing the pressure according to the equation .

Bone has adapted in another way to reduce pressure the finger bones are flat rather than cylindrical on the gripping side and the force is spread over a large surface this reducing tissues over the bones according to :

$$P = \frac{F}{A}$$