

Fatal case of hyponatraemia in Altnagelvin Hospital

- A healthy child who should have had an uneventful recovery died under our care
- The cause of death was brain swelling brought about by a condition called hyponatraemia (low sodium)
- This was caused by a very rare idiosyncratic reaction to surgery and concomitant therapy with fluid having a low sodium content
- Such a case has happened before in N Ireland, and although there are cases in the literature, this was not generally known. This condition occurs more commonly in children and particularly girls
- The practices in Altnagelvin were the same as the majority of other hospitals treating children
- If we had known, it could probably have been avoided!

Following the death a critical incident investigation was commenced and other hospitals immediately alerted (13.6.01)

Action

Notification of Chief Medical Officer

background information on hyponatraemia

revision of fluid policy

information to medical & nursing staff

revision of charting fluid balance

Meeting with the family

apology and condolences

explanation of the events

a promise to rectify the procedures, which were common practice but which had allowed this tragedy to occur

AT RISK OF HYPONATRAEMIA

INTRODUCTION

- Any child on IV fluids or oral rehydration is potentially at risk of hyponatraemia.
- Hyponatraemia is potentially extremely serious, a rapid fall in sodium leading to cerebral oedema, seizures and death. Warning signs of hyponatraemia may be non-specific and include nausea, malaise and headache.
- 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.
- Complications of hyponatraemia most often occur due to the administration of excess or inappropriate fluid to a sick child, usually intravenously.
- Hyponatraemia may also occur in a child receiving excess or inappropriate oral rehydration fluids.
- Hyponatraemia can occur in a variety of clinical situations, even in a child who is not overtly "sick". Particular risks include:
 - Post-operative patients
 - CNS injuries
 - Bronchiolitis
 - Burns
 - Vomiting

BASELINE ASSESSMENT

Before starting IV fluids, the following must be measured and recorded:

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

FLUID REQUIREMENTS

Fluid needs should be assessed by a doctor competent in determining a child's fluid requirement. Accurate calculation is essential and includes:

Maintenance Fluid

- 100mls/kg for first 10kg body wt. plus
- 50mls/kg for the next 10kg, plus
- 20mls/kg for each kg thereafter, up to max of 70kg. [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 in both volume and composition (lab analysis of the sodium content of fluid loss may be helpful).

CHOICE OF FLUID

- Maintenance fluids must in all instances be dictated by the anticipated sodium and potassium requirements. The glucose requirements, particularly of very young children, must also be met.
- Replacement fluids must reflect fluid lost. In most situations this implies a minimum sodium content of 130mmol/l.
- When resuscitating a child with clinical signs of shock, if a decision is made to administer a crystalloid, normal (0.9%) saline is an appropriate choice, while awaiting the serum sodium.
- The composition of oral rehydration fluids should also be carefully considered in light of the U&E analysis.

Hyponatraemia may occur in any child receiving any IV fluids or oral rehydration. Vigilance is needed for all children receiving fluids.

MONITOR

- Clinical states: including hydration status. Pain, vomiting and general well-being should be documented.
- Fluid balance: must be assessed at least every 12 hours by an experienced member of clinical staff.

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.

If a child still needs prescribed fluids after 12 hours of starting, their requirements should be reassessed by a senior member of medical staff.

- Biochemistry: Blood sampling for U&E is essential at least once a day - more often if there are significant fluid losses or if clinical course is not as expected.

The rate at which sodium falls is as important as the plasma level. A sodium 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 samples from the same limb as the IV infusion.

Capillary samples are adequate if venous sampling is not practical.

Urine osmolality/sodium: Very useful in hyponatraemia. Compare to plasma osmolality and consult a senior Paediatrician or a Chemical Pathologist in interpreting results.

SEEK ADVICE

Advice and clinical input should be obtained from a senior member of medical staff, for example a Consultant Paediatrician, Consultant Anaesthetist or Consultant Chemical Pathologist.

- In the event of problems that cannot be resolved locally, help should be sought from Consultant Paediatrician/Anaesthetists at the PICU, RBHSC.