PlasmaLyte use at PICU/CICU UHL

1. Introduction & Scope

This guideline is intended for use by Medical and Nursing Staff working within UHL Children’s Hospital caring for children and young people aged up to 16 years in the PICU/CICU UHL Children’s Hospital and East Midlands Congenital Heart Centre requiring fluid replacement and specifies use of PlasmaLyte 148 with or without 5% glucose.

Related documents:

1) Fluid and electrolyte management C6/2015
2) Metabolic disease UHL C97/2016; All children with inherited metabolic disease will have a personal fluid plan which their parents carry. More guidance is available in the red “metabolic” folder on CAU; http://www.bimdg.org.uk/site/guidelines.asp
4) Pyloric stenosis C159/2016
5) Guideline for Management of Fluids in Children and Young People with known Renal Disorders http://www.emeesykidney.nhs.uk/professional-area/individual-guidelines
6) UHL policy for infant feeding C120/2008
7) Guideline: Admission to Paediatric Intensive Care Unit Following Cardiac Surgery C150/2016

2. What is PlasmaLyte 148?

- Balanced, crystalloid iv fluid
- Osmolality and electrolyte concentration including chloride is very similar to blood plasma
- It is used as resuscitation fluid and in combination with glucose as maintenance fluid

The reason replacement of 0.9% Sodium chloride is hyperchloremic metabolic acidosis causing reduction in glomerular filtration due to decrease in renal artery flow rate which results in deterioration in renal function and postoperative mortality. (1-7)
<table>
<thead>
<tr>
<th></th>
<th>Blood</th>
<th>0.9%Sodium Chloride</th>
<th>PlasmaLyte148</th>
<th>PlasmaLyte148 with 5% glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (mmol/l)</td>
<td>140</td>
<td>150</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Potassium (mmol/l)</td>
<td>4.5</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Chloride (mmol/l)</td>
<td>99</td>
<td>150</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Magnesium (mmol/l)</td>
<td>1.2</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Glucose %</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>pH</td>
<td>7.4</td>
<td>5.5</td>
<td>7.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Osmolality (mOsm/l)</td>
<td>290</td>
<td>300</td>
<td>294</td>
<td>572</td>
</tr>
</tbody>
</table>

3. **Advantage of PlasmaLyte 148:**

- Diminished hyperchloremic metabolic acidosis (10)
- Quicker resolution of acid-base disturbances (11)
- Better than other balanced crystalloids such as Hartmanns and has been shown to decrease mortality in postoperative patients compare to group treated with 0.9% sodium chloride or lactated Ringer’s solution (9,12,13)
- In paediatrics, in patients with gastroenteritis, rehydration and normalisation of bicarbonate levels are reached more quickly and less abdominal pain also noted (14,15)

4. **Limitations of PlasmaLyte use:**

Patients at risk of hyperkalaemia eg: Tumour Lysis syndrome, Rhabdomyolysis, renal impairment. Myasthenia gravis (Mg content).

5. **Specific areas:**

A. Renal patients with separate Na requirements:
   [http://www.emeesykidney.nhs.uk/professional-area/individual-guidelines](http://www.emeesykidney.nhs.uk/professional-area/individual-guidelines)


6. **Risks:**

a) **Care must be taken with specific patients who may not tolerate some elements of this fluid,** especially the potassium component - only available with standard 5 mmol/l potassium. Patients needing less potassium than this
would need 0.9% Sodium chloride with glucose (or 0.45%Sodium chloride depends on Na requirement).
b) **Plasma-Lyte 148 and Plasma-Lyte 148+5% dextrose** have similar names and fluid bag looks similar – needs attention!

**Compatibility:** Basically, from 87 tested drugs used at PICU relatively frequently **Y-site incompatible are:** Amiodarone, Cyclosporin, Mycophenolate mofetil, Propofol. (For further information please contact pharmacy regarding Y-site compatibility of intravenous drugs with Plasmalyte 148)

### 7. Recommended resuscitation and maintenance fluid:

<table>
<thead>
<tr>
<th>Patient - condition</th>
<th>Resuscitation fluid</th>
<th>Maintenance fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible hyperkalemia (eg. renal impairment)</td>
<td>0.9% Sodium Chloride</td>
<td>0.9% Sodium chloride with 5% glucose&lt;br&gt;See also: <a href="http://www.emeesykidney.nhs.uk/professional-area/individual-guidelines">http://www.emeesykidney.nhs.uk/professional-area/individual-guidelines</a></td>
</tr>
<tr>
<td>Hypochloraemia (see Pyloric stenosis)</td>
<td>0.9% Sodium Chloride</td>
<td>0.9% Sodium chloride with 5% glucose</td>
</tr>
<tr>
<td>Metabolic disease</td>
<td>0.9% Sodium Chloride</td>
<td><a href="http://www.bimdg.org.uk/site/guidelines.asp">http://www.bimdg.org.uk/site/guidelines.asp</a></td>
</tr>
<tr>
<td>Glucose free diet (Ketogenic diet)</td>
<td>Plasma-Lyte 148</td>
<td>Plasma-Lyte 148</td>
</tr>
<tr>
<td>&lt;1 month of age (except term neonates in postnatal adaptation/preterm neonates)*</td>
<td>Plasma-Lyte 148</td>
<td>0.9% Sodium chloride with 5% or 10% glucose</td>
</tr>
<tr>
<td>Any other patients</td>
<td>Plasma-Lyte 148</td>
<td>Plasmalyte 148 + 5% dextrose</td>
</tr>
</tbody>
</table>

* If term neonates need IV fluids for routine maintenance, initially use 0.9% Saline with 5-10% glucose. Only for term neonates in critical postnatal adaptation phase (for example, term neonates with respiratory distress syndrome, meconium aspiration, hypoxic ischaemic encephalopathy), give no or minimal sodium until postnatal diuresis with weight loss occurs. Preterm neonates (by Corrected Gestational Age) should be started on 10% Dextrose and add sodium as required, based on U&Es.
MAINTENANCE IV FLUID
PICU/CICU
check electrolytes & glucose level daily

NEONATE
(doesn't include VLBW neonates)

1 month - 16 years of age

Holiday - Segar formula:
100 ml/kg/d for the first 10kg of weight
50 ml/kg/d for the second 10kg of weight
20ml/kg/d for the remaining weight
Max 2500ml for male; 2000ml for female

Alternatively:
4 ml/kg/h for the first 10kg of weight
2 ml/kg/h for the second 10kg of weight
1 ml/kg/h for the remaining weight
Max 100ml/h for male; 80ml/h for female

Body surface:
300 - 400ml/m² (insensible losses) +
urinary output

Use for oliguric/anuric patient
(e.g. weaning from CRRT)

If the risk of water retention
(non-osmotic ADH secretion: critical illness, general anaesthesia, surgery)
RESTRICT to 50 - 80% of iv maintenance

For post cardiac surgery patients see C150/2016, Appendix A

If postnatal adaptation phase
(RDS, HI) use 5 - 10% glucose, add Na based on
U&E (0.45 or 0.9% Sodium chloride)

0.9% Sodium chloride with 5 or 10% glucose

Possible hyperkalemia
(renal impairment)

0.9% Sodium chloride with 5% glucose (the need for sodium may vary)

Hypochloremia
(Pyloric stenosis, large NG losses)

0.9% Sodium chloride with 5% glucose

Metabolic disease

www.bimdg.org.uk/site/guidelines.asp

Glucose free diet
(ketogenic diet)

Plasmalyte 148

Any other patients

Plasmalyte 148 with 5% glucose
8. Monitoring and recording

The child's fluid requirements should be calculated and recorded on a daily basis bearing in mind that critically ill children have decreased ability to excrete free water and insensible losses are reduced on humidified invasive ventilation, so “fluid restriction” is often required. Exceptions could be children with burns and metabolic disease. (For fluid requirement post cardiac surgery see the guideline “Admission to Paediatric Intensive Care Unit Following Cardiac Surgery” C150/2016)

Every child on i.v. fluids should have:
- regularly reviewed their fluid status and iv fluid requirement
- documented input, on-going losses, urine output and calculated fluid balance
- checked electrolytes and glucose daily
- regularly checked their weight

9. Summary of the role of Plasma-Lyte 148 in PICU/CICU

- Maintenance fluids with or without 5% dextrose
- Replacement of GI losses
- Bolus administration (without dextrose)
- Priming CRRT/ECMO circuits

10. Education and Training

Training and raising awareness are on-going processes. On-going awareness is promoted through the induction and continuous bedside teaching. Training is provided for medical staff during lunchtime teaching (Wednesdays) and other sessions, and at junior doctors’ induction training. Nursing education is supported by the Practice Development teams, and nursing educators.

11. Monitoring and audit criteria

<table>
<thead>
<tr>
<th>Key performance indicator</th>
<th>Method of Assessment</th>
<th>Frequency</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment algorithm followed and documented</td>
<td>Audit</td>
<td>As required</td>
<td>CPM</td>
</tr>
</tbody>
</table>

12. Key words: PlasmaLyte, maintenance fluid, fluid resuscitation
13. References:


