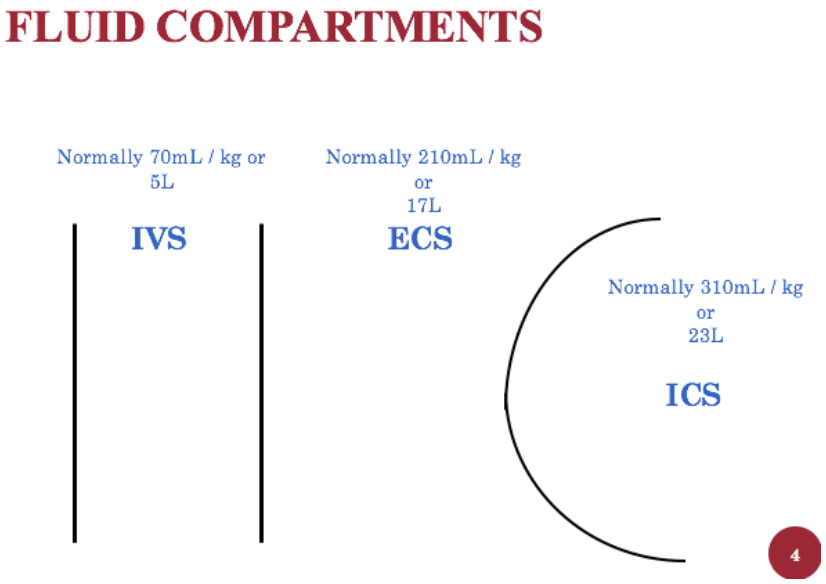
HV4/Week1 – Hospital acquired pneumonia

Concepts around shock:

- Fluid compartments
- Capillary dynamics
- Energy production
- Fluid resuscitation

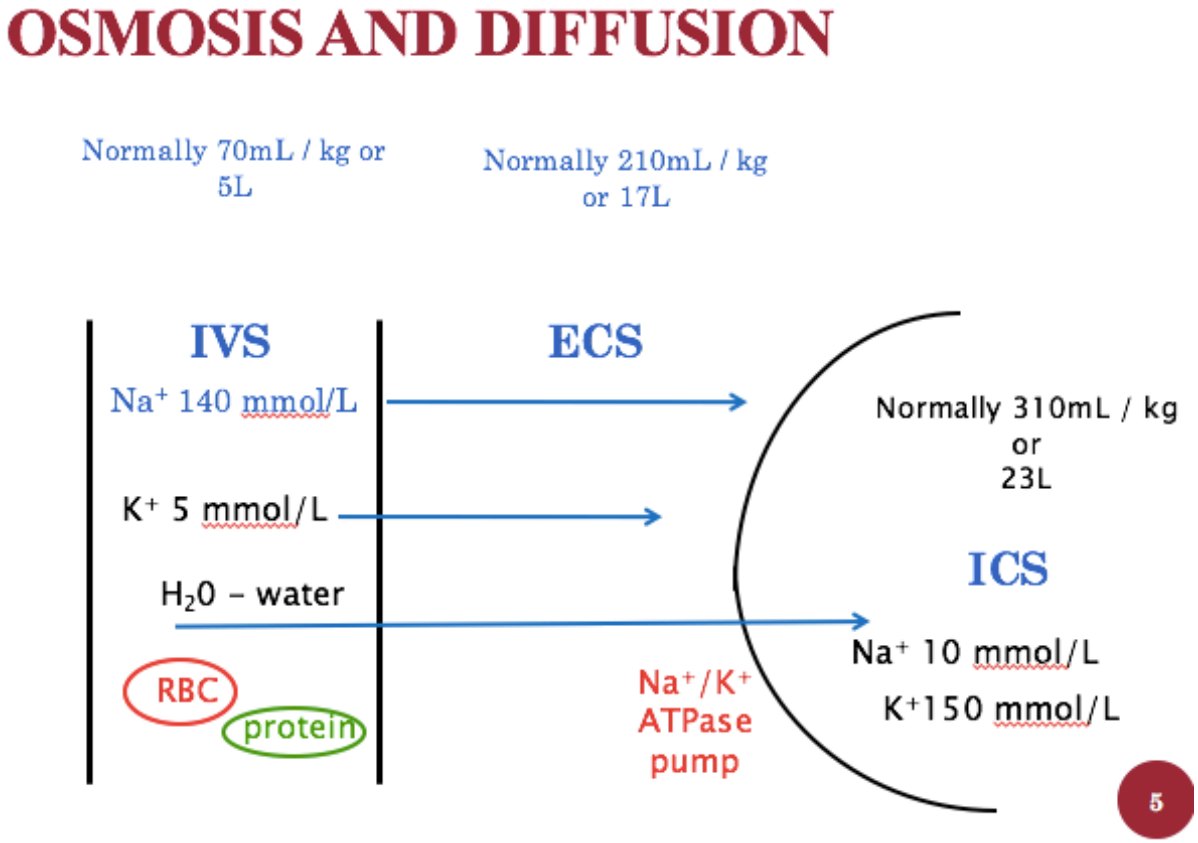
Body fluids –

- Review the fluid spaces within the body
- Discuss the principles of osmosis and diffusion
- Detail the different types of intravenous fluids used in fluid resuscitation
- Fluid resuscitation is the medical practice of replenishing bodily fluid lost through sweating, bleeding, fluid shifts or other pathologic processes. Fluids can be replaced orally, rectally, subcutaneously, or intraveneously.
- **In severe dehydration, intravenous fluid replacement is preferred as it the quickest.** It is especially useful where there is depletion of fluid both in the intracellular space and the intracellular space Fluid replacement is indicated in fluid depletion due to hemorrhage, extensive burns and excessive sweating (as from a prolonged fever), prolonged diarrhoea (cholera), and for the treatment of shock.
- Typically and adult requires 30mLof fluid per kilogram of weight in a 24 hour period. This fluid should include approximately 1 mmol of sodium and ½ to 1 mmol of potassium per kilo of body weight in a 24 hour period.
- In addition, during e.g. surgical procedures, fluid requirement increases because of increased evaporation, fluid shifts and/or excessive urine production. Even a small surgery may cause a loss of approx. 4 ml/kg/hour, and a large surgery approximately 8 ml/kg/hour, in addition to the basal fluid requirement.



Water is contained within the intracellular and extracellular compartments of the body. Fluid in the intracellular compartment of an adult constitutes 40% of body weight. Fluid in the extracelluar spaces is divided into two compartments: the plasma (intravascular, 4% of body weight) and the interstitial compartment (15% of body weight) (Porth, 2006).

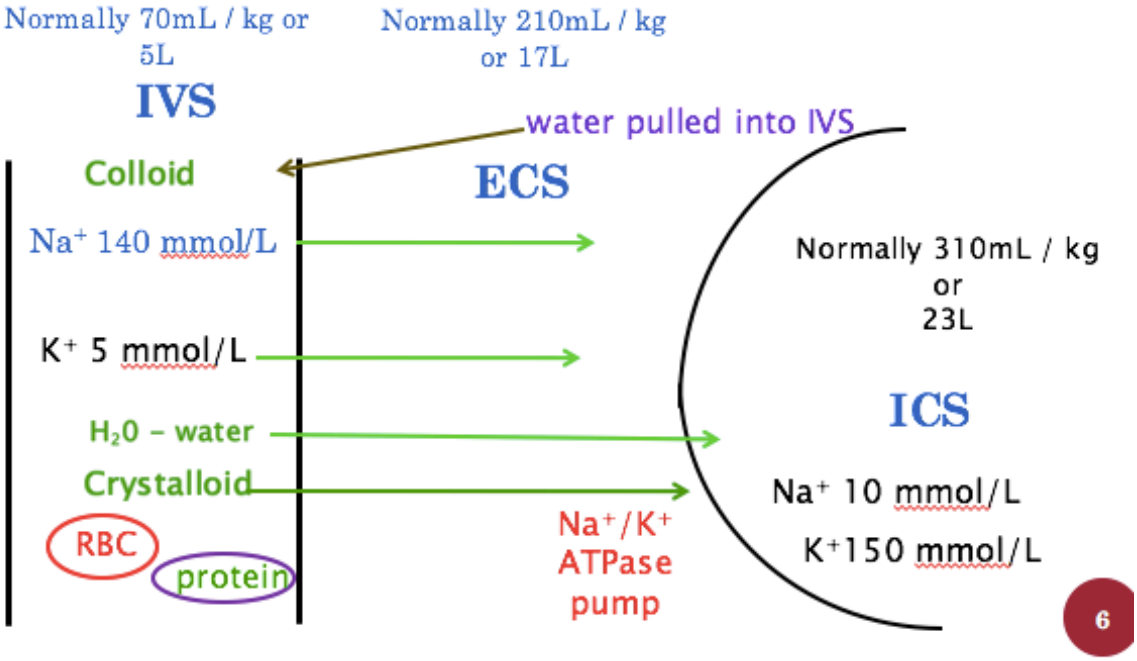
The interstitial fluid serves as a reserve during times of dehydration, and it also acts as transport vehicle for gas and nutrient exchange between vascular compartment and the cells.
As the vascular system fails during shock, there is a loss of vascular motortone, a decrease in arterial pressure and a venous pooling of blood. Hypoxia and the byproducts of cell damage cause an increase in permeability – this results in a shift of fluid from the intravascular space into the interstitium. This is termed "third spacing" (Porth, 2006). When this occurs – the circulating blood volume is further decreased, exacerbating the hypo-perfusion associated with shock



The make-up of the fluids infused into a patient directly relate to where those fluids will end up once in the body.
Specific to the intravascular space (IVS) is **colloid** such as RBC and protein, albumin etc
Solutions without sodium (Na+) can travel across spaces (e.g. 5% dextrose)

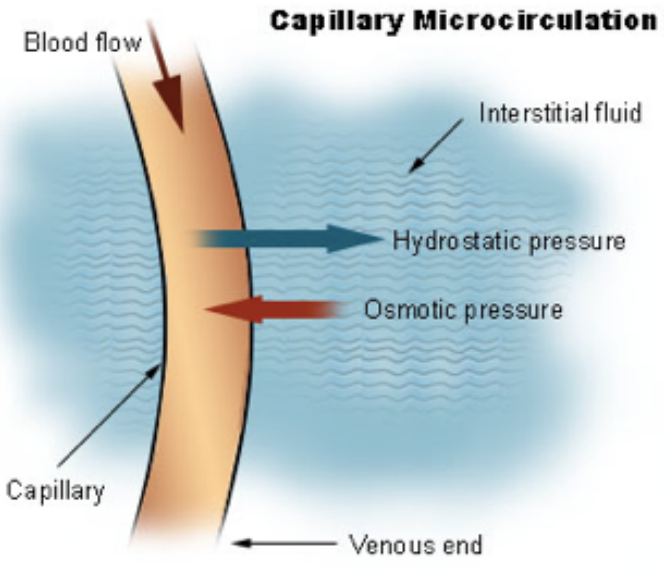
Filtration = fluid squeezed out of the capillary by blood pressure
Reabsorption = fluid re-entering capillary by osmotic attraction

OSMOSIS AND DIFFUSION OF FLUIDS INTO SPACES

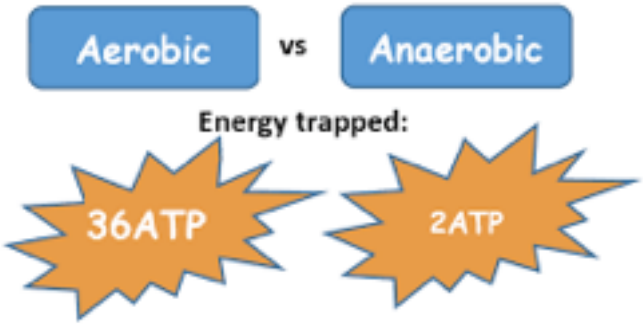


- The green on this slide illustrates the movement of fluids and electrolytes from IV fluids into the spaces. This depends on the concentration of the fluids and the spaces. It's a good idea for you to take the time to review principles of oncotic pressure and osmotic pull etc.
- Generally, colloids stay in the intravascular space (IVS) and exert an osmotic pull of fluid into the intravascular space (IVS) from the extracellular space (ECS)

REVISION CAPILLARY DYNAMICS



consequences of not enough oxygen: when cells don't have enough oxygen only a small amount of energy (ATP) is produced by a process called anaerobic respiration



When cells do not receive an adequate blood supply (hypotension of occlusion of an artery), there is not enough ATP for cellular metabolism e.g. Na+/K+ATPase affected and membrane function is compromised, lactic acid is then produced.

Fluids sometimes used:

- Albumex 4 (isotonic)
- Human albumin 40 g/L
- Sodium, chloride etc
- Albumex 20 (hypertonic)
- Human albumin 200 g/L
- Sodium
- Gelofusion
- Succinylated gelatin 40g/L, sodium chloride, sodium hydrocide
- Haemaccel
- Polygeline 35 g/L, sodium, potassium, calcium, chloride, etc
- Plasma-Lyte (isotonic)
- Water and electrolytes

These all increase intra vascular volume and increase BP. The haemoglobin (Hb) needs to be taken into account when infusing these fluids as loss of red blood cells (RBC) in haemorrhage would require blood (packed cell) infusion as well as fluids.
Plasma expanders are generally used in conjunction with other intravenous (IV) fluids.

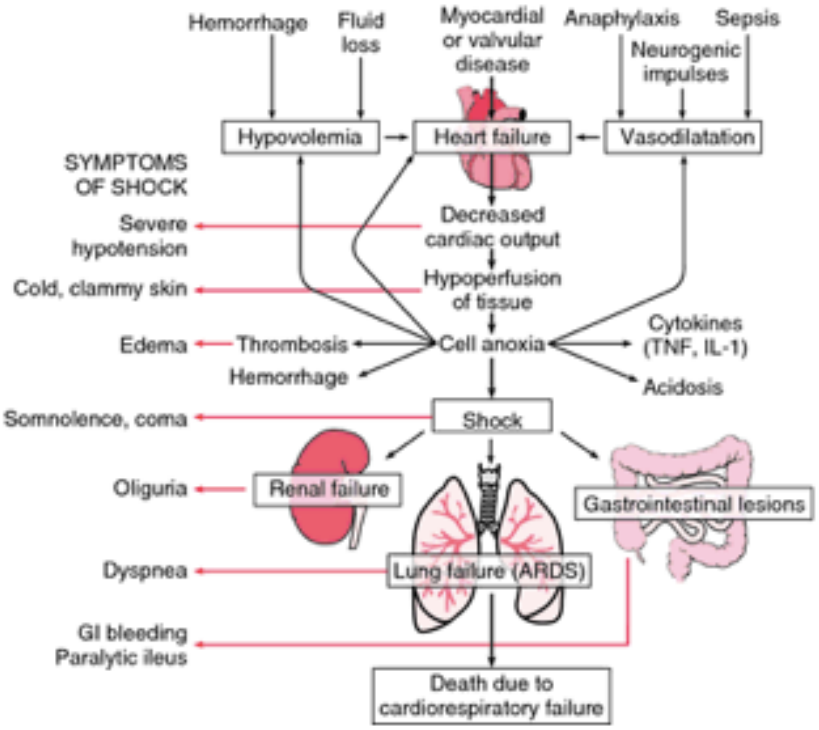
Colloids versus crystalloids in trauma:
NB

- There remains a debate regarding the use of colloids or crystalloids
- Findings of the SAFE study (Elliott et al., 2015)
    - Crystalloids (isotonic saline-based solutions are as effective as colloids (albumin-based solutions) for fluid resuscitation (Jabaley & Dudaryk, 2014))
- Thus know the theory behind both
    - Plus the arguments for and against!

Understanding shock:

- Is a complex syndrome associated with a cardiovascular systems failure to deliver blood, oxygen & nutrients to the cells, tissues and organs
- It is a group of clinically identifiable manifestations which signal the body's inability to supply sufficient oxygen for the consumption needs of cells

SIGNS/SYMPTOMS/COMPLICATIONS IN SHOCK



classification of shock:

- **Hypovolaemic shock:** decreased circulating blood volume leading to decreased cardiac output and reduced tissue perfusion
- **Transport shock:** when there is insufficient haemoglobin to carry the required oxygen to the tissues
- **Obstructive Shock:** Inability of the heart to fill properly (e.g. tamponade) or obstruction of outflow from heart (pulmonary embolism, pneumothorax, cardiac tumours, dissecting aortic aneurysm)
- **Cardiogenic shock:** circulatory failure caused by the inability of a damaged heart muscle (Right or Left ventricle) to pump the require volume of blood with each stroke

There are multiple classifications of shock – regardless of the classification of shock – the bodies physiological processes are the same.