Guideline for fluid management in PICU

These guidelines apply to infants and children admitted to the paediatric intensive care unit at St George’s Hospital, London. They include:

1. Normal maintenance requirements for intravenous and enteral fluids
2. Replacement of pre-existing fluid deficit
3. Replacement of ongoing fluid losses

1. Normal maintenance fluid requirements

- Whenever possible the enteral route should be used for fluids (or feeds). Intravenous fluid should only be given to children who cannot receive enteral fluids.
- Water requirement is the same for both routes of administration; however infants may need larger volumes of milk (see below) to provide adequate nutrition.
- Maintenance fluid requirement is calculated using the method suggested by Holliday and Segar. However this may overestimate the fluid requirement in an unwell child by up to 50% (Holliday et al) and almost always needs to be adjusted in a child admitted to PICU. At St George’s PICU we agree to give 80% of the calculated amount as maintenance.

Calculation of maintenance fluid (in mls)

<table>
<thead>
<tr>
<th>First 10 kg</th>
<th>Second 10 kg</th>
<th>Subsequent kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mls / kg / day</td>
<td>50 mls / kg / day</td>
<td>20 mls / kg / day</td>
</tr>
<tr>
<td>(100 \times \text{weight in kg})</td>
<td>(1000 + (\text{weight in kg} - 10) \times 50)</td>
<td>(1500 + (\text{weight in kg} - 20) \times 20)</td>
</tr>
</tbody>
</table>

Reference guide for maintenance fluid (mls/hr) requirement based on weight (Kg)

<table>
<thead>
<tr>
<th>Weight (Kg)</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 % Requirement</td>
<td>16</td>
<td>25</td>
<td>33</td>
<td>41</td>
<td>45</td>
<td>50</td>
<td>54</td>
<td>58</td>
<td>63</td>
<td>70</td>
<td>79</td>
<td>87</td>
</tr>
<tr>
<td>80% requirement</td>
<td>13</td>
<td>20</td>
<td>27</td>
<td>33</td>
<td>36</td>
<td>40</td>
<td>43</td>
<td>47</td>
<td>50</td>
<td>56</td>
<td>63</td>
<td>70</td>
</tr>
</tbody>
</table>

Which Fluid?

- 0.9% saline with 5% dextrose with or without potassium chloride (20 mmols /l) is our default intravenous maintenance fluid (till further evidence is available on the use of Plasmalyte).
- 0.45% saline with 10% dextrose may be used in the first four weeks of life.
- 0.9% saline (without dextrose) should be used in children with intracranial pathology; If hypoglycaemia ensues, change to 0.9% saline with 5% dextrose.

For delivery of adequate nutrition infants on enteral feeds may have 120% (< 6 months) or 100% (6-12 months) of calculated maintenance fluid requirement following discussion with consultant.
2. Replacement of pre-existing fluid deficit

Pre-existing fluid deficit requires to be corrected in addition to the maintenance fluid requirement.

It can present in two forms – hypovolemia with or without shock and dehydration

Hypovolemia with or without shock

Fluid bolus of 10-20 mls/kg aliquots; repeat as necessary.

- 0.9% sodium chloride is the default bolus fluid of choice.
- Ringer’s lactate solution may be used in presence of hyperchloremia but should be avoided in congenital metabolic disorders.
- 4.5% Human Albumin Solution (HAS) may be used in sepsis; do not use in traumatic shock.
- Consider packed red cells in hypovolemia due to blood loss (e.g. trauma, burns, post-operative)
- HES (starch) must not be used; it is pragmatic to avoid other synthetic colloids (like gelatine) if alternative fluid can be used.

Correction of dehydration

The water deficit can be calculated following an estimation of the degree of dehydration as a percentage of body weight.

Fluid deficit (ml) = weight (kg) x % dehydration x 10

This deficit should be replaced, usually over 24 hours. In some instances replacement of the deficit over 48 -72 hours is more appropriate (e.g. diabetic ketoacidosis (DKA), hypernatraemic dehydration etc). See separate DKA guideline for management of DKA.

3. Replacement of ongoing fluid losses

- Naso-gastric losses, ileostomy losses and profuse diarrhoea should be measured and replaced ml for ml with 0.9% sodium chloride + added potassium chloride.
- Chest drain losses should be replaced with 0.9% sodium chloride or 4.5% HAS.
- Significant blood loss with falling haemoglobin should be replaced with packed red cells.
- Excess urinary loss due to diabetes insipidus or cerebral salt wasting should have urine biochemistry analysed and replaced with fluid of similar composition to urinary loss. Commence replacement of urinary loss with 0.45% saline in diabetes insipidus and replace urine loss with 0.9% saline in cerebral salt wasting, pending biochemical analysis of urine and blood.
- Measurement of ongoing losses should be done half hourly, hourly or 4 hourly depending on the severity of the fluid loss.
