

Standards and Guidelines Committee

Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.

Summary	<p>This policy outlines the BHSCT approach for administration of intravenous fluids to children aged from 1 month until the 16th birthday with particular reference to reducing the risk of hyponatraemia.</p> <p>It maps the advice issued in March 2007 from the National Patient Safety Agency (NPSA) and September 2007 from the Northern Ireland Regional Paediatric Fluid Therapy Working Group on how to reduce the risks associated with administering intravenous infusions to children.</p> <p>This is fundamentally a document aimed at prevention of hyponatraemia and not treatment.</p>
Purpose	To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.
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28/06/2011	V4.3	JRJ	Feb 2010 wall chart; Training Hyponatraemia Guidance Note
August 2013	V5.3	JRJ	8.4.2 changes after consultation
08Aug 2013	V5.4	CM	App. 3b (trigger) and 5 (Sources of advice) updated.

Policy Record

		Date	Version
Author (s)	Approval	27/03/2008	1.2
Director Responsible - Dr A Stevens	Approval	27/03/2008	1.2

Approval Process – Trust Policies

Policy Committee	Approval		
Executive Team	Authorise		
Chief Executive	Sign Off		

Approval Process – Clinical Standards and Guidelines

Standards and Guidelines Committee	Approval		1.2
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Appropriate Director	Sign Off		

Summary

Reference No: SG001/08

Title:

Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.

Purpose:

To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.

Objectives:

This Policy sets out recommended practice for everyone who looks after children receiving intravenous fluids. It is based on regional and national guidance, ongoing clinical audit, published literature and is also aimed at specifically reducing the risk of hyponatraemia.

It should be considered alongside the guidance from the National Patient Safety Agency Patient Safety Alert 22¹, and the Regional Paediatric Fluid Therapy Group wallchart².

Policy Statement(s):

1. The Paediatric Parenteral Fluid Therapy wallchart² forms the basis of BHSCT guidance on fluid prescription in paediatric patients aged from 1 month until the 16th birthday.
2. Sodium chloride 0.18% with glucose 4% will be withdrawn from general use in all BHSCT ward areas that treat children and the availability of these fluids will be restricted to critical care areas and other specialist wards such as renal, liver and cardiac units.
3. This policy, the wallchart and a guidance note will be disseminated throughout the BHSCT.
4. Information about the availability of infusion fluids throughout the BHSCT will be available with the Paediatric Fluid Guideline wall chart².
5. The development of new BHSCT paediatric and adult fluid prescription/ balance charts will be completed.
6. All staff involved in prescribing, administering and monitoring IV fluids to such children will be made aware of this policy and the Paediatric Parenteral Fluid Therapy wallchart² through the BHSCT intranet and Service Group dissemination.
7. The BHSCT will implement the following governance measures – incident reporting using a set of reporting ‘triggers’ and formal auditing.

Chief Executive/ Director
Date:

Author
Date:

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Full Description

Reference No: SG001/08

1. **Policy for the administration of intravenous fluids to children aged from 1 month until the 16th birthday: reducing the risk of hyponatraemia.**

2. **Introduction:**

The development of fluid-induced hyponatraemia in the previously well child undergoing elective surgery or with mild illness may not be well recognised by clinicians.¹

Since 2000, there have been four child deaths following neurological injury from hospital-acquired hyponatraemia reported in the UK.¹ International literature cites more than 50 cases of serious injury or child death from the same cause, and associated with the administration of hypotonic infusions.¹

In March 2007 the National Patient Safety Agency (NPSA), with Alert 22, issued advice on how to reduce the risks associated with administering infusions to children¹.

In April 2007, with DHSSPSNI circulars^{3,4}, NHS organisations in Northern Ireland were tasked to produce and disseminate local clinical guidelines for the fluid management of paediatric patients based on the suggested NPSA guidelines template. The Northern Ireland Regional Paediatric Fluid Therapy Working Group produced an intravenous fluid clinical guideline (updated in February 2010) in accordance with NPSA guidance¹. This was disseminated to each HSC Trust for local implementation and monitoring.

In February 2009 the Regulation and Quality Improvement Authority (RQIA) published an independent review "Reducing the risk of hyponatraemia when administering intravenous infusions to children" which dealt with the implementation of recommended actions outlined within the NPSA Alert 22 and dissemination of the clinical guidelines / wall chart throughout HSC Trusts and independent hospitals. (see appendix 7.)

This document, using both the NPSA guidance and the RQIA recommendations, outlines the BHSCT policy for administration of intravenous fluids to children aged from 1 month until the 16th birthday with particular reference to reducing the risk of hyponatraemia; it is fundamentally a document aimed at prevention of hyponatraemia rather than treatment.

3. **Purpose:**

To improve the safe use of intravenous fluid in children and reduce the risk of hyponatraemia.

4. **The scope:**

4.1 Applicable to all children more than 1 month and until their 16th birthday throughout the Belfast Health and Social Services Trust (BHSCT).

It is relevant for all general inpatient areas that treat patients from this age range (even if it is only occasionally) and includes the post-operative scenario, emergency departments, day case departments and the ambulance service.

This policy (and attendant fluid prescription chart) is not intended to apply to paediatric and neonatal intensive care units, specialist areas such as renal, liver and cardiac units where it is used to replace ongoing losses of hypotonic fluids, or those

suffering from burns or diabetic keto-acidosis (DKA) where hypotonic solutions may have specialist indications.

Children receiving long term Total Parenteral Nutrition (TPN) are not covered by the conditions of this policy.

4.2 Young people

As a child progresses through the teenage years there is a transitional stage of physical development i.e. adolescence, as that child progresses through towards adulthood. They will be referred to as 'young people' and many are cared for in adult wards by staff who generally treat adults.

The DHSSPSNI indicates that this paediatric fluid therapy guidance relates to all children from 1 month until their 16th birthday, regardless of the ward setting, except in the ICU and specialist areas mentioned above.

5. **Objectives:**

This policy sets out recommended practice for everyone who looks after children receiving intravenous fluids. It is based on regional and national guidance, ongoing clinical audit, the published literature and is also aimed at specifically reducing the risk of hyponatraemia.

It should be considered alongside the guidance from the National Patient Safety Agency Patient Safety Alert 22¹, and the Regional Paediatric Fluid Therapy Group wallchart² and the RQIA recommendations⁵.

6. **Roles and Responsibilities:**

All professionals caring for children must:-

- be familiar with the signs of hyponatraemia.
- be familiar with its emergency management.
- ensure that they have received adequate training in intravenous fluids appropriate to their role.
- if they exclusively care for young people in an adult ward, know where to obtain expert paediatric advice should it be needed. (Appendix 5).
- be familiar with the guidance on intravenous fluids for children outlined by the Regional Paediatric Fluid Therapy Group wallchart².

7. **The definition and background of the policy:**

A child, for the purposes of this policy, is defined as being aged from 1 month up to their 16th birthday.

Hyponatraemia is an abnormally low concentration of sodium (Na) in serum. The normal range is generally agreed to be 135 – 145 mmol/L.

Hyponatraemia is defined as a plasma Na of less than 135 mmol/L. It represents an excess of water in relation to sodium in extracellular fluid and is described as severe or significant if below 130 mmol/L.

Significant acute hyponatraemia is defined as a decrease in plasma sodium from normal to less than 130 mmol/L in less than 48 hours.

Symptoms are likely with serum Na <125 mmol/L or if the serum Na has fallen rapidly; greater than 5 mmol/L decline in 24 hours.

The main causes of hyponatraemia in children are:

- Administration of hypotonic fluids, intravenous or enteral (e.g. excessively dilute formula or sodium chloride 0.18% and glucose 4% (No 18 solution))
- Conditions with impaired free water excretion and high anti-diuretic hormone levels
 - Meningitis, encephalitis, pneumonia, bronchiolitis, sepsis
 - Surgery, pain, nausea and vomiting
- Gastrointestinal fluid losses

Less common but important causes are:

- Adrenal insufficiency (Congenital Adrenal Hyperplasia, Addison's Disease)
- Defect in renal tubular absorption, including obstructive uropathy
- Psychogenic polydipsia

The main symptoms of hyponatraemia relate to its central nervous system effects; cerebral oedema, seizures and death. Warning signs may be non-specific and include nausea, malaise and headache.

All children are potentially at risk, even those not considered to be obviously 'sick'. The complications of hyponatraemia often occur because of the inappropriate management of intravenous fluids but they can also occur with inappropriately managed oral fluid regimes. Vigilance is required for all children receiving fluids.

Children particularly at risk are those who are postoperative, have gastrointestinal fluid losses or who have bronchiolitis, CNS injuries or burns. These risk factors also apply to young people.

8. Policy / Guideline description:

The NPSA recommended in Alert 22 the following actions:-

1. **Remove 'No. 18 solution'** from general areas that treat children and restrict availability to specialist areas except in critical care and specialist wards such as renal, liver and cardiac units.
2. Produce and disseminate **clinical guidelines** for the fluid management of paediatric patients.
3. Provide adequate **training** and supervision for all staff involved in the prescribing, administering and monitoring of intravenous infusions for children.
4. Review and improve the design of existing intravenous fluid prescriptions and **fluid balance charts** for children.
5. Promote reporting of hospital acquired hyponatraemia **incidents** via local risk management reporting systems. Implement an **audit** programme to ensure adherence to the above.

The 16 RQIA recommendations (appendix 8) map to the above NPSA recommendations:-

NPSA	RQIA
1	1, 2
2	3, (4), 5, 7
3	6, 7, 8, 9, 10
4	11
5	12, 13, 14,
6	15, 16

The specific actions that the BHSCT will institute in order to limit the production of hospital acquired hyponatraemia are detailed below and are mapped to the RQIA recommendations.

8.1.1 Remove 'No. 18 Solution'

NPSA 1

RQIA 1 Sodium chloride 0.18% with glucose 4% has been withdrawn from general use in all BHSCT ward areas that treat children. The availability of these fluids is restricted to critical care areas and other specialist wards such as renal, liver and cardiac units. Areas permitted to stock or order 'No.18 solution' are given in appendix 6.

8.1.2 *NPSA 1
RQIA 2* Any area that is still permitted to stock 'No. 18' solution will arrange for the provision of additional labelling or separate storage.

8.1.3 *NPSA 2
RQIA 5* Information about the availability of infusion fluids throughout the BHSCT (Appendix 4) will be available with the Paediatric Fluid Guideline wall chart².

8.1.4 The BHSCT's list of sanctioned standard maintenance fluids is given in Appendix 4.

Where a senior clinician(s) considers that a "special" maintenance infusion fluid is required, then this alternative choice for fluid maintenance must be endorsed by the Chief Executive with clear documentation of the reasons for that endorsement.

8.2 Clinical Guideline

*NPSA 2
RQIA 3,5,7*

The Paediatric Parenteral Fluid Therapy wallchart² (Feb. 2010 version) forms the basis of BHSCT guidance on fluid prescription in paediatric patients within the previously defined age range. This will be disseminated and displayed throughout the BHSCT; to all wards that accommodate children aged from one month until their 16th Birthday including Emergency Departments, Adult Wards, Theatre and ICUs.

This will replace any previous wallchart including the 2002 wallchart issued by CMO entitled "Any Child Receiving Prescribed Fluids is at Risk of Hyponatraemia". All previous versions of the chart should be removed.

8.2.1 *NPSA 2
RQIA 7* The BHSCT will develop policy and guidelines on the general principles of intravenous therapy for adults and children.

Until then, this policy will form the basis of guidance on fluid therapy in children within the BHSCT and, as for all BHSCT policies, it will be reviewed and implemented throughout the organisation.

8.2.3 *NPSA 2
RQIA 3* All medical and nursing staff should base their intravenous fluid practice for children, young people (and indeed adults) on the following best practice model of:-

- administer appropriate therapy for shock such as fluid boluses
- measure/estimate and correct any fluid deficit
- prescribe a fluid maintenance fluid regime.

Treatment of these elements of the overall fluid status is outlined in the Paediatric Parenteral Fluid Therapy wallchart².

The fundamental layout selected for this guideline complements a structured approach to patient clinical assessment. A sequence of questions is offered that prompts the clinician to

- assess for the presence of shock and guides treatment, if required;
- further assessment of whether there is also a deficit to be considered and then
- calculation and prescribing for maintenance requirements is also included.

8.2.4 This policy, centred on children, has many features that indicate good practice for young people and adults. An intravenous fluid therapy practice based on using

- an individual patient's weight in kilograms
- fluid administration based on a millilitres/hour prescription

is commended rather than blanket prescriptions based only on fluid volume.

8.2.5 Baseline Assessment

Good practice guidelines on monitoring body weight, electrolytes/urea and fluid balance should be followed. Again, these recommendations apply to adults as well as children.

An essential preliminary to these assessments is to accurately measure the body weight in kilograms or failing this, to make an estimate. This must be cross-referenced with the child's age to minimize the risk of error.

In the emergency situation an estimation of the child's weight should be made and an accurate weight obtained as soon as practically possible.

Baseline measurement of electrolytes and urea should be made unless the child is healthy and scheduled for elective surgery when it may be considered unnecessary.

8.2.6 Shock therapy

Shocked or collapsed children must immediately receive fluid boluses as outlined on the Regional Paediatric Fluid Therapy Group wallchart².

Good practice would indicate that the response to fluid therapy is closely observed and if there is no response by the time 40 mls/kg has been administered, senior medical advice and help is required.

Note that special treatment is needed for children with diabetic coma and trauma and the need to obtain senior advice and help is highlighted.

8.2.7 Fluid Deficit management

Calculation of the overall fluid deficit and the prescription of deficit replacement should only be undertaken by a doctor experienced in caring for dehydrated patients. The recommended fluid is sodium chloride 0.9% and it must be prescribed separately. The rate at which it is given is determined by the degree of dehydration and a relevant electrolyte sample.

For those caring for young people in a general adult ward, and who may not have such experience, they should ensure that they can avail themselves of advice from the sources as detailed in Appendix 5.

8.2.8 For advice regarding the estimation of the percentage of dehydration which is required for the fluid deficit calculation, the table in Appendix 2 should be consulted.

8.2.9 Maintenance fluid therapy

When prescribing maintenance fluids to children, young people and adults, the following scheme would be standard practice. For

- children use the calculations as indicated in the Regional Paediatric Fluid Therapy Group wallchart².
- young people and adults prescribe
 - 2 litres fluid for females over the weight of 40 kg.
 - 2.5 litres fluid for males over the weight of 60 kg.

- 8.2.10 The type of fluid selected must be tailored to the patient's needs as set out in the guideline. For example, following surgery, children who require intravenous fluids will be prescribed either sodium chloride 0.9% with or without pre-added glucose or Hartmann's solution in the post-operative period for maintenance fluid needs.
- 8.2.11 Children must not receive intravenous fluids unnecessarily. This guideline emphasises that assessment of each patient should include a decision on whether oral fluid therapy could be appropriately initiated instead of intravenous therapy and further prompts reconsideration of this question when IV therapy is reviewed.
- 8.2.12 This advice does not override or replace the individual responsibility of health professionals to make appropriate decisions in the circumstances of their individual patients, in consultation with the patient and/or guardian or carer or for consultation with a more senior clinician. This would, for example, include situations where individual patients have other conditions or complications that need to be taken into account in determining whether the guidance as detailed in the wallchart² is fully appropriate in their case.

8.3
NPSA 3
RQIA
3,6,8,10

Training

The BHSCT will use various forms of training on paediatric fluid management; didactic lectures, staff induction training and computer based training:-

1. Training 'Powerpoint' presentations in the policies and guidelines section of the Intranet. These multidisciplinary presentations are accessible from any computer terminal within the BHSCT. They cover :-
 - paediatric IV therapy which concludes with a competency assessment section which should be completed by those who may care for children.
 - the methodology for using the paediatric and adult fluid prescription and balance charts.
2. BMJ e-learning module

8.3.1
NPSA 3
RQIA 6,8,10

All staff involved in prescribing, administering and monitoring IV fluids to children will be made aware of this policy and the Paediatric Parenteral Fluid Therapy wallchart² through the BHSCT intranet and Service Group dissemination.

All staff working exclusively with children and especially those prescribing fluids to children will be encouraged to ensure they are conversant with the knowledge required to prescribe IV fluids to children and that it is within their scope of practice.

They will be encouraged to use the intranet training presentations and the BMJ learning module on hyponatraemia - <http://learning.bmj.com/learning/search-result.html?moduleId=5003358>

The production of the certificate on completion of the above module may be sought at staff assessments, performance review, personal development plans and appraisals.

8.3.2
NPSA 3
RQIA 6,8

All professionals caring for children must be familiar with the signs of hyponatraemia and its emergency management.

8.3.3
NPSA 3
RQIA 6,8

For those caring for young people, they should either have received adequate training in intravenous fluids or if they exclusively care for young people in an adult ward, they should know where to obtain such expertise on children should it be needed. (Appendix 5).

Furthermore, they should be familiar with the guidance on intravenous fluids for children outlined in this policy and Regional Paediatric Fluid Therapy Group wallchart².

8.3.4 NPSA 3
RQIA 9 The BHSCT has identified that young people aged 14 - 16 years old can be cared for (even if only occasionally) on most wards that are generally regarded as adult wards with the obvious exceptions of wards like Care of the Elderly. Staff in those locations will be made aware of the training opportunities mentioned in 8.3 and 8.3.1.

BHSCT Service groups continue to consider cohorting young people in dedicated wards - where this can be done safely and will not lead to any diminution in the level of care.

8.3.5 The BHSCT will work with the NIMDTA to ensure that the principles of paediatric fluid therapy and its potential risks, as highlighted in the National Patient Safety Agency Alert, are highlighted in postgraduate training programmes.

8.3.6 All professionals caring for children must be able to diagnose and manage acute hypoglycaemia.

8.4 Fluid prescription/ balance chart

NPSA 4
RQIA 11

A new fluid prescription/ balance chart has been developed within the Belfast Trust. It will be used for the prescription of fluids for all children and young people treated in the BHSCT with the exception of treatment of diabetic ketoacidosis (DKA) and acute burns when specialised fluid prescription charts may be used.

A multidisciplinary training presentation in the policies and guidelines section of the Intranet, outlines how the chart should be completed. This presentation is accessible from any computer terminal within the BHSCT.

If needed, they should avail themselves of advice from the sources as detailed in Appendix 5.

8.4.1 All children, other than emergencies, must have a blood sample taken for electrolyte and blood glucose estimation before intravenous maintenance fluids are started. This must be repeated at least 24 hourly, more often in the circumstances described. Clinical and other methods of monitoring are outlined in the guidance.

8.4.2 Monitoring

Monitoring of the child receiving parenteral fluid will include considerations of:-

- Body weight to be measured or assessed as a baseline and at least daily thereafter.
- Clinical state to be closely monitored and recorded on a regular basis.
- All fluid intake of any kind (intravenous, oral and medicines) must be measured and recorded on the fluid prescription and balance chart.
- All fluid output of any kind must be assessed. If considered necessary, it should be measured and recorded on the fluid prescription and balance chart.
- Children on intravenous fluids must have any nappies weighed. Children receiving other forms of fluid intake must also have any nappies weighed when clinically indicated. If not clinically indicated to weigh nappies, an estimation e.g. small, moderate or large volume must still be made and recorded on the fluid prescription and balance chart.
- An assessment of input/output and need for plasma glucose estimation should be made and documented every 12 hours.
- A formal reassessment of the fluid prescription and the need for intravenous fluids must be made and documented every 12 hours.
- Measurement of E&U and blood glucose/BM should be made at least daily.

- If hyponatraemia exists, these measurements should be 4 – 6 hourly.
- Urinary osmolarity and electrolytes measurements should be considered when dealing with hyponatraemia.
- The ill child will require more frequent and detailed investigations.

For more detailed information about the monitoring requirements the wallchart² should be consulted.

8.5
NPSA 5
RQIA 12

Audit

The BHSCT will implement the following governance measures.

8.5.1
NPSA 5
RQIA 13

The BHSCT clinical biochemistry department will collate, analyse and report quarterly on paediatric hyponatraemia incidents to designated clinicians for children and young people. They will regularly audit these incidents, collate them with the Trust Adverse Incident Reporting System and instigate actions linked to the NPSA Alert 22. Appendix 3a outlines this audit process.

8.6
NPSA 5
RQIA 14

Incident reporting

The BHSCT will report these potential adverse incidents related to intravenous infusion through the Trust Adverse Incident Reporting System.

A system of 'triggers' (adapted from those developed by the NHSCT) will be used to

- generate a list of hospital acquired hyponatraemia episodes
- highlight variance from best practice guidance as highlighted in this document
- generate a Trust Adverse Incident Form whenever such incidents occur.

These triggers (Appendix 3b) will cover the choice of fluid prescribed at ward level, charting relevant findings in the medical notes, the frequency of electrolyte analysis and the detection of biochemical abnormalities.

9. Additional policy statements:

9.1 Senior medical advice must be sought when treating the child with hyponatraemia.

9.2 Where additional electrolytes are required, they should only be administered as supplied by the manufacturer and in line with guidance.

Children at or below the age of 13 years must not have electrolytes added to bags of intravenous fluids.

Ordinarily children from 13 to 16 should also not have electrolytes added to bags of intravenous fluids; in certain, predominantly adult areas, children of this age group may have magnesium sulphate or phosphates added.

9.3 Apart from boluses for shocked patients, fluids may only be administered by way of an infusion device. Details of the pump must be recorded on the fluid prescription and balance chart.

9.4 When referring to this policy, staff should consult the BHSCT policy on the management of strong intravenous potassium solutions and/or injections.

10. Implementation / Resource requirements:

The implementation requirements for this policy include:-

- Wallchart production and distribution
- Fluid prescription/ balance chart production and distribution

PARENTERAL FLUID THERAPY for CHILDREN & YOUNG PERSONS (AGED OVER 4 WEEKS & UNDER 16 YEARS)

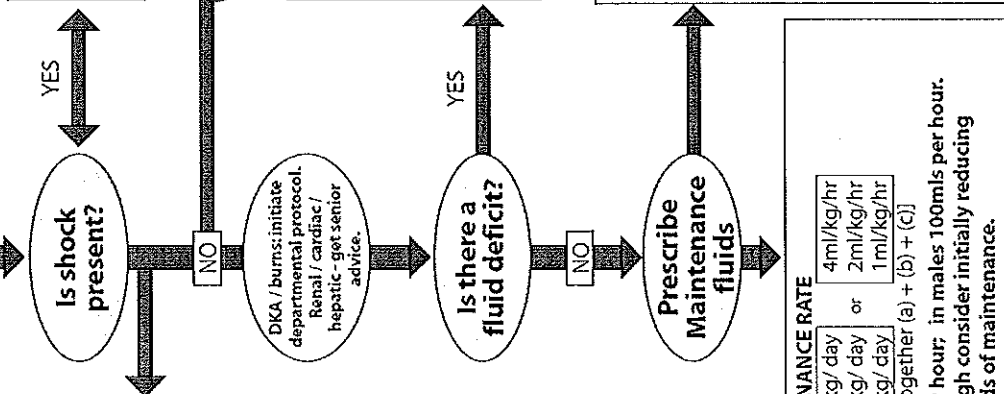
Initial management guideline



Sept 2007
Amended June 2013

Monitoring & observations essential

- ALL CHILDREN**
Admission Weight, U&E (unless child is well & for elective surgery)
- 12 Hourly** - Assess In / Output, glucose
- Daily** - Clinical reassessment, U&E (more often if abnormal; 4-6 hourly if $Na^+ < 130$ mmol/L).
- ILL CHILDREN**
May need:
Hourly - HR, RR, BP, GCS, Fluid In/Output (urine osmolality if volume cannot be assessed)
2-4 hourly - glucose, U&E, +/- blood gas.
- Daily** - weight if possible
- Each shift**
Handover and review of fluid management plan.
- If plasma $Na^+ < 130$ mmol/L or > 160 mmol/L or plasma Na^+ changes > 5 mmol/L in 24 hours ask for senior advice**



ADMINISTER RAPID FLUID BOLUS
Give 20 ml/kg sodium chloride 0.9% IV or Intravenous [10 ml/kg if history of haemorrhage or in diabetic ketoacidosis]
Reassess. Repeat bolus if needed. Call for senior help.
(Up to 60 ml/kg may be needed. Use blood after 40 ml/kg if patient has haemorrhaged)

Can child be managed with oral fluids?
YES
PRESCRIBE ORAL REHYDRATION SOLUTION

ESTIMATE DEFICIT
FLUID DEFICIT = (% dehydration x kg x 10) as mls of: sodium chloride 0.9%
The volume of fluid to be prescribed is: fluid deficit MINUS volume of any fluid bolus received
Prescribe this residual volume of deficit separately from the maintenance prescription.
Give over 24 hours (but over 48 hours if $Na^+ < 135$ or > 145 mmol/L)
ONGOING LOSSES: calculate at least 4 hourly. Replace with an equal volume of: sodium chloride 0.9% (with or without pre-added potassium)
Be prepared to change fluid type and volume according to clinical reassessment, electrolyte losses and test results

PRESCRIBE INITIAL IV MAINTENANCE FLUID AND TIME FOR REASSESSMENT
Patients particularly at risk of hyponatraemic complications: peri-operative patients; patients with head injuries; gastric losses; severe sepsis; hypotension; intravascular volume depletion; bronchiolitis; gastroenteritis with dehydration; abnormal plasma sodium, particularly if less than 138 mmol/L but also when greater than 160 mmol/L; salt wasting syndromes.
Fluid choices: glucose containing fluid normally required if under 1 year old and may also be required by older children sodium chloride 0.9% (with/ without pre-added glucose 5%)
or
Hartmann's Solution
or
Solution Corporately Approved at Trust Level
Other Patients:
All Patients:
sodium chloride 0.45% with pre-added glucose 2.5% or 5%
Alter fluid rate according to clinical assessment. Change electrolyte and glucose content of infusion fluid according to test results.
COMMENT: ORAL FLUIDS & DISCONTINUE IV FLUIDS AS SOON AS POSSIBLE

CALCULATION OF 100% MAINTENANCE RATE
(a) for first 10 kg: 4ml/kg/hr
(b) for second 10 kg: 50 ml/kg/day or 2ml/kg/hr
(c) for each kg over 20 kg: 20 ml/kg/day or 1ml/kg/hr
[for 100% daily maintenance add together (a) + (b) + (c)]
MAXIMUM: in females 80 mls per hour; in males 100mls per hour. If the risk of hyponatraemia is high consider initially reducing maintenance volume to two thirds of maintenance.

Hypokalaemia (< 3.5 mmol/L): Check for initial deficit. Maintenance up to 40 mmol/L IV potassium usually needed after 24 hrs using pre-prepared potassium infusions as far as possible. Consult Trust Policy on IV strong potassium.
Oral intake and Medications: volumes of intake, medications & drug infusions must be considered in the fluid prescription.
Hypoglycaemia (< 3 mmol/L). Medical Emergency: give 5 ml/kg bolus of glucose 10%. Review maintenance fluid, consult with senior and recheck level after 15-30 mins. **INTRA-OPERATIVE PATIENTS:** consider monitoring glucose.
Symptomatic Hyponatraemia: check U&E if patient develops nausea, vomiting, headache, irritability, altered level of consciousness, seizures or apnoea. This is a Medical Emergency and must be corrected.
Commence infusion of sodium chloride 2.7% at 2 ml/kg/hour initially and get senior advice immediately.

Appendix 2

Estimating the percentage dehydration based upon physical examination findings.

Estimated Percentage Dehydration	Physical Examination Findings
<3	History of fluid loss but no findings on physical examination
5	Dry oral mucous membranes but no panting or pathological tachycardia
7	Mild to moderate decreased skin turgor, dry oral mucous membranes, slight tachycardia, and normal pulse pressure.
10	Moderate to marked degree of decreased skin turgor, dry oral mucous membranes, tachycardia, and decreased pulse pressure.
12	Marked loss of skin turgor, dry oral mucous membranes, and significant signs of shock, pallor, cool peripheries, prolonged capillary refill time, hypotension, confusion.

Hyponatraemia Low Sodium Audit
Agreed Audit Process

1. Biochemistry Department will collate and provide SQA with a quarterly report on all laboratory results where the serum sodium is <130mmol/l.
2. SQA Dept will identify patient list to be audited:
 - All Hyponatraemia cases occurring on Adult wards.
 - RBHSC patients aged between 1 month and 16 years.
(Exclusions: *Paediatric ICU, RBHSC A&E*)
3. A random sample of 12 RBHSC patients per 3 month period to be selected to facilitate case note review of 10 cases.
4. SQA to agree suitable date and support with Clinical Leads re: data collection.
5. SQA Dept to request case notes from Medical Records.
6. SQA Dept to provide audit proforma (*see attached*), the case notes to be audited and support required on the date agreed for data collection.
7. SQA Dept will establish if incident forms have been completed and submitted (*where appropriate*) to Risk and Governance Dept.
8. SQA Dept to analyse data and produce regular quarterly reports to the Hyponatraemia Project Group.
9. Results of Hyponatraemia Low Sodium Audit to be fed back to the relevant Governance/Audit meetings for action.

SQA = Standards, Quality and Audit Department

PAEDIATRIC HOSPITAL ACQUIRED HYPONATRAEMIA AUDIT

Laboratory Report Details (to be completed by audit dept)

Patient No.: _____ Patient Date of Birth: _____
 Date of specimen: _____ Time of specimen: _____ Result : _____

Admission Details

Date of admission: _____ Time of admission: _____
 Diagnosis: 1. _____
 2. _____

Hospital acquired hyponatraemia (defn)

- Na =130mmol/l at time of admission, & a subsequent Na of < 130mmol/l whilst on IV fluids.
- Na< 130mmol/l on their initial U&E's, where the U&E's are done >48hrs after admission and they are on IV fluids.
- Admitted from another hospital with Na < 130mmol/l at time of admission whilst on IV fluids.

1. Is this hospital acquired hyponatraemia? Yes / No

If no, reason: _____

If yes, was it acquired whilst in this trust? Yes / No

If no, patient transferred from: _____

Prescription and monitoring of IV Fluids prior to Na <130

2. Was IV fluid prescribed? Yes/No (If no, go to Q9)

3. Was the fluid prescribed appropriate? Yes / No

If no, details: _____

4. Was IV fluid prescription reviewed 12hrly whilst on IV fluids? Yes / No

5. Were U&E done 24hrly whilst on IV fluids? Yes / No

Following the Na of <130mmol/l,

6. Was appropriate advice sought? Yes / No

Grade: _____ Speciality: _____

7. Was the frequency of repeat U&Es appropriate? Yes / No

If No, details: _____

8. Was appropriate action taken? Yes/No

If no, details: _____

Recording and communication of incidents (to be completed by Audit dept)

9. If yes to Q1, was adverse incident form completed? Yes / No

10. Was copy of form sent to other trust if acquired outside BHSCT? Yes / No

Triggers for potential adverse events related to the administration of intravenous fluids to Children (1 month – 16 years old)

CHOICE OF IV FLUID

1. Bolus fluid: use of a solution with sodium concentration of <130mmol/L for treatment of shock.
2. Deficit fluid *: use of a solution with sodium concentration of <130mmol/L for correction.
3. Maintenance fluid: use of a solution with sodium concentration of <130mmol/L in a peri-operative patient (intraoperative period and first 24 hours following surgery).

BIOCHEMICAL ABNORMALITIES

4. Any episode of symptomatic hyponatraemia while in receipt of IV fluids.
5. Any episode of hypoglycaemia (blood glucose less than 3mmol/L) while in receipt of IV fluids.
6. Any episode of severe acute hyponatraemia (i.e. sodium level dropping to < 130mmol/L whilst on IV fluids).

ASSESSMENT

7. Failure to check electrolytes at least once per 24 hours in any patient receiving IV fluids over the majority of that 24 hour period.
8. Failure to record the calculations for fluid requirements on the fluid balance and prescription sheet.
9. Failure to note in the case notes, fluid balance and prescription sheet a serum sodium of <130mmol/L.
10. Failure to document in the case notes the steps taken to correct a serum sodium of < 130mmol/L.

If any of the above occurs, an Adverse Incident Form must be completed.

*In diabetic ketoacidosis and burns: follow departmental protocol

July 2013

Appendix 4

Availability of intravenous crystalloid fluids (500mls) for use in paediatric patients from BHSCT Pharmaceutical Services.

Name of fluid	Comments
Sodium Chloride solutions	
Sodium chloride 0.45%	Treatment of hypernatraemia
Sodium chloride 0.9%	
Sodium chloride 1.8%	
Sodium chloride 2.7%	Emergency treatment of hyponatraemia & head injury
Combined solutions	
Sodium chloride 0.45% glucose 5%	
Sodium chloride 0.45% glucose 2.5%	
Sodium chloride 0.9% glucose 5%	
Glucose solutions	
Glucose 5%	
Glucose 10%	
Glucose 20%	
Glucose 50%	
Potassium containing solutions	
Sodium chloride 0.18% glucose 10% 10mmol Potassium chloride Commonly known as Basic Solution	Pyloric stenosis patients ONLY
Sodium chloride 0.45% glucose 2.5% 10mmol Potassium chloride	
Sodium chloride 0.45% glucose 5% 10mmol potassium chloride	
Sodium chloride 0.45% glucose 5% 20mmol potassium chloride	
Sodium chloride 0.9% 10mmol potassium chloride	
Sodium chloride 0.9% 20mmol potassium chloride	
Sodium chloride 0.9% glucose 5% 10mmol potassium chloride	Recommended for DKA protocol
Sodium chloride 0.9% glucose 5% 20mmol potassium chloride	Recommended for DKA protocol
Sodium chloride 0.9% 10% glucose 10mmol potassium chloride	For DKA protocol ONLY
Sodium chloride 0.9% 10% Glucose 20mmol potassium	For DKA protocol ONLY
Dipotassium hydrogen phosphate in Sodium chloride 0.9% (20mmol potassium : 10mmol phosphate)	Treatment of hypophosphataemia
Miscellaneous	
Sodium bicarbonate 1.26% polyfusor	
Sodium bicarbonate 8.4% polyfusor (200mls)	Emergency use only
Sodium compound (Hartmann's)	

If it is necessary to prescribe a fluid containing sodium chloride 0.18% then a consultant request form should be completed and sent to Pharmacy.

It can be printed from the Policies and Guidelines section of the BHSCT Intranet, (under Clinical → under Hyponatraemia).

Please note that to avoid any delay to the patient receiving the fluid, Pharmacy must be contacted as soon as possible after the decision is made to prescribe it.

Appendix 5

Sources of advice regarding Paediatric fluid therapy

For help and advice regarding

- management of fluid therapy
- especially to prevent and/or treat hyponatraemia

in all children, but especially for those children aged 13 – 16 years old being managed in adult wards.

Please use the following sources of help and advice in the order they appear in the table. Ordinarily, advice should be for complex cases and should be Consultant to Consultant discussions even though contact will often have to be made through trainee on-call rotas.

Team		Address	Extension
RBHSC Paediatricians	Paediatric On Call Rota	Allen Ward	Bleep [REDACTED]
RBHSC Paediatric ICU	Paediatric ICU		[REDACTED] [REDACTED]
Musgrave Park	Orthopaedic theatre – Anaesthesia team during working hours.		
General Biochemistry	Clinical Biochemistry		
	Inside working hours	Outside working hours	
Ext. [REDACTED] [REDACTED]	Ext. [REDACTED] [REDACTED]	Contact Medical doctor on call either via the laboratory or via switchboard.	
Ext. [REDACTED] [REDACTED]	Available from Royal Site - [REDACTED]		
Ext. [REDACTED] [REDACTED]			

Other sources of help are:

- 1 APA consensus guideline on perioperative fluid management in Children
http://www.apagbi.org.uk/sites/apagbi.org.uk/files/Perioperative_Fluid_Management_2007.pdf
- 2 Royal Children's hospital Melbourne Clinical Practice Guidelines
Intravenous fluids
http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5203#Other%20Resources
- 3 Royal Children's hospital Melbourne Clinical Practice Guidelines:
Hyponatraemia
http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=8348

August 2013

Appendix 6

Areas where it is permitted to stock/order fluids containing Sodium Chloride 0.18%

SERVICE GROUP	SITE	SPECIALITY	Stock on Ward	Fluid
Specialist Hospitals	RBHSC	PICU	X	No.18 solution*
Specialist Hospitals	RBHSC	Barbour Ward	X	Basic solution**

*"No. 18 solution" = sodium chloride 0.18% and glucose 4%

** Basic solution = sodium chloride 0.18%, glucose 10%, potassium chloride 10mmol

Wards are not permitted to transfer fluids containing sodium chloride 0.18% from areas allowed to stock to other areas.

Exception

Barbour Ward is permitted to transfer 'Basic Solution' to pyloric stenosis outliers within RBHSC. In these instances, the consultant only request form should still be completed for the specific patient and sent to Pharmacy.

Consultant only request

Other wards requiring a supply of any solution containing sodium chloride 0.18% must complete a consultant only request form – available on the Trust intranet at

<http://intranet.belfasttrust.local/Policies%20and%20Procedures/Hyponatraemia%20%E2%80%93%20Reducing%20the%20risk%20-%20Consultant%20request%20form%20for%20No%2018%20solution.pdf>

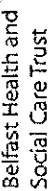
In the event that the consultant is unavailable to sign the form then a doctor, under the specific request of a named consultant, should complete the form, add their own name, signature and designation and include the name of the consultant who has requested the IV fluid. This form must then be signed by that consultant at the earliest opportunity.

Only the estimated quantity needed to treat the patient should be ordered.

The completed consultant only request form, together with a requisition for the fluid, should be sent to pharmacy.

Hyponatraemia Guidance Note

For Children and Young People (aged over 1 month until their 16th birthday)



April 2011

The guidance notes complement the DHSSPSNI Regional Paediatric Fluid Therapy Guidelines. **1** Use only in the context of a paediatric admission. **2** A valid prescription must be in place for all fluids. **3** Some fluids may require a specific order form.

Triggers for potential adverse events related to the administration of intravenous fluids:

If any one of these occurs an Incident Report Form must be completed.

CHOICE OF IV FLUID

1. Bolus fluid: use of a solution with sodium concentration of <130mmol/L for treatment of shock.
2. Deficit fluid: use of a solution with sodium concentration of <130mmol/L for correction.
3. Maintenance fluid: use of a solution with sodium concentration of <130mmol/L in a peri-operative patient (intraoperative period and first 24 hours following surgery).

* In diabetic ketoacidosis and burns follow departmental protocol

BIOCHEMICAL ABNORMALITIES

4. Any episode of symptomatic hyponatraemia while in receipt of IV fluids.
5. Any episode of hypoglycaemia (blood glucose less than 3mmol/L) while in receipt of IV fluids.
6. Any episode of severe acute hyponatraemia (i.e. sodium level dropping from 135mmol/L or above to < 130mmol/L within 24hrs whilst on IV fluids).

ASSESSMENT

7. Failure to check electrolytes at least once per 24 hours in any patient receiving IV fluids over the majority of that 24 hour period.
8. Failure to record the calculations for fluid requirements on the fluid balance and prescription sheet.
9. Failure to note in the case notes, fluid balance and prescription sheet a serum sodium of <130mmol/L.
10. Failure to document in the case notes the steps taken to correct a serum sodium of < 130mmol/L

Availability of intravenous crystalloid fluids (500ml) for use in paediatric patients from BHSC/Pharmaceutical Services

Name of Solution	Contents
Sodium Chloride solutions	Treatment of hyponatraemia
Sodium chloride 0.45%	
Sodium chloride 0.9%	
Sodium chloride 1.8%	Emergency treatment of hyponatraemia & head injury
Sodium chloride 2.7%	
Combined solutions	
Sodium chloride 0.45% glucose 5%	
Sodium chloride 0.45% glucose 2.5%	
Sodium chloride 0.9% glucose 5%	

Glucose solutions	
Glucose 5%	
Glucose 10%	
Glucose 20%	
Glucose 50%	
Potassium containing solutions	
Sodium chloride 0.18% glucose 10% 10mmol Potassium chloride	Pyloric stenosis patients ONLY
Commonly known as Basic Solution	
Sodium chloride 0.45% glucose 2.5% 10mmol Potassium chloride	
Sodium chloride 0.45% glucose 5% 10mmol Potassium chloride	
Sodium chloride 0.45% glucose 5% 20mmol Potassium chloride	
Sodium chloride 0.9% 10mmol Potassium chloride	
Sodium chloride 0.9% glucose 5% 10mmol Potassium chloride	Recommended for DKA protocol
Sodium chloride 0.9% glucose 5% 20mmol Potassium chloride	Recommended for DKA protocol
Sodium chloride 0.9% 10% glucose 10mmol Potassium chloride	For DKA protocol ONLY
Sodium chloride 0.9% 10% glucose 20mmol Potassium chloride	For DKA protocol ONLY
Dipotassium hydrogen phosphate in sodium chloride 0.3% (20mmol potassium : 10mmol phosphate)	Treatment of hypophosphataemia

Miscellaneous	
Sodium bicarbonate 1.26% polyfusor	
Sodium bicarbonate 8.4% polyfusor (200mls)	Emergency use only
Sodium lactate compound (Harmann's)	

If it is necessary to prescribe a fluid containing sodium chloride 0.18% then a consultant request form should be completed and sent to Pharmacy. It can be printed from the Policies and Guidelines section of the BHSC/Intranet (under Clinical → under Hyponatraemia). Please note that to avoid any delay to the patient receiving the fluid, Pharmacy must be contacted as soon as possible after the decision is made to prescribe it.

Sources of advice regarding Paediatric fluid therapy

For help and advice regarding management of fluid therapy especially to prevent and/or treat hyponatraemia in all children, but especially for those children aged 13 - 16 years old being managed in adult wards. Please use the following sources of help and advice in the order they appear in the table. Ordinarily, advice should be for complex cases and should be Consultant to Consultant discussions even though contact will often have to be made through trainees on-call rota.

Team	Address	Ext
For patients within RBHSC		
RBHSC Paediatric ICU		32449
Paediatric ICU		
RBHSC Paediatricians	Allen Ward	Bleep 2277
Paediatric On Call Rota		
For patients outside RBHSC		

General Biochemistry	Clinical Biochemistry	
	Inside working hours	Outside working hours
RWH Tlx line: 7222 Ext: 33798	Ext: 34714	Contact Medical doctor on call either via the laboratory or via switchboard.
BCH Tlx line: 7111 Ext: 2625/2950/3448	Ext: 2625/2950/3448	
MIH Tlx line: 7231 Ext: 2391/2325	Ext: 2391/2325	
RBHSC Paediatric ICU	Paediatric ICU	32449
RBHSC Paediatricians	Paediatric On Call Rota	Allen Ward Bleep 2277

Musgrave Park
Orthopaedic theatre - Anaesthesia team during working hours.
BCH Dufferin theatres
ENT theatre - Anaesthesia team during working hours.

- Other sources of help are:
1. APA consensus guideline on perioperative fluid management in Children http://www.aapahq.org.uk/files/peroperative_fluid_management_2007.pdf
 2. Royal Children's Hospital Melbourne Clinical Practice Guidelines: Intravenous fluids http://www.rch.org.au/clinicalguidelines/cdl/doc_id=5203/Ch07-2008aources
 3. Royal Children's Hospital Melbourne Clinical Practice Guidelines: Hyponatraemia http://www.rch.org.au/clinicalguidelines/cdl/doc_id=4848

RQIA INDEPENDENT REVIEW - SEPTEMBER 2008 - RECOMMENDATIONS

- Recommendation 1 All hospitals should monitor the ongoing use of No. 18 solution to enable assurance that infusions are removed from stock and general use in areas that treat children.
- Recommendation 2 Where appropriate, hospitals must be able to demonstrate that an active strategy is in place for minimising risk of use in clinical areas that continue to stock No 18 solution and where children are accommodated. For example, provision of additional labelling or separate storage for those No.18 solution bags still stocked in such clinical areas.
- Recommendation 3 All hospitals should continue with the ongoing work of disseminating clinical guidelines. This should be undertaken in conjunction with multidisciplinary awareness-raising and education on the use of the guidance and wall chart in all settings where children may be treated. This is particularly important in adult wards where older children are treated.
- Recommendation 4 Independent hospitals must be assured that all visiting doctors who may manage patients up to 16 years old use the clinical guidelines when managing children being treated with intravenous infusions.
- Recommendation 5 All hospitals should ensure that only the DHSSPS Paediatric Parenteral Fluid Therapy wall-chart *issued by DHSSPS in October 2007* is displayed in clinical areas where children may be treated, with a list of available local fluids available alongside it. All previous versions of the wall chart should be removed from clinical areas.
- Recommendation 6 Hospitals should assure themselves that staff have the appropriate skill and knowledge in this clinical area. Competency assessment tools in administration of intravenous infusion to children should be developed, formalised and implemented for all relevant, multi-professional staff.
- Recommendation 7 Hospitals should continue to review, collaborate and implement organisation wide policy and guidelines, in relation to intravenous infusion for children.
- Recommendation 8 All hospitals should ensure that the development and provision of multidisciplinary education opportunities in administration of intravenous infusion to children and that all relevant clinical staff uptake this education.
- Recommendation 9 Hospitals should develop mechanisms to identify the location of patients aged 14-16 years who are in adult wards and ensure staff who care for those children are provided with competency based, assessed education in administration of intravenous infusion to children.
- Recommendation 10 All hospitals should make wider use of training sources available such as BMJ E-Learning Module on Hyponatraemia to address different learning styles and devise a mechanism to ensure 100% multi-professional uptake of such learning.
- Recommendation 11 Priority must be given to the completion of a Trust-wide review, and implementation of revised paediatric intravenous fluid prescription and fluid balance charts in all settings where children may be treated including adult wards where children are treated.
- Recommendation 12 All hospitals should develop a culture of incident reporting, analysis and learning generally and specifically in respect of intravenous fluids and hyponatraemia.
- Recommendation 13 Plans for development of systems for reporting, analysing and monitoring incidents to assure organisations of safe practice and that actions linked to NPSA Alert 22 should be implemented and regularly audited by all hospitals to ensure adherence to the process.
- Recommendation 14 The development of 'trigger lists' that have been adopted by a the Antrim Area Hospital to aid understanding of the types of incidents to be reported should be shared and taken up more widely .
- Recommendation 15 The development of an audit tool which may include wider aspects but should address as a minimum aspects of NPSA Alert 22 should continue to be progressed and used at least annually.
- Recommendation 16 Trusts should continue to seek approval and funding for a regional audit (GAIN proposal) on the uptake of the Paediatric Parenteral Fluid Therapy guideline and potential unexpected clinical consequences of the guideline.