Westmead Intensive Care Unit

Fluids and Electrolytes Learning Package

Aim of the Package
To provide the registered nurse with the opportunity to acquire the level of knowledge, through self-directed learning, on which to base the nursing skills necessary for safe practice.

Objectives of the Package

1. Review the normal distribution of fluid and electrolytes in the body and the mechanism which maintains this distribution
2. To identify the normal serum electrolyte values as well as the cause and consequence of abnormal levels
3. To identify appropriate fluid therapy and electrolyte replacement precautions
4. Identify and describe issues related to glycaemic control in relation to the critically ill patient.

ANSWERING THE QUESTIONS

1. Attempt all questions
2. You will need to exceed 80% correct answers to pass the package, if this is not achieved you will need to repeat the package
3. Your package will reviewed by a CNE and then you will be provided with the package answers to allow further review

FINDING IMFORMATION

- References found in this package will provide a guide for answering questions
- Textbooks are available in the CNE nook
- CIAP can be access on all the computers through the intranet site

<u>Fluid Compartments and Electrolyte Distribution</u>

"Water contributes to approximately 60% of body weight, with different organs varying in water content. Men normally have less fat than women, thus have a higher percentage of body weight as water.
The average water content as a percentage of total body weight is 60% for men and 50% for women. Total body water (TBW) as a percentage of total body weight decreases with age due to a progressive loss of muscle mass.
TBW is commonly divided into two volumes,
1) Extracellular fluid (ECF), that in blood vessels, where it is called plasma and also interstitial fluid.
2) Intracellular fluid (ICF), which also includes red cell volume."
(T.E.Oh., pg.700)

Q1. Explain these terms ECF and ICF volumes and how they are normally regulated by the body to maintain homeostasis.

PARTICLES IN A SOLUTION CONTRIBUTE TO THE GENERATION OF AN OSMOTIC PRESSURE.
The osmotic pressure is referred to as osmolality, osmolarity, or tonicity of the fluid.

Q2. Explain these terms, osmolality, osmolarity and tonicity.

Normal Osmolarity of the three body fluid compartments is about 300mOsm/litre. The Plasma concentration is slightly higher than that of the other two compartments because of the osmotic effect of the plasma proteins.

Q3. Explain the role of capillary blood pressure in water movement between the plasma and interstitial fluid.

Q4. What is an electrolyte? Give examples of electrolytes and non electrolytes.

Q5. The concentration of solutes varies according to the different fluid compartments. Identify the electrolyte composition of these fluid compartments.

Q6. Explain the Sodium – Potassium pump.

Note that the Na+ - K+ pump requires the ATP derived energy. ATP production requires oxygen. So cells that are hypoxic will have a failure of their cell membrane function and integrity and will become oedematous.

Q7. Explain the hormonal control that affects the kidneys ability to control urine volume.

Q8. Briefly review the forces (osmotic or oncotic and hydrostatic) that maintain capillary to interstitial space fluid equilibrium and explain how peripheral oedema forms.

Q9. Briefly identify the normal value and main function of each of these electrolytes. Please explain hypo and hyper conditions and the effect that they have on the body including ECG changes if relevant and <u>treatment.</u>

– Potassium
- Sodium
- Magnesium
- Calcium
- Phosphate

<u>IV Fluid Replacement</u>

The selection of an intravenous fluid depends on the patient's requirements with respect to water, sodium and intravascular filling.
"All infused fluid may be seen as being composed of plasma equivalents (colloid solutions), saline equivalents (crystalloid solutions), or water equivalents. Plasma equivalents will remain confined essentially to the circulation as a result of their oncotic pressure. Saline equivalents will distribute between the interstitium and plasma, but remain restricted to the extracellular fluid compartment because of their sodium content. Water equivalents will distribute in accordance with the distribution of water in the body." (Scheinkestel CD., Tuxen D., Cade JF. Shann FA.)

Q10. Describe the composition and tonicity (mmol/L) of the following fluids.

- Normal Saline
- 5% Dextrose
- Plasmalyte
- Hartmanns

Fluid	Sodium%	Potassium%	Chloride	Glucose	Tonicity

			mmol/l	mmol/L	mmol/L
N/Saline					
5% Dex					
Plasmalyte					
Hartmanns					

Q11. In administering IV fluids, what ABG results would you consider necessary to take into consideration and why before commencing the infusion?

Colloid – albumin 20% / 100mls & 5% / 500mls
Plasma and plasma derivatives – packed cells, platelets, fresh frozen plasma, cryoprecipitate.
These are all used in relation to the clinical situation and availability from blood bank. All plasma and plasma derivatives should be given through a 200 micron filter as per blood bank recommendations.

Q12. What type of patient would require a RBC leukocyte depleting filter and why?

During resuscitation all IV fluids should be given through a pump set. These infusion sets have an inbuilt 200 micron filter and are designed to administer fluids at a fast rate.

Q13. Ideally which lumen of the central venous catheter should be used for maintenance and bolus fluids?

Precautions should be taken with all electrolyte solutions. i.e. Potassium acetate, potassium di-hydrogen phosphate, potassium chloride, Magnesium sulphate.etc. Administration of all electrolytes require strict adherence to ICU guidelines.

Q14. When administering IV potassium solutions what precautions should be taken? What is the ICU policy for administration, include in your answer peripheral cannular administration.

Q15. What is the rational for administering potassium acetate or potassium di-hydrogen phosphate instead of potassium chloride.

Q16. IV Magnesium replacement. What precautions should be taken when administering IV magnesium sulphate? What is

the side effect of administering MgSo4 too quickly?

Q17. Briefly outline the process by which the following conditions produce a diuresis.

- Diabetes insipidus
- Hyperglycaemia

Glycaemic control

Q18. Describe the negative effects of hypoglycaemia.

Q19. Current research indicates an increased mortality rate in critically ill patients with sustained hyperglycaemia. Discuss the rational behind this statement.

Q20. What are the ICU guidelines for the administration an insulin infusion? Describe the nursing care required for maintenance of normal gylcaemic control.