

PREVENTION OF HYPONATRAEMIA IN CHILDREN RECEIVING INTRAVENOUS FLUIDS

INTRODUCTION

- Hyponatraemia most often reflects failure to excrete water. Stress, pain and nausea are all potent stimulators of anti-diuretic hormone (ADH), which inhibits water excretion.
- Hyponatraemia is potentially extremely serious, a rapid fall in sodium leading to cerebral oedema, seizures and death.
- Complications of hyponatraemia most often occur due to the administration of excess or inappropriate fluid to sick children, usually intravenously, but potentially with excess dilute oral fluids.
- Hyponatraemia can occur in a variety of clinical situations, even in children who are not overtly "sick". Those at particular risk include:
 - Post-operative patients.
 - CNS injuries
 - Bronchiolitis
 - Burns
 - Vomiting

BASELINE ASSESSMENT

Before starting IV fluids:

- **Weight:** accurately in kg. [In a bed-bound child use best estimate.] Plot on centile chart or refer to normal range.
- **U&E:** take serum sodium into consideration.
- **Fluid needs:** calculate accurately including:

Maintenance Fluid

100mls/kg for first 10kg body weight plus
50mls/kg for the next 10kg body weight plus.
20mls/kg for each kilo thereafter, up to max

[This provides the total 24 hr calculation, divide by 24 to get the mls/hr].

Replacement Fluid

Must always be considered and prescribed separately.

Must reflect fluid loss.

Must replace loss with most appropriate fluid.

MONITOR

- **Clinical state:** including hydrational status. Pain, vomiting, general well-being should be documented.
 - **Fluid balance:** must be assessed at least daily by an experienced member of clinical staff.
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- ~~Intake. All oral fluids (including medicines) must be recorded and IV intake reduced by equivalent amount.~~

Output: Measure and record all losses (urine, vomiting, diarrhoea, etc.) as accurately as possible

- **Biochemistry:** Regular blood sampling for U&E may be difficult but remains essential.
- At least once a day but more often if there are significant fluid losses or if clinical course is not as expected.
- The rate at which Na⁺ falls is as important as the actual plasma level. A Na⁺ that falls quickly may be accompanied by rapid fluid shifts with major clinical consequences.
- Consider using an indwelling heparinised cannula to facilitate repeat U&Es.
- Do not take sample from the same limb as the IV infusion.
- Capillary samples are adequate if venous sampling is not practical.
- **Urine osmolarity/Na:** Very useful in hyponatraemic. Compare to plasma osmolarity (measure or calculate: $= 2\text{Na} + 2\text{K} + \text{glucose} + \text{urea}$)

Urine Osm	Urine Na	
<200	>40	H ₂ O excretion. Appropriate response to hypotonic fluid excess. Normal situation
>300	<20	H ₂ O conservation. Appropriate response to ↓ circulating volume/dehydration.
>300	>40	H ₂ O conservation. Inappropriate response to normal circulating volume (ie SIADH).

(Intermediate values less easy to interpret. Not valid in diuretic Rx, renal, thyroid or adrenal disease)

- Hyponatraemic complications are most likely with last pattern ie H₂O retention in setting of good hydration.

CHOICE OF FLUID

Fluid and electrolyte requirements vary as a function of metabolic activity.

- The choice of maintenance fluids will be influenced by anticipated sodium, potassium and glucose requirements.
- The choice of replacement IV fluids will depend on replacement needs, eg fluid loss for vomiting etc.

Hyponatraemia may occur in children receiving any IV fluid. Vigilance is needed for all children receiving fluids.

SEEK ADVICE

Advice and clinical input may be obtained readily from a senior member of medical staff including:

Consultant Paediatrician
Consultant Anaesthetist
Consultant Chemical Pathologists

- In the event of problems that cannot be resolved locally, help should be sought from consultant paediatricians/anaesthetists at the PICU, RBHSC.

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