

Perioperative Intravenous Fluids Prescription and Monitoring in Children 3 months to 16 years	Clinical Guideline Register No: 08000 Status: Public
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Consulted With	Post/Committee/Group	Date
Dr S Lim	Consultant Paediatrician	June 2016
Melanie Chambers	Lead Nurse Children and Young People	June 2016
Claire Fitzgerald	Paediatric Pharmacist	June 2016
Dr D O'Hara	Consultant Anaesthetist	June 2016
Professionally Approved By	Dr Chris Wright	February 2017

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Author/Contact for Information	Dr J Hussey, Consultant Anaesthetist
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Document Review History

Review No	Reviewed by	Active Date
1.0	Agnes Watson	24th January 2008
2.0	Agnes Watson	15th March 2013
3.0	Dr Joe Hussey	17 July 2017

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1.0 Purpose

- 1.1 This guideline is to aid in the correct prescription of fluids to children and monitoring in the perioperative period before and after surgery.
- 1.2 It is for use by surgeons, anaesthetists and nurses caring for children who need intravenous fluids before or after surgery.
- 1.3 This guideline is a starting point for the prescription of fluid in previously well children having elective or emergency surgery.

2.0 Scope

- 2.1 This policy applies to previously well babies and children from 3 months to 16 years if intravenous fluids are required before and after surgery.
- 2.2 For diabetic children follow children's diabetic guideline, for those with renal disease seek paediatric advice.

3.0 Procedure

- 3.1 All prescriptions need to be individualised for each child with careful assessment of fluid and electrolyte requirements and careful monitoring.
- 3.2 The process to follow is set out in Appendix 1.

4.0 Resuscitation Fluid

- 4.1 Generally 20mls/kg (over less than 10 minutes) aliquots of a glucose free iso-tonic / iso-osmotic crystalloid solution (e.g. 0.9% saline or Hartmann's solution) should be given according to clinical response except in trauma / head injury patients where 10mls/kg of 0.9% saline should be first choice (followed by blood products if required).
- 4.2 4.5% or 5% Albumin can be used in children with shock caused by sepsis or burns.
- 4.3 Expert advice (i.e. CATS / PICU) should be sought if 60mls/kg or more fluid is required as part of initial fluid resuscitation.

5.0 Maintenance Fluids

- 5.1 **Preop (if required)** Initially use an isotonic crystalloid solution that contains Sodium in the region of 131 - 150 mmol/L at 100% calculated hourly maintenance fluid requirements (see box below to calculate). if there is a risk of water retention associated non-osmotic ADH secretion, maintenance fluid should be reduced to 75% of calculated maintenance. Subsequent IV fluid prescriptions should be based on plasma electrolyte concentrations and glucose measurement.
- 5.2 **Day 1 Postop** Use an isotonic crystalloid solution that contains Sodium in the region of 131 - 150 mmol/L at 75% calculated hourly maintenance fluid requirements (see box below to calculate). Avoid glucose containing solutions unless the child is hypoglycaemic.

5.3 Day 2 and thereafter- IV fluid prescriptions should be based on plasma electrolyte concentrations and glucose measurement.

- Use an isotonic crystalloid solution that contains Sodium in the region of 131 - 150 mmol/L at 100% calculated hourly maintenance fluid requirements (see box below to calculate).
- If there is a continued risk of water retention associated non-osmotic ADH secretion, maintenance fluid should be reduced to 75% of calculated maintenance
- If Na is > 135 mmol/L a hypotonic fluid with Sodium \geq 75mmol/L (i.e 0.45% Saline) can be given with or without glucose. Consider adding 20 mmol/L KCl especially after bowel surgery please discuss with the paediatric team.

Weight	Hourly fluid requirement
<10kg	4mls/kg/hr
10-20kg	40mls + 2mls/kg/hr for each kg over 10
>20kg	60mls + 1ml/kg/hr for each kg over 20
Limit maintenance fluids to no more than 2000mls/day for Females / 2500mls/day for Males	

6.0 Ongoing Fluid Losses

- 6.1 Replace all losses (Nasogastric losses, vomiting, diarrhoea) ml for ml with 0.9% saline with 20mmol KCl/litre
- 6.2 See Appendix 2 for pictorial guide of ongoing losses in young people

7.0 Monitoring of fluid and electrolyte balance

- Weigh all children prior to starting intravenous fluids and daily thereafter until tolerating their normal oral / enteral intake.
- Document an accurate daily fluid balance chart
- Check U&E before starting intravenous fluids (except well children, elective surgery)
- Check U&E daily for the first 4 days of intravenous fluids, thereafter as clinically indicated.
- If electrolytes are abnormal check more frequently.
- Check BG if prolonged fasting, young infant or unwell child.
- Be aware of the risk of hyponatraemia - take serum electrolytes immediately if this is suspected and take action according to Hyponatraemia algorithm (appendix 3)

8.0 Audit and Monitoring

- 8.1 An annual audit of children attending for planned cleft palate / lip surgery will be undertaken to assess compliance to this guideline. The annual audit results will be presented to the Paediatric safe Surgery Group.

8.2 A risk event form must be completed for all incidents relating to this guideline. Each incident will be investigated, an action plan drawn up and recommendations made for improving the care provided.

9.0 References

NPSA Alert 22: Reducing the Risk of hyponatraemia when administering intravenous infusions to children, 28 March 2007

Association of Paediatric Anaesthetists Consensus guideline on perioperative fluid management in children September 2007

Intravenous fluid therapy in children and young people in hospital. NICE guideline NG29. December 2015

Perioperative Intravenous Fluids Prescription and Monitoring for Children

These guidelines are a starting point for the prescription of fluid in previously well surgical children. For diabetic children follow paediatric diabetic guideline, for those with renal disease seek paediatric advice. All prescriptions need to be individualised for that child with careful assessment of fluid and electrolyte requirements and careful monitoring.

Resuscitation Fluid:

Generally 20mls/kg of 0.9% Saline (No Glucose) infused in under 10 minutes. Use 10mls / kg in Trauma or suspected head injury. 20mls/kg of 4.5% Albumin can be used in septic / burn shock.

Maintenance Fluids:

Use an isotonic crystalloid solution that contains Sodium in the region of 131-150 mmol/L

Preop (rarely required) at 100% calculated hourly maintenance fluid requirements. If there is a risk of water retention associated non-osmotic ADH secretion, maintenance fluid should be reduced to 75% of calculated maintenance.

Day 1 Postop 75% calculated hourly maintenance fluid requirements. Avoid glucose containing solutions unless the child is hypoglycaemic.

Day 2 and thereafter Use an isotonic crystalloid solution that contains Sodium in the region of 131-150 mmol/L at 100% hourly calculated maintenance requirements. Consider using a glucose containing solution or adding 20mmol/L KCL if serum electrolytes / glucose measurements indicate.

Weight	Hourly fluid requirement
<10kg	4mls/kg/hr
10-20kg	40mls + 2mls/kg/hr for each kg over 10
>20kg	60mls + 1ml/kg/hr for each kg over 20
Limit maintenance fluids to no more than 2000mls/day for Females / 2500mls/day for Males	

Ongoing Fluid Losses:

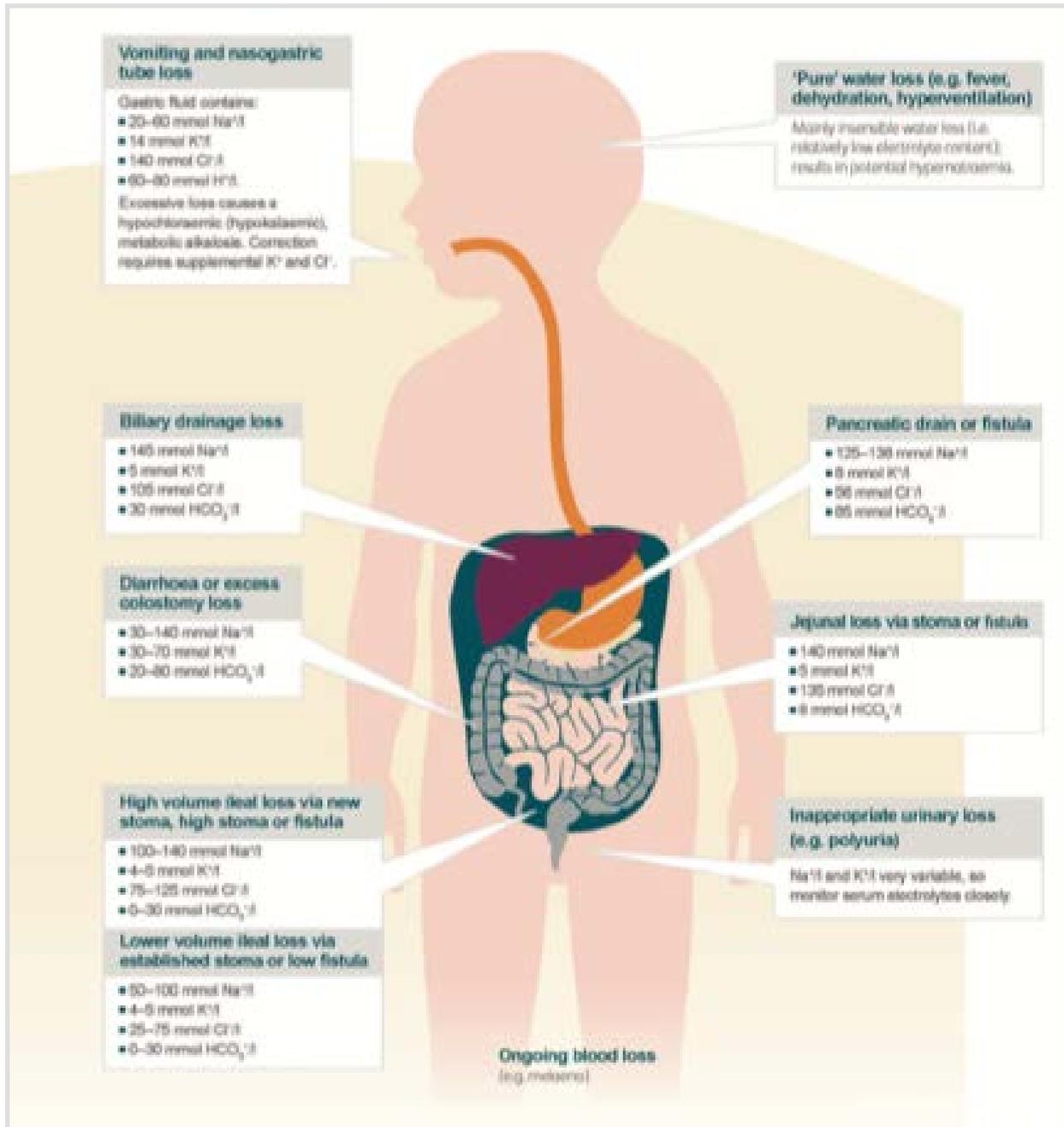
Replace all losses ml for ml with 0.9% saline with 20mmol/L KCl

Monitoring:

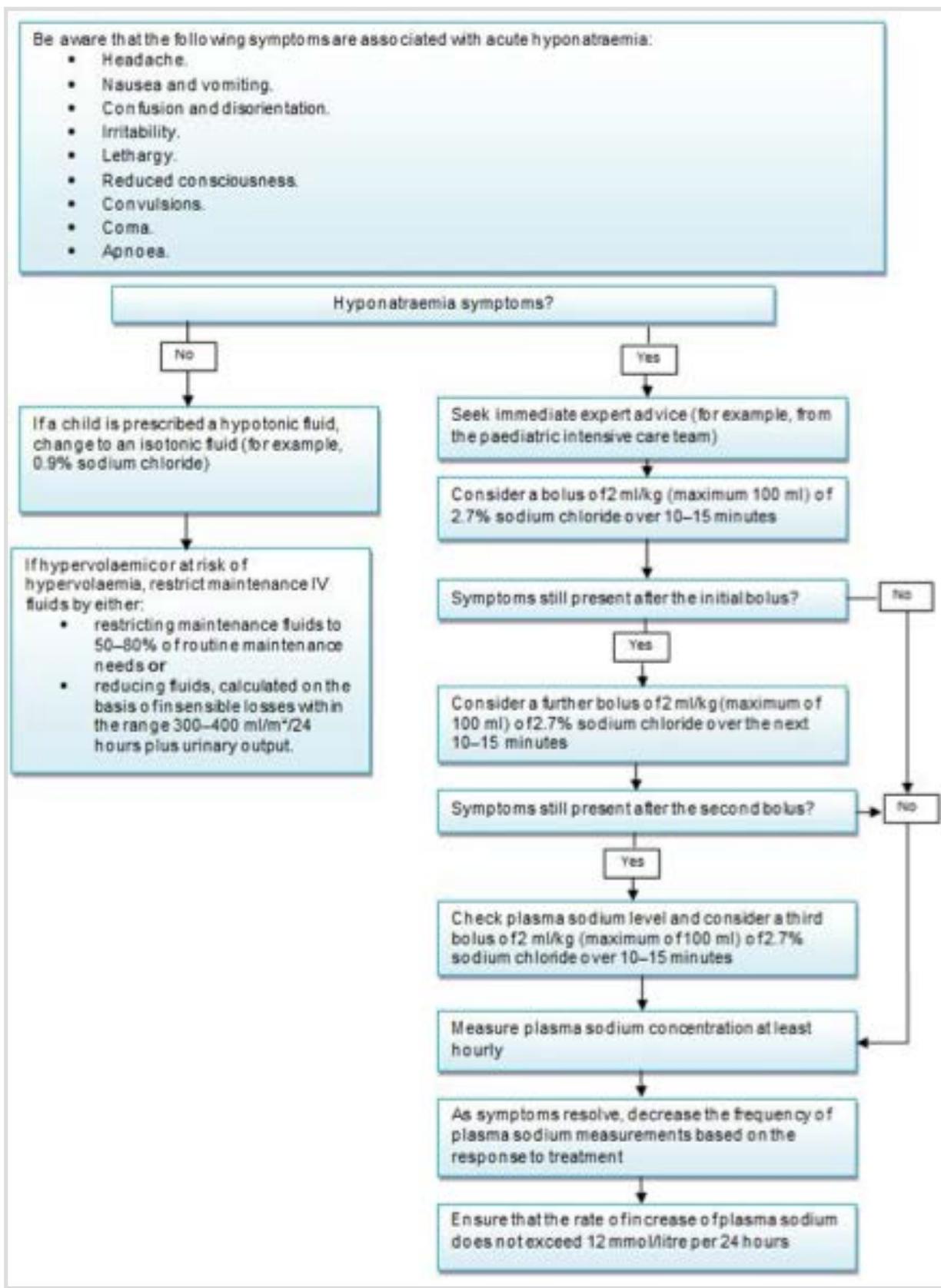
- Weigh all children prior to starting fluids, daily thereafter until IV fluids discontinue
- Document an accurate daily fluid balance
- Check U&E before starting intravenous fluids (except well children, elective surgery)
- Check U&E daily for the first 4 days of intravenous fluids, thereafter as clinically indicated.
- If electrolytes are abnormal, consider rechecking 6 hourly, definitely if sodium <130 mmol/l
- Check BG if prolonged fasting or unwell child

If symptoms of hyponatraemia develop: headache, nausea and vomiting, seizure- call for senior help & take serum electrolytes & treat

Diagram of ongoing losses in children and young people



Management of Hyponatraemia (Na <135mmol/L) that develops during IV therapy



Intravenous fluid types for children and young people

Fluid with recommendation reference	Fluid type ^a	Osmolality (compared with plasma)	Tonicity (with reference to cell membrane)	Sodium content (mmol/litre)	Potassium content (mmol/litre)
Isotonic crystalloids that contain sodium in the range 131–154 mmol/litre [10, 11, 17, 26, 29, 32]	0.9% sodium chloride	Isosmolar	Isotonic	154	0
	Hartmann's solution	Isosmolar	Isotonic	131	5
Isotonic crystalloids with glucose that contain sodium in the range 131–154 mmol/litre [21]	0.9% sodium chloride with 5% glucose	Hyperosmolar	Isotonic	150	0
Hypotonic fluids [29, 32]	0.45% sodium chloride with 5% glucose	Hyperosmolar	Hypotonic	75	0
	0.45% sodium chloride with 2.5% glucose	Isosmolar	Hypotonic	75	0
	0.45% sodium chloride	Hyposmolar	Hypotonic	75	0
	5% glucose	Isosmolar	Hypotonic	0	0
	10% glucose	Hyperosmolar	Hypotonic	0	0

(a) Fluids given are examples of appropriate fluids; for further details, see the British national formulary for children.