Medical physics module
Semester 1

Session 2

Lec.2

Pressure

By: Lect. Dr. Nadia Hussein

Objectives

- After the end of this lecture, the student must know:

1. Definition pressure.
2. How can pressure affect our various body parts and organs.
3. Measurement of pressure in the body.
4. Knowledge of the principles of pressure when dealing with certain investigational tools in disease state.

Obj. 1

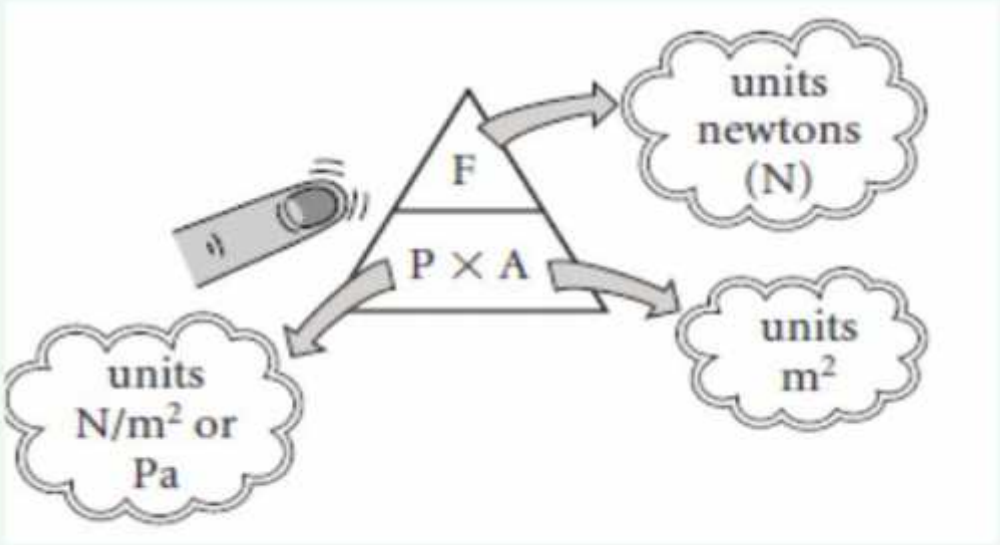
Definition pressure

Pressure is defined force per unit area in gases or liquid while for solids the quantity force per unit area is referred to as *stress*, the atmospheric pressure is about 10^5 N/m² or 760 mm Hg.

$$P = F/A$$

Pressure formula and triangle

- Pressure = Force / Area
- P = F / A
- Units N / m^2 special unit the pascal Pa



Obj.2

How can pressure affect our various body parts and organs?

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

The pressure of column of liquid calculate:

$$P = \rho g h$$

ρ = density

g = gravity acceleration

h = height of column

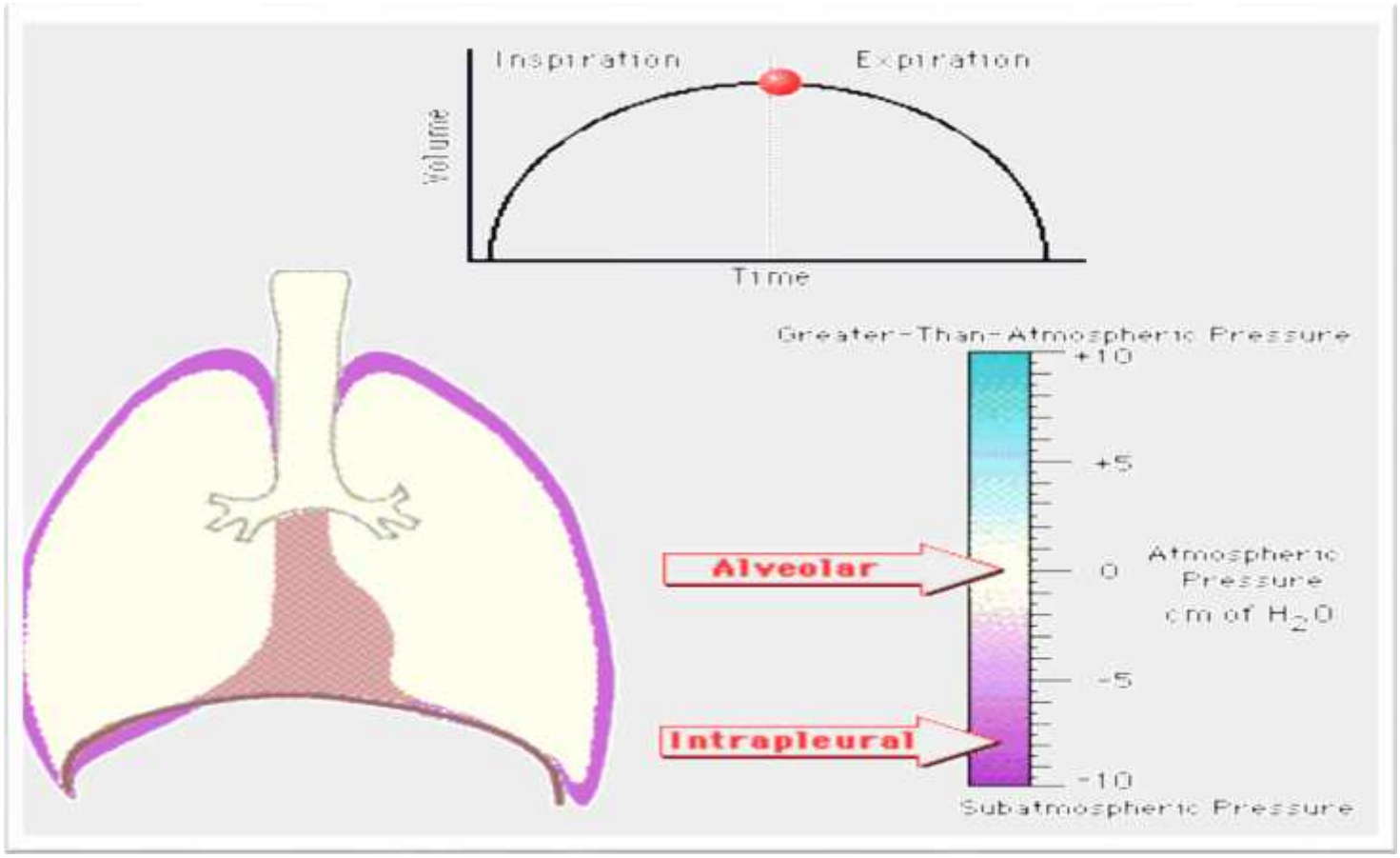
Negative Pressure:

There are places in the body where the pressures are lower than atmospheric.

Example:

When we breath (inspire) the pressure in the lung must be lower than atmospheric pressure or the air would not flow to the lungs.

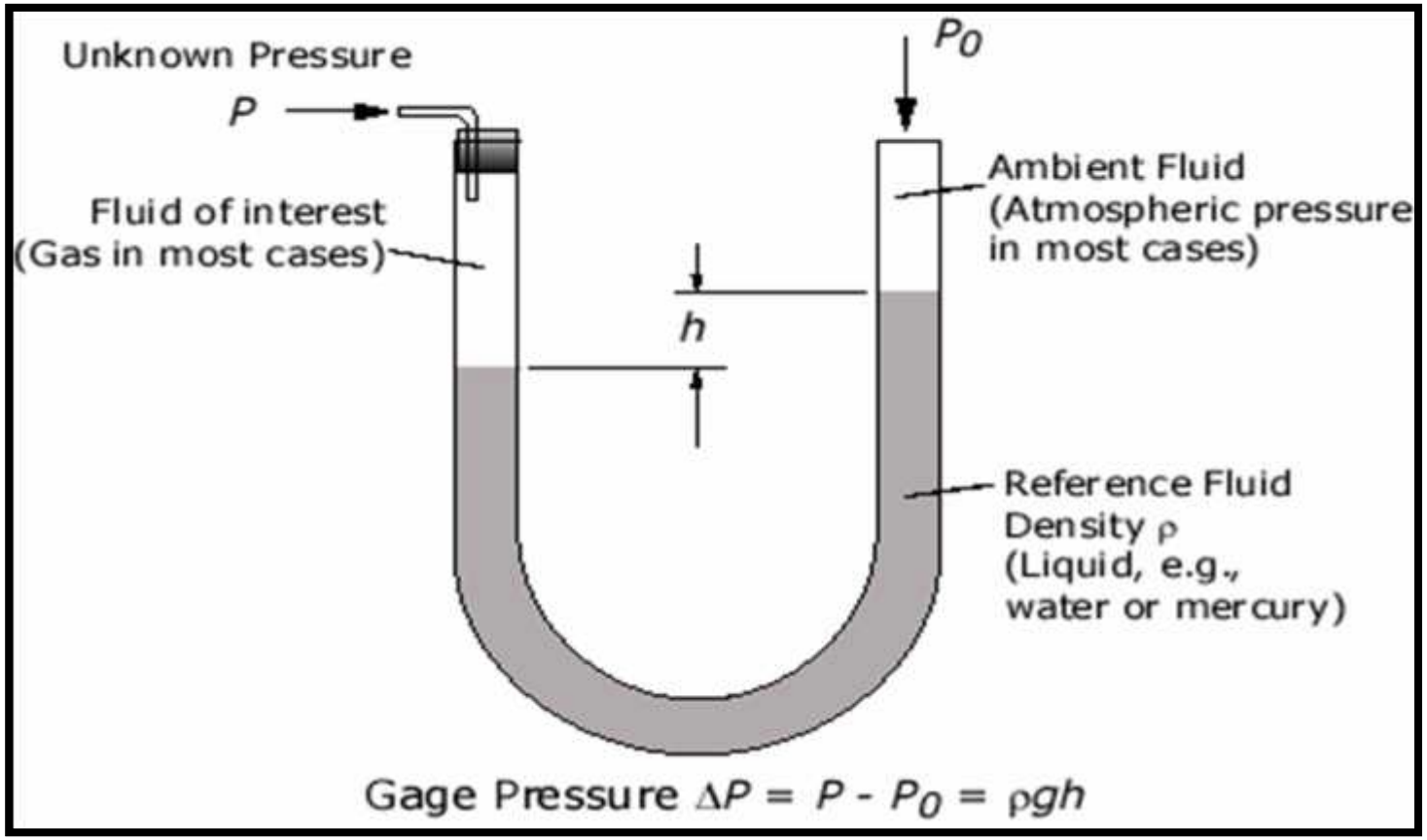
When person drink through straw the pressure in his mouth must be negative by an amount equal to the height of his mouth above the level of the liquid he is drinking.


Inspiration
Expiration
Volume
Time
Greater-Than-Atmospheric Pressure
+10
+5
0
-5
-10
Alveolar
Intrapleural
Atmospheric Pressure
cm of H_2O
Subatmospheric Pressure

Obj.3

Measurement of pressure in the body.

An instrument that measures pressure is called a manometer



The common clinical instrument used in measuring pressure is the sphygmomanometer.

Pressure inside skull

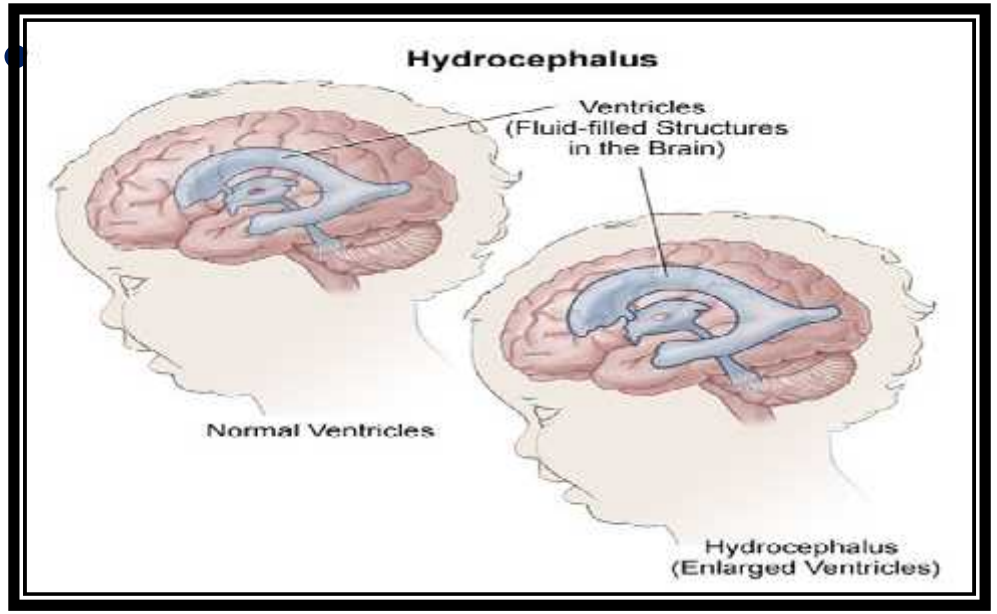
- The brain contains approximately 150 cm^3 of cerebrospinal fluid (CSF) in series of interconnected cavities called ventricles, at birth if this opening is blocked for any reason, CSF is trapped inside skull and increase internal pressure.
- Pressure causes skull to enlarge, this called *hydrocephalus* and is common in infant.

It is suitable to measure the CSF pressure directly.

There are two methods

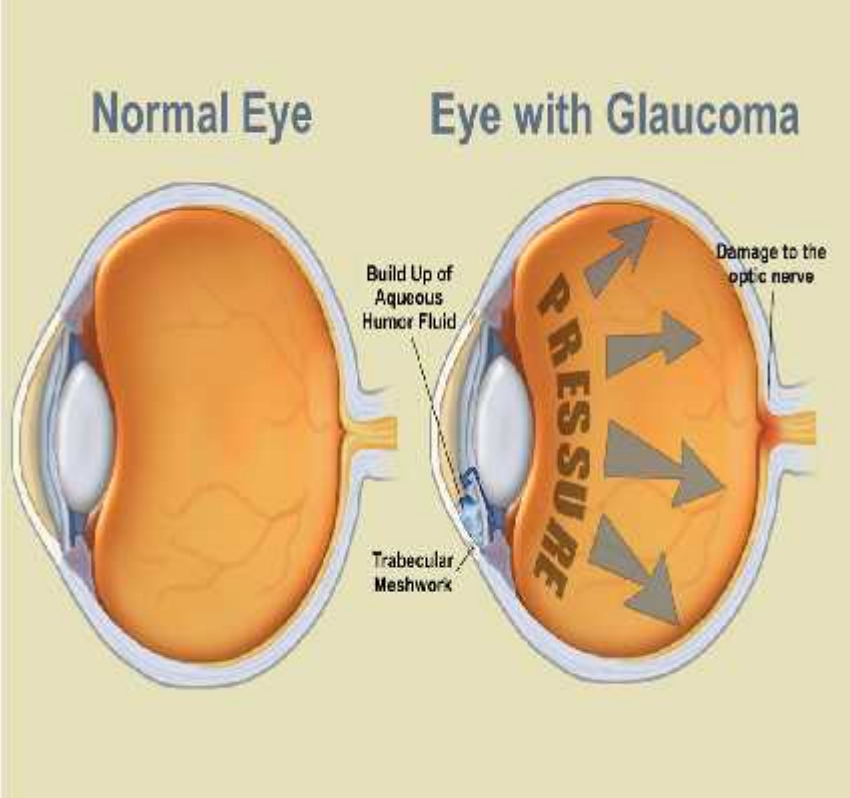
- Illumination: is qualitative method of detection. Make use of the light-scattering properties of the rather clear CSF inside the skull.

•Crude method for detecting hydrocephalus is to measure circumference of the skull just above the ears, normal value of newborn infant are from (32-37)cm, larger value indicate hydrocephalus.



Eye pressure

- A fluid in the eye ball (aqueous and vitreous humors) that transmit light to retina. The dimensions of the eye are critical to good vision; a change of (0.1 mm) in diameter has effect on clarity of vision.



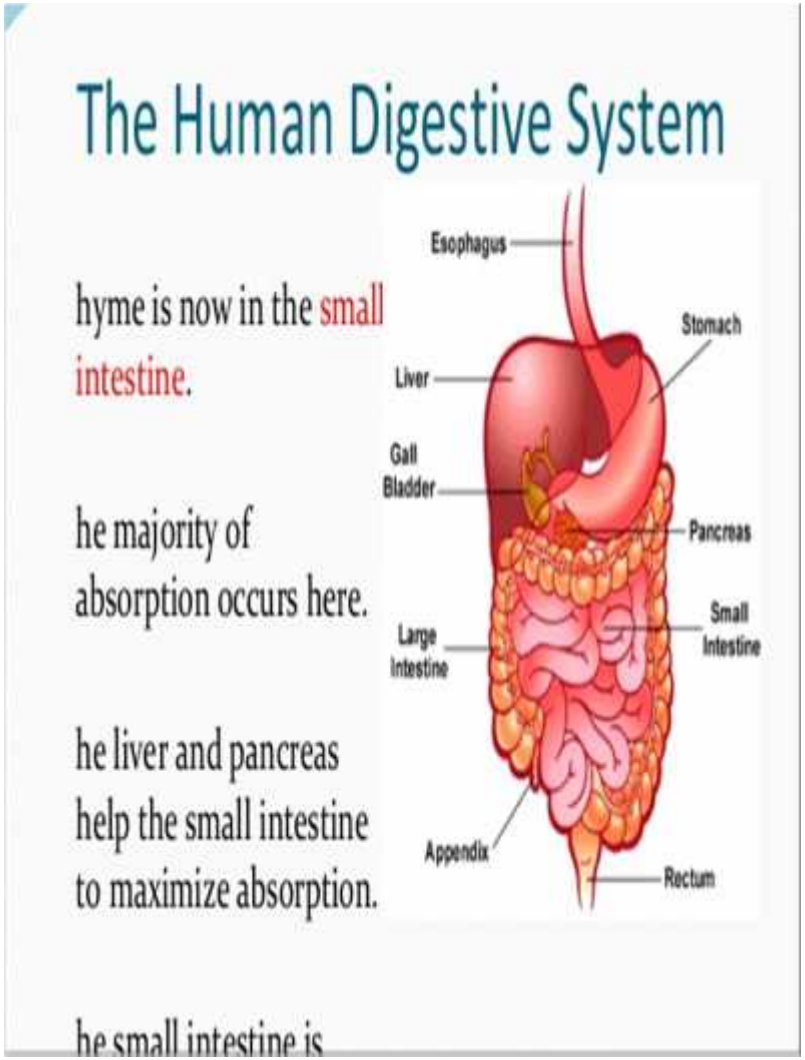
- Pressure in normal eye between (12- 33 mm Hg).

The eye continuously produces aqueous humor and the drainage system allows surplus to escape.

If partial blockage of this drain system occurs, the pressure increases and restrict the blood supply to retina, and thus effect vision, this condition called *glaucoma* producing *tunnel vision* in moderate cases, and *blindness* in severe cases.

Pressure in the digestive system

- The pressure is greater than atmospheric in most gastrointestinal system.
- The pylorus valve prevent the flow of food back into stomach from small intestine, occasionally blockage forms in small or large intestine, and the pressure builds up between blockage and pylorus valve, this pressure become greater enough to restrict blood flow to critical organs, it can cause death.



Intubations, the passing of hollow tube through the nose, stomach, and pylorus is usually used to relieve the pressure. If intubation does not work it is necessary to relive the pressure surgically.

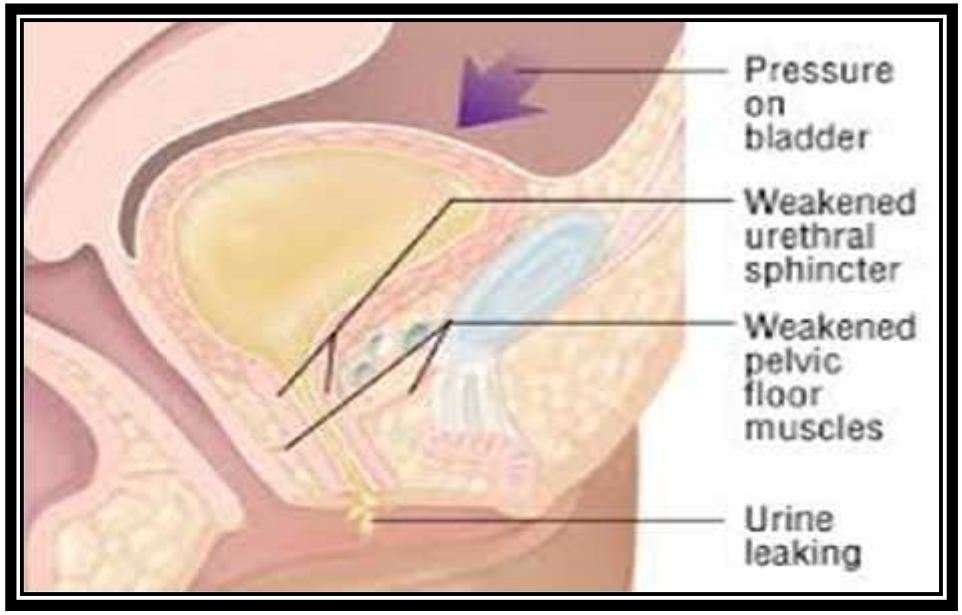
The pressure gastrointestinal GI system is coupled to that in the lungs through flexible diaphragm.

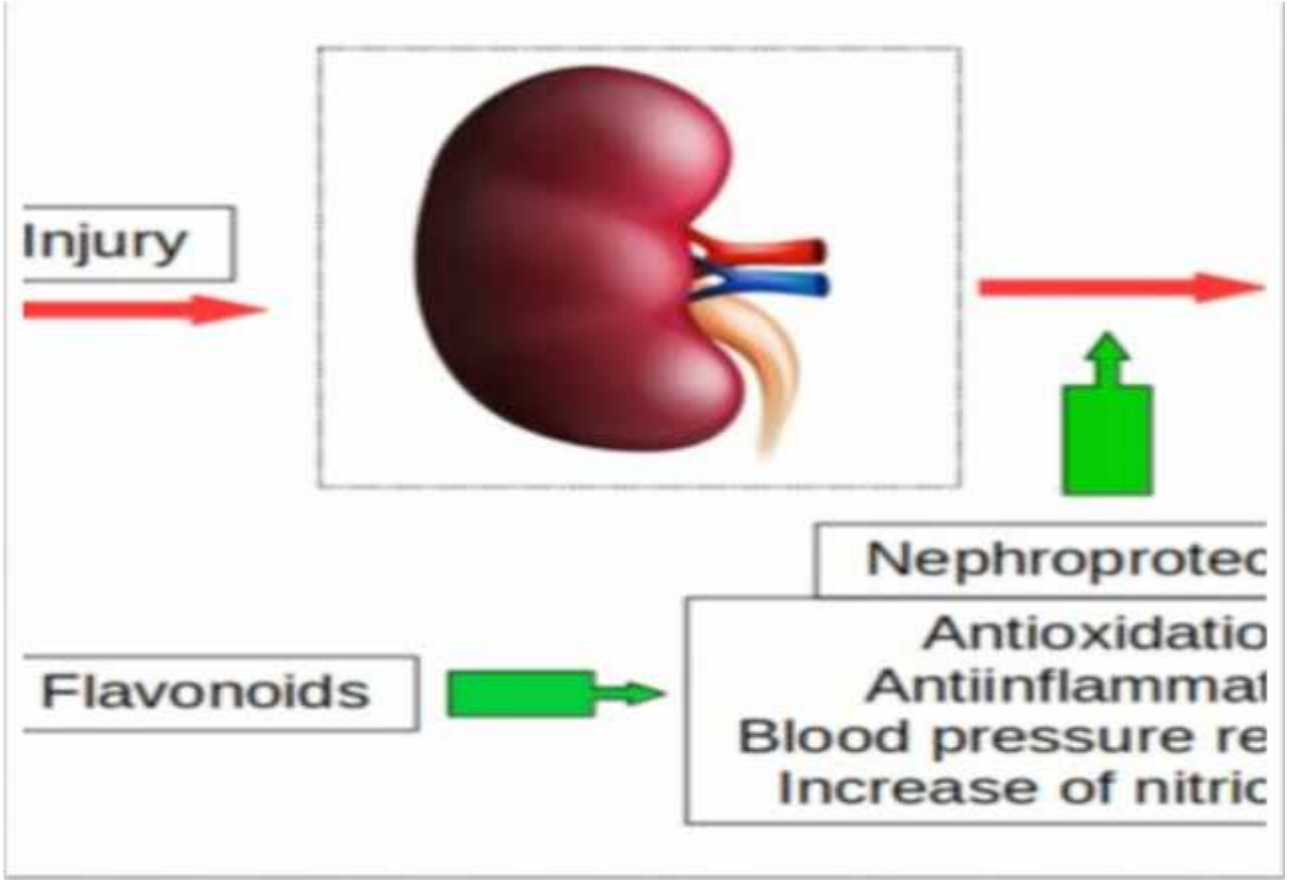
Pressure in the urinary bladder

- There are internal pressure p in the bladder due to accumulation of urine, for adult the maximum volume in bladder before voiding is 500 ml.
- In men who suffer prostatic obstruction of urinary passage, it may be over (100cm) H_2O.

The bladder pressure increasing during coughing and sitting up, during pregnancy, the weight of the fetus over bladder increases the bladder pressure, and causes frequent urination.

A stressful situation may also produce pressure increase, to relieve the pressure in urinary bladder use folly catheter.



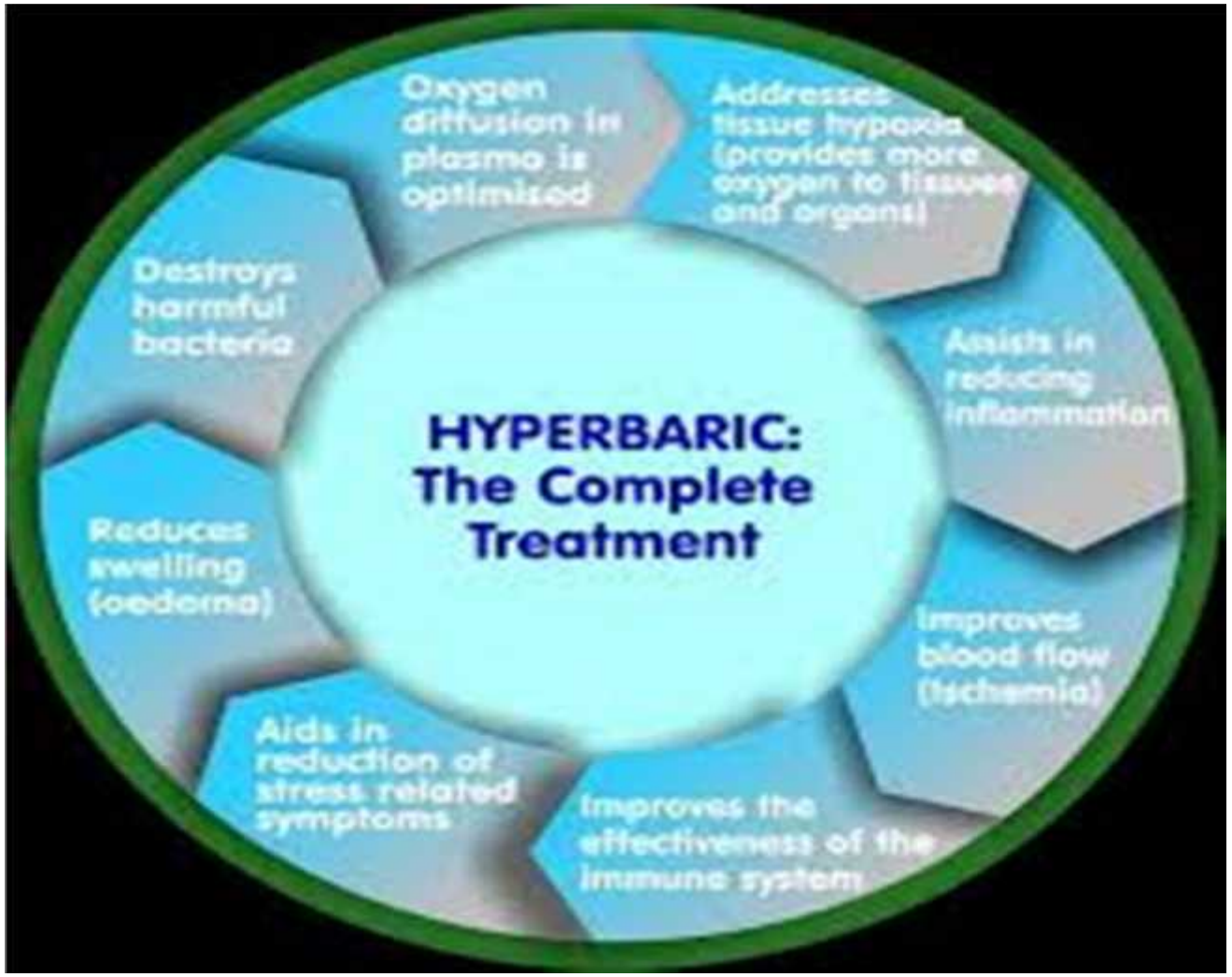

Injury
Nephroprotec
Antioxidatio
Antiinflammat
Blood pressure re
Increase of nitric
Flavonoids

Hyperbaric oxygen therapy (HOT)

- About one fifth oxygen and four fifth nitrogen in atmospheric, to greatly increase the amount of oxygen medical engineering have constructed special high pressure (hyperbaric) oxygen chambers.

HOT

- Gas gangrene is a disease that killed more than half of its victims before HOT was developed, since the bacteria that causes gas gangrene cannot survive in the presences of oxygen, almost all gas gangrene patients treated with HOT are cured without the need for amputation, the previous best method of treatment


HYPERBARIC:
The Complete
Treatment
Oxygen diffusion in plasma is optimised
Addresses tissue hypoxia (provides more oxygen to tissues and organs)
Assists in reducing inflammation
Improves blood flow (Ischemia)
Improves the effectiveness of the immune system
Aids in reduction of stress related symptoms
Reduces swelling (oedema)
Destroys harmful bacteria

Obj.4

Patients in this study had diabetic foot ulcers recalcitrant to standard best practice wound care for four weeks or greater.

The Topical Wound Oxygen therapy was applied by the patient at home for 90 minutes daily 7 days /week.

The Topical Wound Oxygen System delivered 100% oxygen to the wound bed utilizing pressure cycles between 5mbar and 50mbar.

Topical Wound Oxygen Therapy System


Thank
you