CASE SEVEN

Short case number: 3_11_7
Category: Clinical Skills
Discipline: Surgery
Setting: Hospital
Topic: Fluid and electrolyte disorders in surgical patients [SDL]

Case

Arthur Lewis, aged 52 years, had an uncomplicated resection of his sigmoid colon following a diagnosis of diverticular disease which had been causing recurrent symptoms. You are asked to chart his perioperative fluids and electrolytes.

Questions

1. List the I.V. fluids you would order post operatively, any additives and the rate of their administration as per an I.V. fluids chart.
2. How would your I.V. fluid orders have changed if Arthur was 20 years old and if he was 5 years old?
3. If Arthur had presented unwell with signs of volume depletion then how would this be diagnosed clinically and how would it be treated?
4. You were called to see Arthur 8 hours post–operative, and you are advised that there has been an error and Arthur has received 2 litres of normal saline in the past 4 hours and is short of breath. How does the volume overload present and how would you treat Arthur?
5. List the common causes of post–operative hyponatremia.

Suggested reading:

- Henry MM, Thompson JN, editors. Clinical Surgery. 3rd edition. Edinburgh: Saunders; 2012. Chapter 7.
- Garden OJ, Bradbury AW, Forsythe JLR, Parks RW, editors. Davidson's Principles and Practice of Surgery. 6th edition. Philadelphia: Churchill Livingstone Elsevier; 2012. Chapter 1.

ANSWERS

1. List the I.V. fluids you would order post operatively, any additives and the rate of their administration as per an I.V. fluids chart.

There is more than one correct answer, but the principles are outlined below

<u>24h Fluid requirements: (70kg adult) (0.5-1 ml/kg/hour)</u>

- Maintenance fluid 40-50ml/kg (2-3L)
  - 1.5L urine loss, 0.5L lungs/skin/stool loss, changes with ambient temp
- Sodium 2-3 mmol/kg (100-150mmol)
- Potassium 1 mmol/kg (40-80 mmol)

- Need to choose isotonic solution
- It is not necessary to replace potassium within the first 24-48 hours after surgery as there are adequate stores, and can be added when diuresis is adequate
- Fluids should only be charted for 24h max, with reassessment daily
- Also need to assess for ongoing fluid loss (NG tubes and drains, ileus, fever)
- IDC should be used to accurately assess urine output

COMPOSITION OF COMMONLY ADMINISTERED INTRAVENOUS FLUIDS

Fluid	**Na^+ mmol/l**	**K^+ mmol/l**	**Cl^- mmol/l**	**HCO_3^- mmol/l**	**Misc. (mmol/l)**	**Oncotic pressure (mmH_2O)**	**pH**	**Cost per L**
5% dextrose	-	-	-	-	-	0	4.0	
0.9% NaCl	154	0	154	0	0	0	5.0	$1.40
Hartmann's (Ringer's lactate)	131	5	112	29	Ca 1 Mg 1	0	6.5	$1.40
Haemaccel	145	5	145	0	Ca 6.25	370	7.4	
Gelofusine	154	0.4	125	0	Ca 0.4 Mg0.4	465	7.4	$21
4% dextrose + N/5	30	o	30	0	Dextrose 40g			$1.40
Plasma Lyte	140	5	98		Mg 3 Acetate 27 Gluconate 23			$2.10
4% albumin	140		128		Human albumin 40 Octanoate 6.4			$160

Note – risk of allergy with gelofusine and albumin

First 24h post-operative:

Date	Start time	Fluid	Volume	Additives	Rate	Signature	Signature
Today		Hartmanns	1000ml	-	8/24		
		Hartmanns	1000ml	-	8/24		
		4% Dextrose +1/5 NS	1000ml	-	8/24		

- Plasmalyte would also be an acceptable choice
- In the following 24h would need to consider potassium replacement, realising that the fluid status of the patient needs to be reassessed daily, ongoing fluids may be:

Date	Start time	Fluid	Volume	Additives	Rate	Signature	Signature
Today		Normal saline	1000ml	30mmol K+	8/24		
Today		4% dextrose + 1/5 NS	1000ml	-	8/24		
Today		Normal saline	1000ml	30mmol K+	8/24		

- Must check the serum magnesium level as well as other electrolytes.

2. How would your I.V. fluid orders have changed if Arthur was 20 years old and if he was 5 years old?

- In 20yo male there would be no change in planned fluid administration, though it should be noted that a 20yo is less likely to have cardiac insufficiency and thus is less likely to develop fluid overload
- In a 5yo child:

Patients weight	**mls/day**		**mls/hour**	
3 to 10kg		100 x wt		4 x wt
10 - 20kg	1000+	50 x (wt-10)	40 +	2 x (wt-10)
>20kg	1500+	20 x (wt-20)	60 +	1 x (wt-20)

Maintenance fluids charted as: 0.45% NaCl with 5% Glucose + 20mmol KCl / litre

3. If Arthur had presented unwell with signs of volume depletion then how would this be diagnosed clinically and how would it be treated?

Fluid assessment

- BP (including postural)
- HR
- Tissue turgor
- Mucous membranes
- JVP
- Chest auscultation/crepitations
- Sacral oedema
- Peripheral oedema
- Urine output (IDC in situ)

<u>Volume depletion</u>
Postural hypotension (though not assessed in most post-operative patients)
Tachycardia
Decreased skin turgor
Dry mucous membranes
Hypotensive
Oliguria (note, normal urine output 0.5ml/kg/h, for adults 30-70ml/h)
Lethargy
Confused

4. You were called to see Arthur 8 hours post–operative, and you are advised that there has been an error and Arthur has received 2 litres of normal saline in the past 4 hours and is short of breath. How does the volume overload present and how would you treat Arthur?

   Presentation:
   Tachycardia
   Tachypnoeic
   Shortness of breath and increased work of breathing
   Decreased saturations
   Elevated JVP
   Crackles in chest on auscultation
   Sacral and/or peripheral oedema

   Treatment:
   Sit the patient up
   Oxygen
   Nitrates (GTN patch)
   Frusemide
   May need ventilation assistance – CPAP, intubation

5. List the common causes of post–operative hyponatremia.

   Low extracellular fluid volume
   - Volume depletion (vomiting, diarrhoea, burns, decreased fluid intake)*
   - Salt-losing renal disease
   - Hypoadrenalism
   - Diuretic use*

   Normal extracellular fluid volume
   - Hypothyroidism
   - Syndromes of inappropriate ADH secretion (SIADH)

   Increased extracellular fluid volume
   - Excessive water administration*
   - Excessive mannitol use
   - Cardiac failure
   - Cirrhosis
   - Nephrotic syndrome
   - Renal failure

   (* Causes commonly encountered in the surgical patient are denoted with an asterisk.)

   In the surgical patient, the common causes of hyponatraemia are volume depletion, excessive administration of water as 5% dextrose (particularly during the post-operative period of increased ADH secretion) and diuretic use. Comorbidity, such as cirrhosis, cardiac failure and renal impairment, is a potential contributing factor. The treatment of hyponatraemia depends on identifying its cause correctly.