

## Fluids and Electrolyte Balance

There is daily fluid intake and fluid out put

**\*Fluid intake:** It's from two main sources

1. Exogenous: Water is either drunk or ingested in solid food , the a average is 2-3 liters / 24 hour
2. Endogenous: Water released during oxidation of ingested food, it's usually less than 500cc/24 hours

**\*Fluid output:** Water lost from the body by 4 routes:

1. Lungs: About 400 cc of water is lost in expired air/24 hours.
2. Skin: Water loss from the Skin is called (perspiration). It varies according to the atmospheric temperature, humidity, muscular activity and body temperature. The average loss is about 600-1000cc/24 hours.
  - The loss from skin& lungs is called (Insensible loss).
3. Feces: Water loss in the feces is about 100cc/24 hours. In diarrhea the amount is greatly increased.
4. Urine: Normal urinary output is approximately 1500cc/24hours.provided the kidney is normal. A minimum 400cc/24 hour is required to excrete the end product of metabolism

### Fluid Balance

Intake (mL)		Output (mL)	
*Water	1200	*Urine	1500
*Water from food	1000	*Insensible loss (from skin & Lungs)	900
*Water from oxidation	300	*Feces	100
<b>Total</b>	<b>2500</b>	<b>Total</b>	<b>2500</b>

### Intravenous fluid

The indications for giving intravenous fluid in a surgical patient are:

1. To give the normal fluid and electrolyte requirement in a postoperative patient who is unable to oral fluids.
2. To replaces abnormal losses e.g. hemorrhage, vomiting, sweating, diarrhea, fistula, ileus...
3. As a route for intravenous drugs.
4. To give parenteral feeding.

### Normal daily Requirements

Fluid requirement are calculated from estimated insensible and obligatory losses, various formulae are available for calculating fluid replacement based on body weight and surface area.

A useful approximation which can be remembered and used to check the fluid intake against body weight is:

40ml fluid/Kg adult body weight (babies need more, old people less)

- 1-2 mmol sodium/Kg
- 1 mmol potassium/kg

Example: A suitable basic intravenous regime for a 60Kg adult in 24 hour is:

- Water                    2500 ml
- Sodium(Na)            100 mmol
- Potassium(K)         60 mmol

## **Types of intravenous fluids**

### *I- Crystalloid solutions:*

These are solutions of electrolyte (or dextrose) in water. They disperse throughout the (ECF) extracellular fluid space and are not confined to the circulation. They are available in 500 or 1000 cc units. Crystalloid preparations include the followings:

5% dextrose, Normal saline 0.9%, dextrose saline, Ringers solution, Hartmann's solution (Ringer lactate)

### *II-Colloid solutions:*

They stay in the blood circulation and increase blood volume by both the added volume of fluid and the increase in colloid osmotic pressure drawing fluid into the circulation from the tissues. They are, therefore, useful for the maintenance of blood volume. Colloid preparations include the followings:

Plasma protein fractions, Dextran, Haemaccel, Blood

### **I- Crystalloid solutions:**

#### 5% dextrose (glucose water)

- The content of 1 liter water contains 50 gm dextrose(glucose) OR
- 500cc water contains 25 gm dextrose (glucose) .

#### Normal saline 0.9%

- The content of 1 liter water contains 153mmol Na+153mmol Cl

#### Dextrose saline (4% dextrose+0.18% saline)

- The content of 1 liter water contains 40gm dextrose +30.6mmol Na
- Some bags contains 1 liter water+0.9% saline+5% dextrose( this is hyperosmolar)

#### Ringer's solution

- The contents are water+ Na +Ca +K +Cl

#### Hartmann's solution (Ringer's lactate solution)

- The contents are water+ Na +Ca +K +Cl + HCO<sub>3</sub> as lactate

## **II-Colloid solutions:**

### Plasma protein fractions

- This is a 5% solution of protein containing 88%albumin. One liter contains 145mmol Na and 0.25mmol K. it should be given through a filter but carries no hepatitis risk.

### Dextran

- These solutions are polymers of glucose of different molecular weight. The usual fluids begin dextran 40(average mol.wt 40.000)and dextran 70(average mol.wt 70.000)
- Dextran 40 is filtered by the kidney but dextran 70 is not therefore persists in the circulation longer.
- Dextran interferes with cross-matching of blood once in the circulation, and therefore any serum for cross-matching should be taken before the infusion is started.

### Haemaccel

- It's a solution of partially degraded gelatin. This has a half-life in circulation of 3-4 hours and a lower binding capacity than dextran 70.it may be more likely to cause an anaphylactic reaction. Haemaccel contains (water+ polygeline +Ca +Cl+Na+K)

### Blood

- Whole blood or packed RBC is used.

## **Prescribing the daily requirement**

### Regime A

1liter normal saline + 2liters of 5% dextrose=100gm (which yield 400kcal)

+ 60mmolKCl/24hours:

- 1 liter water+153mmol NaCl + 20mmolKCl(in 8 hours)
- 1 liter water+50gm dextrose +20mmolKCl(in 8 hours)
- 1 liter water+50gm dextrose +20mmolKCl(in 8 hours)

### Regime B

3 liters of 4%dextrose 0.18%saline (120gmof dextrose&90mmol of sodium) +60mmolKCl/24hours:

- 1 liter water+40gm dextrose+30.6 NaCl+20mmolKCl (in 8 hours)
- 1 liter water+40gm dextrose+30.6 NaCl+20mmolKCl (in 8 hours)
- 1 liter water+40gm dextrose+30.6 NaCl+20mmolKCl (in 8 hours)

## **Water depletion**

### *Causes of pure water loss*

#### 1-Diminished intake:

- Lack of water
- In able to swallow as in painful mouth or pharyngeal conditions
- Esophageal obstruction
- Paralysis of pharyngeal muscles

#### 2-Increase loss

- From lungs after tracheostomy (500cc in excess is lost after tracheostomy)so humidification of inspired air is an important preventive measure.

#### *Clinical feature:*

- Weakness
- Intense thirst
- Urinary output will decrease & the specific gravity will increase

## **Water intoxication**

The commonest causes in surgical ward are:

- Over-prescribing intravenous 5% dextrose solution post operatively.
- Colorectal wash out with water instead of saline.
- After TURP (Trans Urethral Resection of Prostate) .excessive water uptake from irrigation.
- Inappropriate ADH secretion.in conditions as carcinoma of bronchus or after head injury.

#### *Clinical feature:*

- Drowsiness, weakness, convulsion & coma
- Nausea and vomiting
- Large amount of dilute urine(except in case of inappropriate ADH secretion)

#### *Treatment:*

- Water restriction i.e.: intake of water should be stopped.