

INTRAVENOUS FLUID AND ELECTROLYTE THERAPY - SCH

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- All children, particularly neonates and infants are vulnerable to injury from inappropriate intravenous fluid use.
- 1000mL (1 Litre) Intravenous Fluid bags are used throughout SCH for Paediatric patients, and 500mL bags are used for neonates (less than one month corrected).
- Unwell Children should be managed according to the following:
 - Treat SHOCK / HYPOVOLAEMIA
 - Replace DEFICIT / DEHYDRATION
 - Replace ONGOING LOSSES
 - Provide MAINTENANCE REQUIREMENT
 - Re-evaluate OFTEN
- Maintenance Fluids:
 - Children under 1 month of age should be initiated on 0.45% sodium chloride + 10% glucose +/- potassium chloride 10mmol/500mL and blood glucose checked daily. (This excludes neonates in NICU and Special Care Nurseries),
 - Children 1 month and older should be initiated on maintenance with 0.9% sodium chloride + 5% glucose +/- potassium chloride 20mmol/1000mL.
 - Alternatively and ONLY under direction of a consultant 0.45% sodium chloride + 5% glucose +/- potassium chloride 20mmol/1000mL or Plasma-Lyte 148 + 5% glucose, may be used.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCH Drug Committee	
Date Effective:	5 August 2016	Review Period: 3 years
Team Leader:	CNC	Area/Dept: Pain Management

CHANGE SUMMARY

- Minor changes made to be consistent with the NSW Ministry of Health Guideline [GL2015_008] [Standards for Paediatric Intravenous Fluids: NSW Health \(second edition\)](#).

29/06/2017

- Hyperlink to old SCH fasting guidelines removed.

READ ACKNOWLEDGEMENT

- All Clinical staff prescribing and administering IV fluids must read and acknowledge this document (e.g. sign-off after reading it acknowledging they understand it).

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

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1 Background

All children, particularly neonates and infants are vulnerable to injury from inappropriate intravenous fluid use. Correct choice of fluid and electrolyte therapy is therefore very important.

This guideline aims to recommend initial (first 8 hours) fluid and electrolyte therapy and make recommendations relevant to ongoing fluid and electrolyte management.

Variations from the guideline will be necessary according to specific needs of individual children, or specialised clinical situations. Management of complex fluid and electrolyte problems are beyond the scope of this guideline.

2 Maintenance fluids

Maintenance fluid is that volume of daily fluid intake which replaces the insensible losses (from breathing, skin, stools), plus a volume that allows excretion of waste (urea, creatinine, electrolytes etc) in urine of similar osmolality to plasma.

Relatively well children with initially normal hydration, who are fasted (nil by mouth), or are unable to drink for more than six hours may require maintenance fluid.

Newborn infants (especially pre-term) have relatively large insensible water loss via the skin. There is often confusion about the difference between oral and IV fluid requirements for young infants. The water requirement is identical for both routes of administration.

The following calculations approximate the maintenance fluid requirement of well children (not pre-term) according to weight in kg.

Table A

Patient age/weight	Daily IV requirements	Hourly IV requirements
Day 1 of life	60mL/kg	2.5mL/kg
Day 2 of life	90mL/kg	3.75mL/kg
Day 3 – 30 of life	120mL/kg	5mL/kg
3 – 10kg	100mL/kg	4mL/kg
10 – 20kg	$1000 + 50 \times [\text{wt (kg)} - 10]$ mL	$40 + 2 \times [\text{wt (kg)} - 10]$ mL
20kg or greater	$1500 + 20 \times [\text{wt (kg)} - 20]$ mL	$60 + 1 \times [\text{wt (kg)} - 20]$ mL

2.1 Initial Maintenance Fluids

When ordering IV fluids the prescription must be written in full such as:

“0.9% sodium chloride + 5% glucose”

Alternatives such as dextrose & abbreviations such as NaCl, N/S and N/2 must not be used.

Under 1 month old

- 0.45% sodium chloride + 10% glucose +/- potassium chloride 10mmol/500mL.
Check urine for glycosuria daily.
- If glycosuria consider a solution with reduced glucose Eg 0.45% sodium chloride + 5% glucose +/- potassium chloride 10mmol/500mL.

1 month or older

- 0.9% sodium chloride + 5% glucose +/- potassium chloride 20mmol/1000mL.
- Alternatively and ONLY under direction of a consultant, 0.45% sodium chloride + 5% glucose +/- potassium chloride 20mmol/1000mL or Plasma-Lyte 148 + 5% glucose, may be used.

If urine output has been established and serum potassium and creatinine are not elevated then maintenance fluids should include potassium chloride (see 2.2).

In very unwell children, e.g. hypovolaemia use 0.9% sodium chloride without glucose, initially for circulatory support (see section 3).

Fluid therapy will need to be adjusted based on subsequent assessment.

To minimise risk of hyponatraemia in children older than 1 month 0.9% sodium chloride + 5% glucose are the recommended commencement IV fluids and initial postoperative fluids. These provide sodium in excess of maintenance requirements; however continuous use of this solution is unlikely to result in hypernatraemia as the excess sodium will be excreted by the kidneys.

Hyponatraemia poses a greater acute danger than hypernatraemia; therefore solutions with low sodium concentrations (salt poor) should be used with caution. In unwell stressed patients (e.g. meningitis, post-surgical, patients receiving opiates, respiratory problems etc), stress response and elevated ADH secretion may result in water retention.

Prescribed maintenance fluids should be reviewed regularly and may need to be adjusted in some children. A typical example is the need to increase maintenance fluids by 10-20 % when fever is present.

2.2 Maintenance Electrolytes and Glucose

Sodium

- **First week of life:** 1 to 1.5mmol/kg/day
- **2 to 3 months old:** 3mmol/kg/day
- **2 years old:** 2mmol/kg/day

- Hyponatraemia may be caused by water overload or salt depletion.
- Water overload is a common cause of hyponatraemia and simply requires water restriction.
- The patient who is salt depleted is usually also water depleted (dehydrated). Slow replacement of sodium depletion with 0.9% sodium chloride is usually all that is required. Rapid correction of the sodium deficit is required only in the rare circumstance of symptomatic hyponatraemia, which may occur at sodium levels below 125mmol/L. Intravenous hypertonic saline (3% sodium chloride) is used only in exceptional circumstances and may warrant ICU admission. Hypertonic saline (3% sodium chloride) should never be used without Consultant approval. It is highly hyperosmolar, irritant and should be administered via Central Venous Line where possible. **Peripheral administration is to occur in emergency situations only.**

Potassium

- **Usual daily requirement:** Approximately 2mmol/kg/day
- Severe total body potassium deficit (e.g. Infantile pyloric stenosis and diabetic ketoacidosis): 5mmol/kg/day of potassium (or more) may be necessary, regardless of the initial serum potassium
- Standard premixed solutions containing potassium chloride (20mmol/1000mL for children over 1 month and 10mmol/500mL for neonates) are available throughout the hospital and should be used in the majority of patients except those with hyperkalaemia, renal impairment or significant oliguria. Do not administer potassium-containing fluids until there is urine production and serum potassium level is known.
- Where additional potassium is added to maintenance fluids: Potassium concentration should not exceed more than 40mmol/1000mL without approval of a senior doctor.
- Refer to the [Potassium Administration – SCH Practice Guideline](#) for prescription and administration requirements.

Glucose

- **Usual requirement Neonate:** Approximately 6-8mg/kg/minute
- **Older infants and children:** Approximately 4-5mg/kg/minute
- Most fluid regimen will not meet maintenance glucose requirements. Normal hepatic gluconeogenesis is therefore essential to avoid hypoglycaemia. 10% glucose at 2mL/kg/hour provides only 3.3mg/kg/min, so on the first or second day of life a higher concentration glucose solution may be required to maintain the blood glucose above 2.2mmol/L.

2.3 Monitoring

All dehydrated children or children on full maintenance IV fluids should be weighed prior to the commencement of therapy and at least daily thereafter.

Children on full maintenance IV fluids should have serum electrolytes checked before commencing the infusion and daily thereafter. More frequent electrolyte determination may be required according to individual circumstances and clinical progress.

Make sure that there are clear orders with respect to frequency and type of vital sign monitoring your patient requires and the upper and lower limits of the observations at which medical staff should be called to reassess the child.

3 Elective surgery in a relatively well child

3.1 Preoperative period

Children should have appropriate fasting. If these fasting rules are applied, no supplemental intravenous fluids should be required in the pre-operative period for well infants and children. This also applies to many children having urgent surgery, where abnormal fluid losses have not yet occurred.

An unwell dehydrated patient will need appropriate resuscitation and rehydration pre-operatively.

3.2 Intraoperative

Maintenance fluid may be continued as per this guideline. All acute and ongoing fluid losses must be replaced with appropriate fluids (0.9% sodium chloride, Hartmann's, colloids or blood products) according to the individual anaesthetist's decision. Glucose containing solutions should never be used for rapid volume replacement.

3.3 Postoperative period

Stress response to surgery often results in non-osmotic ADH secretion, increased water retention and a tendency towards hyperglycaemia. Also many children are relatively salt and water over-hydrated at the completion of surgery due to the volume of intravenous fluids given to counter the vasodilatation caused by general anaesthetic drugs and regional anaesthesia. Fluids containing low concentrations of sodium chloride should be used with caution in the immediate post-operative period (first day).

In children less than one month of age, use 0.45% sodium chloride + 10% glucose and in those one month or older use 0.9% sodium chloride + 5% glucose.

Each of these fluids should be given at reduced maintenance (approximately 80%) in the first 24 hours. Ongoing losses must also be replaced.

Supplemental potassium is usually not necessary in the first 24 hours and should not be commenced until urine is passed and a serum potassium level has been checked.

Re-evaluate the child's fluid requirements within 8 hours of initiation or change in fluid orders.

4 Unwell Medical or Surgical patients

Unwell children should be managed according to the following:

1. Treat SHOCK / HYPOVOLAEMIA
2. Replace DEFICIT / DEHYDRATION
3. Replace ONGOING LOSSES
4. Provide MAINTENANCE REQUIREMENT
5. Re-evaluate OFTEN

1. Clinically significant Shock/Hypovolaemia

- i. Treat neonates with 10mL/kg 0.9% sodium chloride IV then reassess
- ii. Treat children with 20mL/kg 0.9% sodium chloride IV rapidly then reassess; repeat if necessary. Exercise caution in children with suspected raised intracranial pressure, diabetic ketoacidosis or meningitis. Isotonic crystalloid solutions such as Hartmann's or Plasma-Lyte 148 may be administered as advised by the Specialist.
- iii. If the child requires more than 40 mL/kg of fluid resuscitation, consider blood and operative management in trauma, and inotropes (\pm ventilatory support) in sepsis. Consult with on-call Intensivist.

Do not include this fluid volume in any subsequent calculations.

2. Clinical Assessment of Deficit/Dehydration

DEFICIT: A child's fluid deficit in millilitres (mL) can be calculated following an estimation of the degree of dehydration expressed as percentage (%) of body weight.

Fluid deficit (mL) = wt (kg) x percent (%) dehydration x 10

Percent (%) Deficit/Dehydration	Symptoms and Signs
3%	Reduced urine output
5%	Tachycardia. Just detectable loss of skin turgor
7%	Obvious loss of skin turgor, reduced fontanelle tension, lassitude and/or restlessness
10%	Shock, marked tachycardia, prolonged capillary refill +/- hypotension

Note: Hypotension in children usually means severe dehydration.

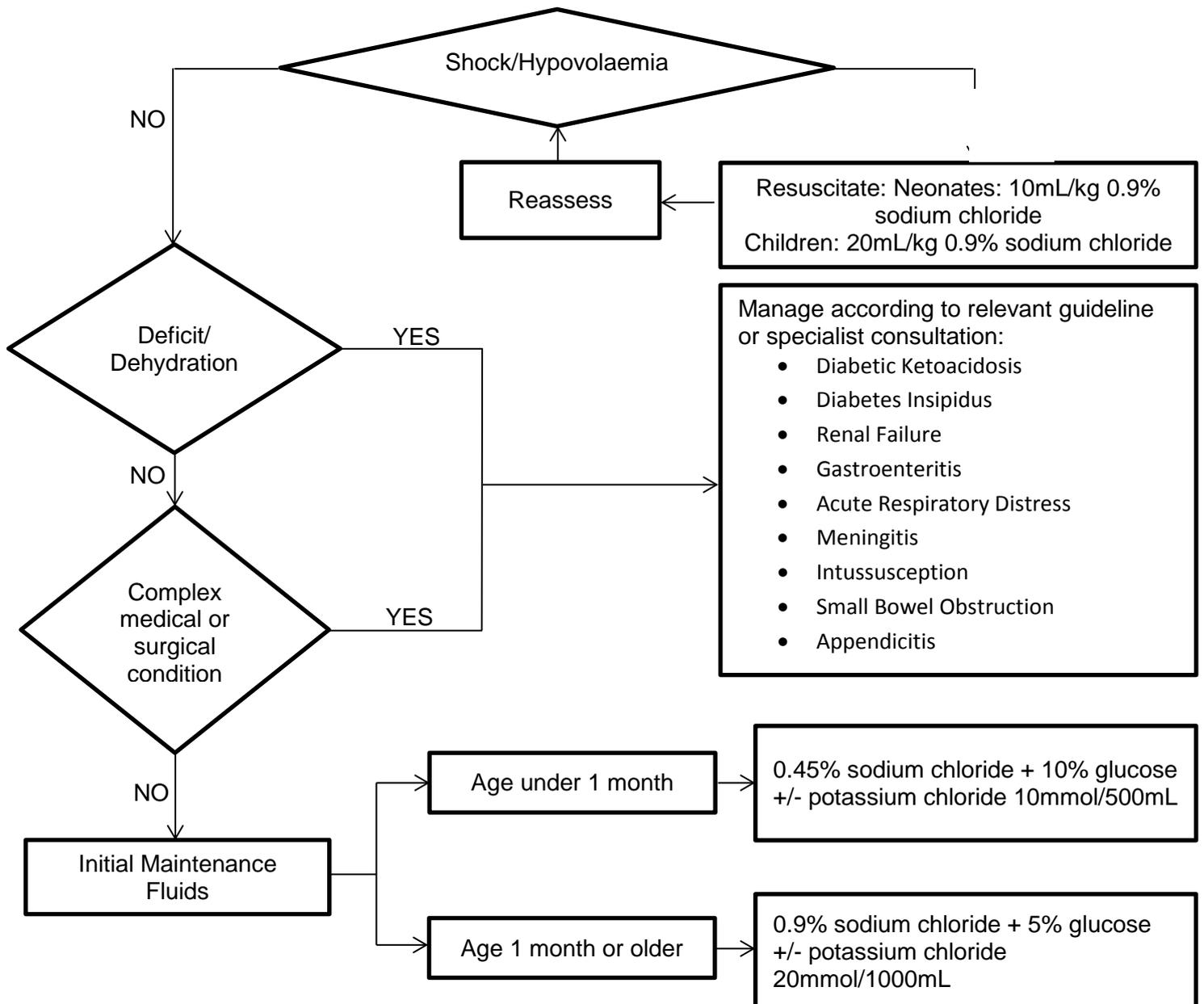
Precise calculation of fluid deficit due to dehydration using clinical signs is often inaccurate. The best method relies on the difference between the current body weight and the immediate pre-morbid weight. Other signs including irritability / lethargy, sunken eyes, dry mucous membranes, and sunken fontanelle have not been shown to be useful in mild-moderate dehydration. They may appear in more severe cases.

Once there has been correction of hypovolaemia, further deficit should be replaced over the next 24 hours.

3. Ongoing losses (eg from drains, vomiting, diarrhoea)

These are best measured and replaced. Calculations may be based on each previous hour, or each 4 hour period. For upper GIT losses use 0.9% sodium chloride + 5% glucose + potassium chloride 20mmol/1000mL.

5 Intravenous Fluids Flowchart



Do not add potassium until there is urine production and serum potassium level is known.

Children on full maintenance IV fluids should have serum electrolytes checked before commencing the infusion and **daily** thereafter.

Neonates should have blood glucose level checked initially and then 8 hourly when on maintenance fluids.

*Isotonic crystalloid solutions such as Hartmann's or Plasma-Lyte 148 + 5% glucose may be administered under direction of a Specialist.

6 References

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