

Paediatric IV Fluid replacement

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****Disclaimer - this guideline is currently only for Paediatric Medical patients****

Background

- Wherever possible, the enteral route should be used for fluids.
- Always use isotonic fluids in children due to risk of hyponatraemia
- In post-op and unwell children, and in certain illnesses, the physiological increase in secretion of ADH may result in hyponatraemia if too much or too hypotonic a fluid is given. Restrict fluid intake in these situations.
- If in doubt about how much / which fluid to prescribe, seek senior advice.
- Guideline based on NICE CG 29 Intravenous fluids therapy in children and NICE CG 84 Diarrhoea and vomiting caused by gastroenteritis in under 5s: diagnosis and management

Newborns (term babies up to 28 days old) are a special group who have different fluid requirements:

Day of life	Fluid requirements ml/kg/day
1	60
2	80
3	100
4	120
5 – 28	120 – 150

- ❖ Use 0.9% Saline with 5 – 10% glucose unless critically unwell
- ❖ If critically unwell e.g. respiratory distress syndrome, meconium aspiration, hypoxic ischaemic encephalopathy, give no or minimal sodium until postnatal diuresis with weight loss occurs.
- ❖ Monitor blood sugar levels at least 6 hourly and U&Es at least 24 hourly
- ❖ In dehydrated or hypernatraemic neonates, type and quantity of fluids may need to be altered – see **below** for guidance, and seek senior advice.

Other special circumstances:

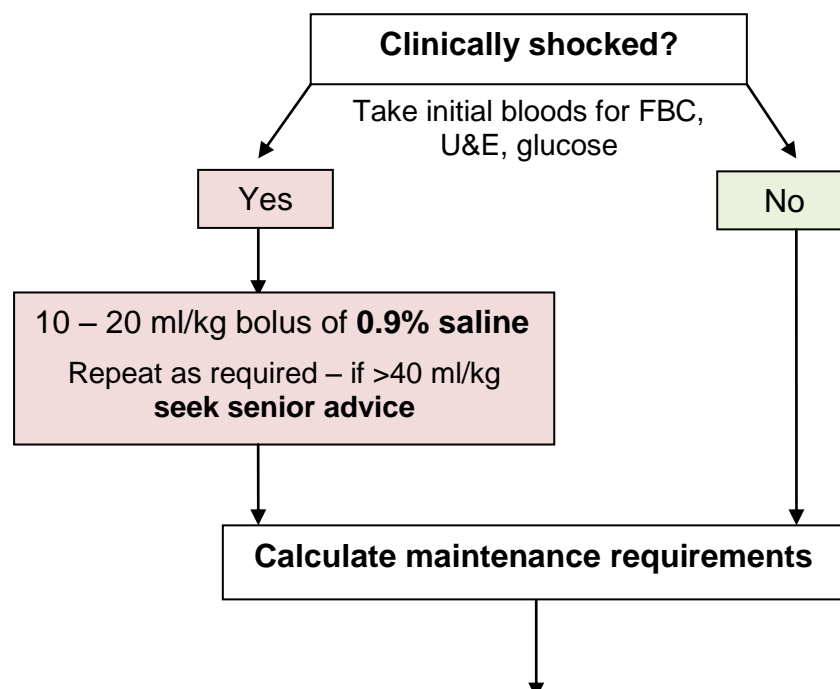
- Mechanical ventilation with humidified oxygen - 75% maintenance should be used
- Diabetes Insipidus - discuss with senior
- Renal / cardiac patient - discuss with senior
- DKA and burns - see separate guidelines

Administration of IV fluids > 1 month of age

Assessing dehydration and shock

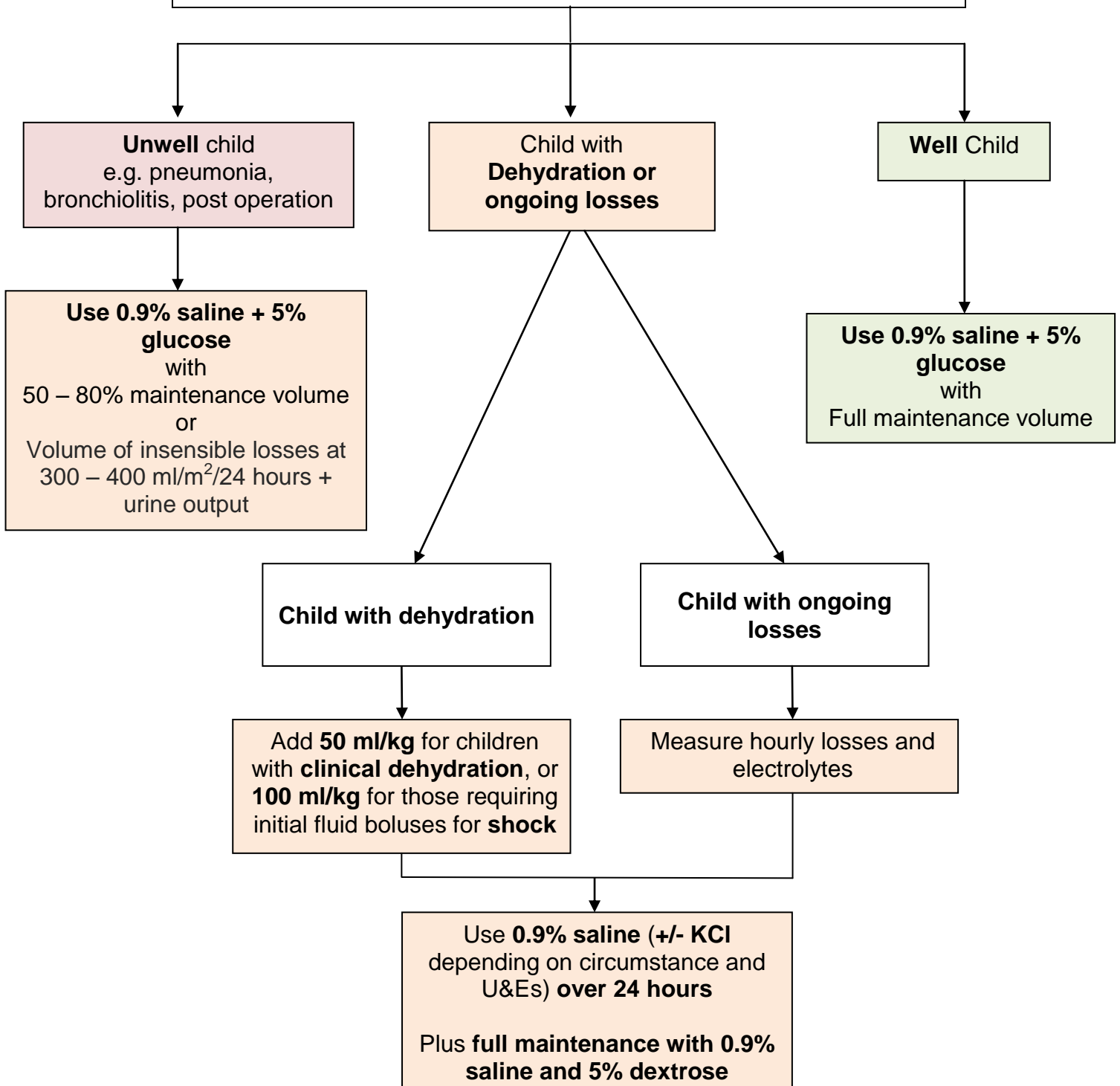
	No clinically detectable dehydration <5% dehydrated	Clinical dehydration 5-10% dehydration	Hypovolaemic shock > 10% dehydrated
Consciousness	Alert and responsive	Irritable / lethargic	Decreased level of consciousness
Appearance	Appears well	Appears to be unwell or deteriorating	
Eyes	Normal	Sunken	
Mucous membranes	Moist	Dry	
Breathing pattern	Normal	Tachypnoea	Tachypnoea
Perfusion	Normal CRT, normal peripheral pulses, warm extremities, normal skin colour	Normal CRT, normal peripheral pulses, warm extremities, normal skin colour	CRT >2 seconds, weak peripheral pulses, cold extremities, pale or mottled skin
Heart rate	Normal	Tachycardic	Tachycardic
Blood pressure	Normal	Normal	Hypotension
Skin turgor	Normal	Decreased	Decreased with tenting
Urine	Normal urine output	Oliguric	Anuric

Fluid administration



Maintenance requirements:

Patient's weight	mls / day	mls / hour
3-10kg	100 x weight	4 x weight
10-20kg	1000 + 50 x (weight-10)	40 + 2 x (weight-10)
>20kg	1500 + 20 x (weight-20)	60 + 1 x (weight-20)
100mls/hour or 2500mls/day is the maximum		



Monitoring and documentation for children receiving IV fluids:

Essential monitoring:

1. Daily weights
2. Daily U&Es and glucose
3. Urinary electrolyte concentrations
4. Fluid input, output and balance over 24 hours with types and volumes of fluid input and output (urine, gastric, other), recorded hourly and with running totals
5. **12 hourly reassessments of:**
 - Fluid prescription
 - Current hydration status
 - Whether oral fluids can be started
 - Urine and other outputs

Document

- Details of any ongoing losses
- Calculations of fluids for maintenance, replacement, redistribution and resuscitation

Specific electrolyte abnormalities

1. Hyponatraemia (Mild 130-135mmol/L, Mod 125-130mmol/L, Severe <125mmol/L)

- Assess the patient. The symptoms of hyponatraemia are predominantly neurological: headache, nausea / vomiting, lethargy, confusion, irritability, hyporeflexia, decreased conscious state and seizures.

If SYMPTOMATIC, this is a **medical emergency**.

- Resuscitate (ABC) and anticonvulsants as indicated.
- Call for senior help and notify HDU
- Use 3% NaCl 2 - 3ml per kg (maximum 100 ml) over 10 – 15 min (1 ml/kg of 3% saline will raise serum Na by 1 mmol/L)
- Measure serum sodium after first bolus. Repeat up to 3 times if required.
- After the seizures have resolved, the total sodium correction (including the bolus) should not exceed 12 mmol/L per day.
- Measure electrolytes every hour until stable, then every 4-6 hours until the serum sodium is normal and the child is off intravenous fluids

- If asymptomatic, assess the child's hydration status:
 - Active correction not necessary
 - Allow the plasma sodium concentration to rise by no more than 12 mmol/L per day using the guidelines below, based on hydration state.

1. The child with normal or increased volume status

- Restrict maintenance fluids to 50% of requirements to slowly remove the increased body water
- Do not use hypotonic solutions – give 0.9% saline with 5% dextrose if intravenous fluids necessary

2. The child with moderate dehydration and serum sodium 130-135mmol/L

- Try oral or nasogastric rehydration – calculate maintenance and deficit requirements as above
- If NG rehydration is not possible or results in a too rapid fall in sodium give intravenous 0.9% NaCl with 5% dextrose

3. The child with severe dehydration or dehydration with serum sodium <130mmol/L

- Give intravenous 0.9% NaCl with 5% dextrose until the child can take enteral feeds calculating maintenance and deficit as above.
- Measure electrolytes every 4 hours until stable

2. Hypernatraemia (>145mmol/l)

- Avoid rapid correction as this may cause cerebral oedema, convulsion and death.
- Aim for correction of deficit over 48 hours and a fall of serum Na concentration < 12 mmol/L per 24 hours
- If intravenous fluids used, give 0.9% saline to ensure the drop in sodium is not too rapid.
- Remember to also give maintenance and replace ongoing losses following recommendations above.
- Consider switching to 0.45% saline with 5% glucose if there is no dehydration or replacing deficit does not resolve hypernatraemia.
- Repeat U&E every 4 hours until stable.

NEONATAL hypernatraemia:

- ❖ See specific neonatal guidelines
- ❖ Consider increasing maintenance fluid volumes to 150-180 ml/kg/day and switch to 0.9% sodium chloride with 5% dextrose according to degree of dehydration and sodium levels.
- ❖ Always seek senior advice in this circumstance.

Appendix

Features of Commonly used Intravenous Fluids in the UK

Solution	Osmolarity (mOsmol/L)	Sodium content mequiv/L)	Osmolality (compared to plasma)	Tonicity (with reference to cell membrane)
Sodium chloride 0.9% with glucose 5%	586	150	Hyperosmolar	Isotonic
Sodium chloride 0.9%	308	154	Isomolar	Isotonic
Sodium chloride 0.45% with glucose 5%	432	75	Hyperosmolar	Hypotonic
Glucose 5%	278	-	Isomolar	Hypotonic
Glucose 10%	555	-	Hyperosmolar	Hypotonic
Hartmann's *	278	131	Isomolar	Isotonic
4.5% human albumin solution	275	100-160	Isomolar	Isotonic