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Pressure

Types of pressures

- The blood pressures
- Pressure inside the Skull
- Eye pressure
- Pressure in the skeleton
- Hyperbaric oxygen therapy (Hot)
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Pressure: is defined as the force per unit area in a gas or liquid. For a solid the quantity force per unit area is referred to as stress.

Measurement of body pressure

Pressure is a very common phenomenon in our live, as the doctor measures our blood pressure as a part of a physical examination.

In metric system pressure is measured in units

- Dynes per square centimeters
- Newton per square meter (Pascal) or (Pa)

None of the above units is in common in medicine. The used unit is the height of a column of mercury (Hg).

Pressure under a column of liquid: $P = \rho g h$

ρ = density of the liquid

For mercury $\rho = 13.6$ g/cm3 for water $\rho = 1$ g/cm3

g = acceleration due to gravity

h = height of the column

Gauge pressure: is defined as the excess pressure over atmospheric pressure.

Gauge pressure $P - P_o = \rho g h$

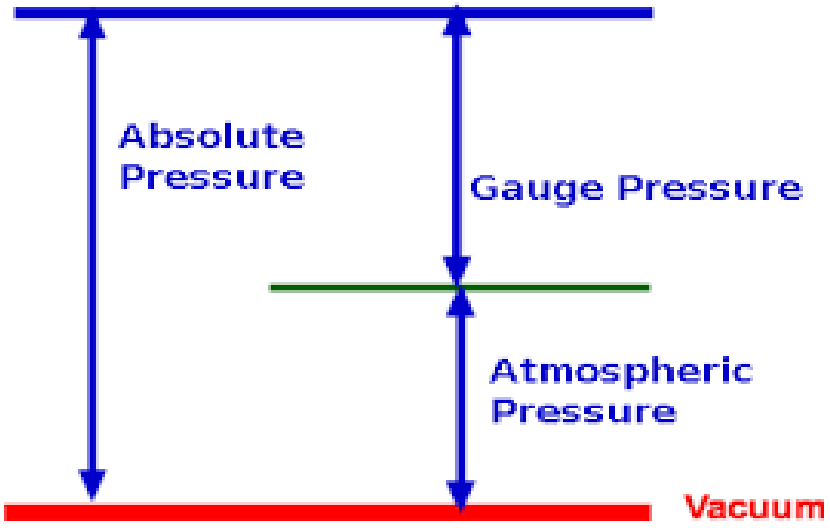
Absolute pressure = atmospheric pressure + gauge pressure

$P = P_o + \rho g h$

Atmospheric pressure = $\rho_{Hg}\ g\ h_{Hg}$

All the pressures used in this chapter are gauge pressures

Negative pressure: Any pressure lower than atmospheric pressure.



Example1: Find the pressure of 10 m of water in Dyne/cm2 and N/m2?

10 * 100 =1000 cm

$P = \rho\ g\ h$

$= 1000 * 9.8 * 10 = 9.8 * 10^4$ N/m2

$= 1 * 980 * 1000 = 980000 = 9.8 * 105$ Dyne/cm2

Example2: Calculate the systolic pressure in Dy/cm² and N/m²?

In systolic pressure = 120 mmHg = 12 cm Hg = 0.12 m Hg

$P = \rho_{Hg}\ g\ h_{Hg} = 13.6 * 980 * 12 = 159936 = 1.6 * 10\text{^}5$ Dy/ cm2

$P = \rho_{Hg}\ g\ h_{Hg} = 13600 * 9.8 * 0.12 = = 1.6 \times 10^4$ N/m2

Example3: Calculate atmospheric pressure in day was the height of mercury is(76cm)?

$P = \rho\ g\ h = 13.6 \times 980 \times 76 = 1.013 \times 10\text{^}6$ dyne/cm2

$= 1.013 \times 10\text{^}5$ N/m2

Example4: What height of water will produce the same pressure as 120 mm Hg?

P (120 mmHg) = ρ g h

$= (13.6\ g/cm^3)\ (980\ cm/s^2)\ (12\ cm)$

$= 1.6\ x10^5 dyne/cm^2$

For water:

$1.6\ x10^5 dyne/cm^2 = (1\ g/cm^3)\ (980\ cm/s^2)\ (h\ cm\ H_2O)$

$= 163\ cm\ H_2O$

The height of water can be obtained by multiplying the height of the mercury by 13.6 ($h_{Hg} . \rho_{Hg}$).

The blood pressure

The most common clinical instrument used in measuring pressure is the sphygmomanometer, which measures blood pressure, two types of pressure gauges are used in sphygmomanometers

- **Mercury manometers**

- **Aneroid**
- **Digital**

Recently another type used (digital) The blood pressure of a patient is used a routine clinical measure of health; this pressure is often measured by using device called **"sphygmomanometer"** The systolic pressure is 120mm Hg and the diastolic pressure is 80 mm Hg.

Pressure inside the Skull

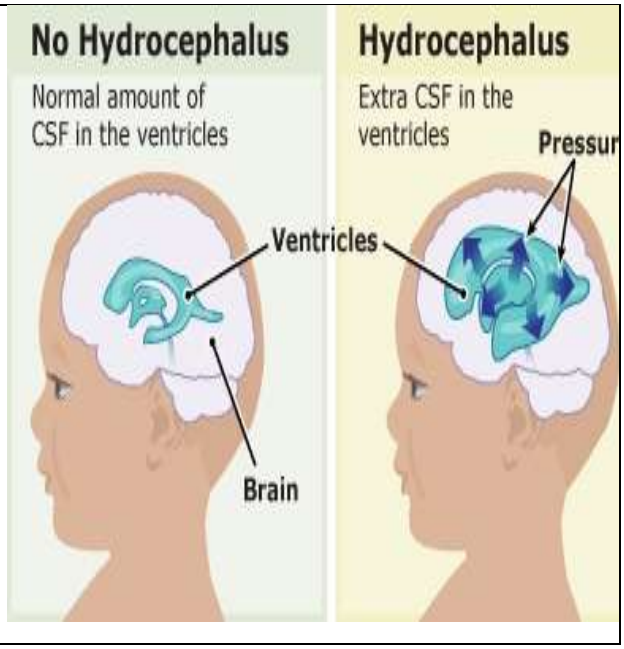
The brain contains about (150cm³) of cerebrospinal fluid "CSF" in a series of interconnected opening called "Ventricles" CSF is generated inside the brain and flows throw the ventricles into the spinal column. If at birth this opening is blocked for any reason, the CSF is trapped (confined) inside the skull and increased the internal pressure. This serious condition, called **"Hydrocephalus".**

Detection of Hydrocephalus

It is not convenient to measure the CSP pressure directly. The method to detect hydrocephalus is to measure the circumference of the skull just above the ears.

1- Normal value for the circumference of the skull of an infant is (32 to 37 cm), and a larger value may indicate hydrocephalus.

2- Transillumination: Makes use of the light - scattering



Eye pressure

The clear fluids in the eyeball (the aqueous and vitreous humors) that transmit the retina (the light sensitive part of the eye), are under pressure and maintain the eyeball in a fixed

size and shape the dimensions of the eye are critical to good vision, a change of only 0.1 mm in it is diameter has a significant effect on the clarity of vision.

If a partial blockage of the drain system occurs, the pressure increases then restrict the blood supply to the retina then affect the vision. This condition, called glaucoma.

Glaucoma:

- **Moderate ----------tunnel vision**
- **Sever----------blindness**
- People over 40 years of age are at greatest risk of developing glaucoma and should have their intraocular pressure tested routinely.
- The pressure in normal eyes ranges from (12 –23) mm.Hg

Measuring the eye pressure

- By (feel)the physician estimates: the pressure inside the eye by feel as they pressed on the eye with their fingertips.

- By the tonometer: an instrument is used to measure intraocular pressure (IOP). Tonometry is a test to measure the pressure inside your eyes. The test is used to screen for glaucoma. It is also used to measure how well glaucoma treatment is working.

IOP… Intraocular pressure.

Pressure in the skeleton

The highest pressures in the body

for example, when all the weight of the body is on one leg, such as when walking, the pressure in the knee joint may be more Than 10 atm.

P=F/A…… (*)

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 (*).

Hyperbaric oxygen therapy (Hot)

The body normally lives in an atmosphere that is about one fifth O2 and four- fifth N_2. In some medical situations it is beneficial to increase the proportion of O2 in order to provide more O2 to the tissue.

1. Gas gangrene

2. Carbon Monoxide poisoning

In carbon Monoxide poisoning, the RBCs cannot carry oxygen without (HOT).

3-Treatment of cancer

(HOT) has been used in conjunction with radiation in the treatment of cancer.