Plasma osmolality is approximately 285-295mosm/l

Osm = osmolality

Potassium and maintenance replacement:

Anomal osmotic level does not mean there is no total body potassium deficit. Give potassium in maintenance fluid. Only in critical care areas give up to 40mmol in 100ml bags via a central line at 25-50ml/hr. Ensure IV cannulae are patent and clean.

Estimate replacement fluid/electrolyte requirements by adding up all the losses over the previous 24 hours and give this volume as a bolus over 15-30 minutes. If the patient is unable to take oral fluids, consideration should be given to enteral feeds.

Give Kay-Cee-L/ Sando-K orally if possible. If the patient is unable to tolerate oral fluids, consider nasogastric feeding. If this is not possible, consider parenteral nutrition.

Give 250-500ml IV fluid challenge over 5-15 mins.

Consider Critical Care Referral if:

- GCS <15 or falling from higher levels
- Oz saturation <90% on 60% O2 or higher
- PaO2&>70kPa unresponsive to NIV
- Persistent hypotension and/or oliguria unresponsive to 2000ml fluid or concern over cardiac function
- Metabolic acidosis: base deficit -8 or worse, bicarbonate <18mmol/l, lactate >3mmol/l and not improving in 2 hours
- Aggressive/agitated patients whose treatment (e.g. sedation/IV therapy) is compromised due to agitation.

Referral is not always appropriate – consult senior doctor.

Plasma osmolality is approximately 285-295mosm/l

RESUSCITATION FLUID

For severe dehydration, sepsis or haemorrhage leading to hypovolaemia and hypotension. For urgent resuscitation use PlasmaLyte 148 (PL148) or colloid (Gelaspan/Albumin). PL148 is a balanced electrolyte solution and is better handled by the body than 0.9%NaCl. Give Albumin only in severe sepsis.

See Fluid Challenge Algorithm

Priorities: Stop the bleeding; consider surgery/endoscopy. Use Major Haemorrhage Protocol. Treat sepsis.

CALL FOR HELP!

For severe blood loss initially use PL148 or colloid until blood/ clotting factors arrive. Use O Negative blood for terminal bleeding. Severely septic patients with circulatory collapse may need intravenous support in a critical care area. Their blood pressure may not respond to large volumes of fluid; excessive volumes (many litres) may be detrimental.

IN SUMMARY: assess, why, how much, which fluid?

- Take time and consult senior if you are unsure.
- Patients on IV fluids need regular blood tests.
- Consider continuing fluid challenge.

If no response:

- Referral is not always appropriate – consult senior doctor.

Fluid Challenge Algorithm

Hypovolaemia: low BP, tachycardia, low CVP/JVP, oliguria, tanned skin turgor, poor tissue perfusion, capillary refill time >4sec. Note patients with epipharals may need vasoconstriction rather than fluid but must be assessed for other causes of hypotension.

If no response:

- Give 250-500ml IV fluid challenge over 5-15 mins.

- Consider Critical Care Referral.

- Adequate response?

- Patient has complex pathology – seek senior critical care opinion urgently

- Are there continued signs of hypovolaemia with low likelihood of fluid overload?

- Have you reached 2000ml limit?

- Sensitivity?

- If yes, consider continuing fluid challenge.

- If no, consider alternative treatment.

- Patient has complex pathology – seek senior critical care opinion urgently

Basic physiology of sick patients

It is easy to give an excess of salt and water but very difficult to remove them. Serum sodium may fall due to excess water load. Inadequate filling may lead to poor organ perfusion.

In sick patients with leaky capillaries fluid retention contributes to complications such as ileus, poor mobility, peripheral oedema, pressure sores, pulmonary oedema, poor wound healing and anastomotic breakdown.

Urinary output naturally decreases during illness or after trauma such as surgery due to increased sodium retention by the kidney. Too much intravenous fluid makes this worse. Cellular dysfunction and potassium loss result. Excess chloride leads to renal vasoconstriction and increased sodium and water retention. Urinary output may be a source Fluid requirements in sick patients and oligaemia does not always require fluid therapy (full assessment is required).

Maintenance requirement: 30ml/kg/24hrs of ‘water’

It is vital that sick patients receive the RIGHT AMOUNT OF THE RIGHT FLUID AT THE RIGHT TIME.

Questions to ask before prescribing fluid:

1. Is my patient euvoalaemic, hypovolaemic or hypervolaemic?
2. Does my patient need IV fluid? Why?
3. How much fluid does my patient need?
4. What type(s) of fluid does my patient need?

1. Assess the patient

Euvolaemic: veins are well filled, extremities are warm, blood pressure and heart rate are normal.

Hypovolaemic: Patient may have cool peripheries, respiratory rate>20, systolic BP<100mmHg, HR>90bpm, postural hypotension, oliguria and confusion. History of fluid loss or low intake. May respond to 45’ passive leg raise.

Consider urinary catheter in sick patients. However signs of hypovolaemia may be unreliable in elderly patients.

Hypervolaemic: Patient is oedematous, may have inspiratory crackles, high JVP and history/charts showing fluid overload.

2. Does my patient need IV fluid?

NO: he may be drinking adequately, may be receiving adequate fluid via NG feed or TPN, or may be receiving large volumes with drugs or drug infusions or a combination.

Yes: note fluid restriction or gentle diuresis. Urinary output is a useful fluid requirement but not always accurate. Excess volumes of this fluid may cause hyponatraemia.

ALLOW PATIENTS TO EAT AND DRINK IF POSSIBLE.

So Why does the patient need IV fluid?

Maintenance fluid only – patient does not have excess losses above insensible loss/urine. If no other intake he needs 30ml/kg/24hrs. He may only need part of this if receiving other fluid. Patients having to fast for over 8 hours should be started on IV maintenance fluid.

Replacement of losses, either previous or current. If losses are predicted it is best to replace these later rather than give extra fluid in anticipation of losses which may not occur. This fluid is in addition to maintenance fluid. Check blood gases.

Resuscitation: The patient is hypovolaemic as a result of dehydration, blood loss or sepsis and requires urgent correction of intravascular depletion to correct the deficit.

3. How much fluid does my patient need?

a. Obtain weight (estimate if required). Maintenance fluid requirement approximately 30ml/kg/24hours. (Table 1). See note on next page regarding the elderly.

b. Review recent U&E’s, other electrolytes and Hb.

c. Recent history – e.g. fasting, input/output, sepsis, operations, fluid overload. Check fluid balance charts.

Calculate how much loss has to be replaced and work out which type of fluid has been lost: e.g. gastro-intestinal (GI) secretions, blood, inflammatory losses.

Note urine does not need to be replaced unless excessive (diabetes insipidus, recovering renal failure). Post-op: high urine output may be due to excess fluid, low urine output is common and may be normal due to anti-diuretic hormone release.

Assess fully before giving extra fluid.

4. What type of fluid does my patient need?

MAINTENANCE FLUID

IV fluid should be given via volumetric pump if a patient is on fluids for over 6 hours or if the fluid contains potassium. Always prescribe as ml/hr not ‘x hourly’ bags.

Never give maintenance fluids at more than 100ml/hour. Do not ‘speed up’ bags; rather give replacement for losses.

Recommended maintenance fluids

<table>
<thead>
<tr>
<th>Weight kg</th>
<th>Fluid Requirement ml/24hrs</th>
<th>Rate ml/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-44</td>
<td>1200</td>
<td>35-44</td>
</tr>
<tr>
<td>45-54</td>
<td>1500</td>
<td>45-54</td>
</tr>
<tr>
<td>55-64</td>
<td>1800</td>
<td>55-64</td>
</tr>
<tr>
<td>65-74</td>
<td>2100</td>
<td>65-74</td>
</tr>
<tr>
<td>&gt;75</td>
<td>2500</td>
<td>&gt;75</td>
</tr>
</tbody>
</table>

Table 1

Preferred maintenance fluids: 0.18%NaCl/4%Glucose with or without added KCl 40mmol per litre. Use litre bags in preference to bags with 20ml/500ml. This fluid if given at the correct rate (Table 1) provides all water and Na/K requirements until the patient can eat and drink or be fed.

Excess volumes of this fluid may cause hyponatraemia.

IF SERUM SODIUM IS <132mmol/L USE Plasmalyte A FOR MAINTENANCE

For the frail elderly, patients with renal impairment or cardiac failure and patients who are malnourished or at risk of refeeding syndrome consider giving less fluid; 20-25ml/kg/day (NICE guidelines). Consult a senior doctor for fluid advice. If the serum potassium is above 5mmol/l or rising quickly do not give extra potassium. Give Pabrinex IV if refeeding risk.

Diabetes: use 0.16%NaCl/4%glucose/KCl at maintenance rates with intravenous insulin.

Electrolyte requirements

Sodium: 130-140mmol/l

Potassium 1 mmol/kg/24hrs (give 40mmol KCl 1000ml)

Calories: 50-100g glucose in 24 hours to prevent starvation ketosis. Consult dietitian if patient is malnourished. Magnesium, calcium and phosphate may fail in sick patients – monitor and replace as required.

REPLACEMENT FLUID

Fluid losses may be due to diarrhoea, vomiting, faecal, drainage output, bile leaks, high stoma output, ileus, blood loss, excess sweating or excess urine. Inflammatory losses (‘redistribution’) in the tissues are hard to quantify and are common in pancreatitis, sepsis, burns and abdominal emergencies. It is vital to replace high GI losses. Patients may otherwise develop severe metabolic derangement with acidosis or alkalosis and hypokalaemia. Hypochloremia