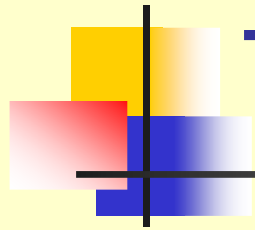




Managing the Risks of Hyponatremia from IV Fluids in Children

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Traditional IV Fluid Guidelines

- Guidelines still in use originated with Holliday and Segar in 1957



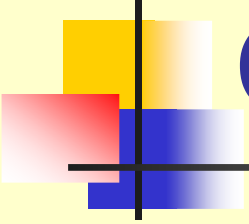
Traditional IV Fluid Guidelines

- These result in IV fluids – especially for the “maintenance” component - that are:
 - Relatively generous in volume
 - Hypotonic with respect to serum



Risks of Traditional IV Fluid Guidelines

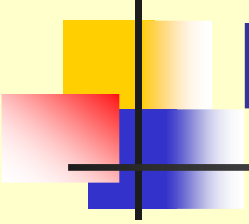
- Growing concerns about risks from traditional IV fluid prescribing
- Numerous reports of death or permanent brain damage – when serum sodium falls rapidly, causing brain swelling – due to inappropriate IV fluids



Risks of Traditional IV Fluid Guidelines – Why?

- “SIADH” – Secretion of Inappropriate Anti Diuretic Hormone
- Occurs in most conditions that lead to a requirement for IV fluids
- Reduces body’s ability to excrete free water
- Serum sodium falls by dilution


Reducing Risks of IV Fluids – How?



- Most agree that “isotonic” solutions (sodium content close to serum) are best for “bolus” therapy and perioperative fluids
- Some controversies remain about “maintenance” requirements and what fluids are best


International Perspective

- UK National Patient Safety Agency issued nationwide "ALERT" March 2007



National Patient Safety Agency

Patient safety alert
22



Alert

28 March 2007

Reducing the risk of hyponatraemia when administering intravenous infusions to children

The National Patient Safety Agency (NPSA) is issuing advice to healthcare organisations on how to minimise the risks associated with administering infusions to children.

The development of fluid-induced hyponatraemia in the previously well child undergoing elective surgery or with mild illness may not be well recognised by clinicians. To date, the NPSA's National Reporting and Learning System (NRLS) has received only one incident report (that resulted in no harm), but it is likely that incidents have gone unreported in the UK.

Since 2000, there have been four child deaths (and one near miss) following neurological injury from hospital-acquired hyponatraemia (see definition on page 7) reported in the UK.¹⁻³ International literature cites more than 50 cases of serious injury or child death from the same cause, and associated with the administration of hypotonic infusions.⁴

Action for the NHS and the independent sector

The NPSA recommends that NHS and independent sector organisations in England and Wales take the following actions by 30 September 2007 to minimise the risk of hyponatraemia in children:

- 1 Remove sodium chloride 0.18% with glucose 4% intravenous infusions from stock and general use in areas that treat children. Suitable alternatives must be available. Restrict availability of these intravenous infusions to critical care and specialist wards such as renal, liver and cardiac units.
- 2 Produce and disseminate clinical guidelines for the fluid management of paediatric patients. These should give clear recommendations for fluid selection, and clinical and laboratory monitoring.
- 3 Provide adequate training and supervision for all staff involved in the prescribing, administering and monitoring of intravenous infusions for children.
- 4 Reinforce safer practice by reviewing and improving the design of existing intravenous fluid prescriptions and fluid balance charts for children.
- 5 Promote the reporting of hospital-acquired hyponatraemia incidents via local risk management reporting systems. Implement an audit programme to ensure NPSA recommendations and local procedures are being adhered to.

<p>For response by:</p> <ul style="list-style-type: none"> • All NHS and independent sector organisations in England and Wales <p>For action by:</p> <ul style="list-style-type: none"> • The chief pharmacist/pharmaceutical adviser should lead the response to this alert, supported by the chief executive, medical director, nursing director and clinical governance lead/risk manager 	<p>We recommend you also inform:</p> <ul style="list-style-type: none"> • Clinical governance leads and risk managers • Clinical directors – paediatrics and child health • Clinical directors – anaesthetics • Clinical directors – surgery • Directors of HFG laboratories • Medical staff • Nursing staff • Pharmacy staff • Patient advice and liaison service staff in England • Procurement managers 	<p>The NPSA has informed:</p> <ul style="list-style-type: none"> • Chief executives of acute trusts, primary care organisations, ambulance trusts, mental health trusts and local health boards in England and Wales • Chief executive/regional directors and clinical governance leads of strategic health authorities (England) and regional offices (Wales) • Healthcare Commission • Healthcare Response Wales <ul style="list-style-type: none"> • Medicines and Healthcare products Regulatory Agency • Business Services Centre (Wales) • NHS Purchasing and Supply Agency • Welsh Health Supplies • Royal colleges and societies • NHS Direct • Relevant patient organisations and community health councils in Wales • Independent Healthcare Forum • Independent Healthcare Advisory Services • Commission for Social Care Inspection
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NPSA Alert

- Alert was very prescriptive about *types* of IV fluids



NPSA Alert

- Recommended limiting availability of “hypotonic” solutions to special units such as ICUs.
- Specifically they limited the UK approximate equivalent to our “D5 1/4 normal saline”

The logo consists of a vertical black line and a horizontal black line intersecting at the center. To the left of the intersection, there are three overlapping squares: a yellow one at the top, a red one in the middle, and a blue one at the bottom. To the right of the intersection, there are two overlapping squares: a white one at the top and a blue one at the bottom.

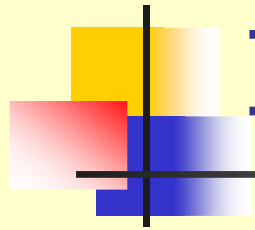
NPSA Alert

- Recommended isotonic IV fluids for most circumstances (Normal saline or equivalent of Ringer's Lactate)
- Allowed D5 0.45% NS (a mildly hypotonic solution) if child's serum sodium is normal, and child not at high risk of SIADH



NPSA Alert

- Other parts of the guidelines were more general, e.g. appropriate
 - Training of staff
 - Monitoring of children
 - Audits of hospital practice



International Perspective - US

- Harriet Lane Handbook notes controversy, but continues to recommend traditional approach
- Anecdotal practice has changed much less in the US than elsewhere



International Perspective - Canada

- Nova Scotia inquest of a death > 20 years ago!
- In April 2007 the Ontario Pediatric Death Review Committee (OPDRC) reported six deaths associated with hypotonic intravenous (IV) fluids.



International Perspective - Canada

- Report circulated to Chiefs of Pediatrics in major hospitals
- Report referred to guidelines from the Hospital for Sick Children



International Perspective - Canada

- The Canadian Medical Protective Association included case reports and an alert in its December 2008 newsletter



International Perspective - Canada

- ISMP Canada Safety Bulletin (October 27 2009)
- Hospital-Acquired Acute Hyponatremia: Two Reports of Pediatric Deaths

ISMP Canada

Recommendations

- “Ensure that guidelines for fluid and electrolyte therapy are aligned with the regional pediatric referral centre within the province or territory”



ISMP Canada Recommends these Guidelines Include:

- the optimal choices for parenteral solutions and rates of administration;
- the circumstances under which hypotonic solutions may be used;



ISMP Canada Recommends these Guidelines Include:

- the minimum requirements and frequency for:
 - monitoring serum electrolytes,
 - accurate measurement of all sources of intake and output (during every shift, and with an ongoing cumulative balance)



ISMP Canada Recommends these Guidelines Include:

- early involvement of the most responsible physician in cases where fluid intake greatly exceeds urine output;
- how to identify, treat, and monitor patients with electrolyte disorders such as hyponatremia
 - (e.g., specify when additional monitoring such as measurement of urine osmolarity and urine electrolytes are required);
- criteria for expert consultation.



What is the role for CAPHC Patient Safety Collaborative?

- Monitoring patient safety risks from IV fluids
- Addressing ISMP Canada's recommendations that small hospitals get guidelines from major regional centres?

Monitoring Risks - Canadian Paediatric Trigger Tool



- Current lab module includes Na < 120 as a trigger
- Standard definition for acute hyponatremia: fall from normal (135-145) to <130 within 48 hours or less
- <120 is typical for patients who have died – too severe to be helpful as a “trigger”



Canadian Paediatric Trigger Tool

- Can definition for hyponatremia be changed at this stage?
- Need to consider trigger for hypernatremia as well
 - Concerns remain about isotonic solutions leading to hypernatremia
 - Neonates are most susceptible to this – most guidelines don't address this well



Role for Collaborative re ISMP Canada Recommendations

- “Regional pediatric referral centres \approx CAPHC centres
- Addressing ISMP Canada’s recommendations seems an appropriate task for the CAPHC Patient Safety Collaborative



Role for Collaborative re ISMP Canada Recommendations

- Do all “regional pediatric referral centres” have guidelines?
- Do those guidelines match ISMP’s criteria?
- Are those guidelines in a form useful for smaller centres?



Possible content for “uniform” guidelines

- Suggestions are adapted from the Hospital for Sick Children guidelines as published in 2009 Handbook, and web site



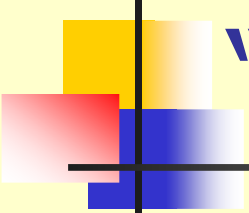
Possible content for “uniform” guidelines

- Very close monitoring of patients receiving intravenous fluids, to include, prior to start of IV therapy, and at least daily thereafter: electrolytes, “ins and outs,” and weight.



Possible content for “uniform” guidelines

- Individualized prescribing of amounts and types of solutions depending on a detailed review of patient hydration status, ongoing losses, and other factors.



Possible (partial) content for “uniform” guidelines

Types of fluids (if > 1 months gestational age):

- Use of isotonic solutions for most circumstances
- Use of solutions with 0.45% normal saline acceptable for maintenance fluids
 - if serum sodium is ≥ 138
 - clinical condition has relatively low risk of SIADH
- Limit very hypotonic solutions (D5 1/4, or “2/3 – 1/3,”) to specific circumstances (e.g. renal loss of free water), with appropriate consultation



Possible content for “uniform” guidelines

- Guidelines for amounts of fluids are clearly important
- Available guidelines address this in background discussion, but not always in the formal “guideline” section
- “Amount” guidelines are harder to specify because prescribing is so individual



Possible content for “uniform” guidelines

However, consider:

- Requiring a maximum total fluid intake order on all patients receiving IV fluids, to address risks due to combined IV plus enteral fluids, or multiple IV fluids for different purposes.
- Defining limits for 12 hour positive or negative fluid balances to ensure a physician is called to reconsider fluid and electrolyte management.



Possible content for “uniform” guidelines

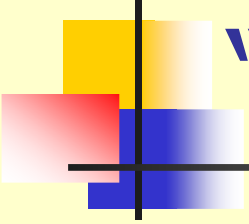
Define when monitoring is not necessary, to prevent guidelines from being too burdensome:

- Day surgery if IV discontinued at end of the case
- Minimal IV fluids (e.g. for medication)
 - HSC suggests if IV < 1/2 “maintenance”
 - However, 1/2 maintenance may be maximum tolerated fluid if severe SIADH



Possible content for “uniform” guidelines

- Guidelines stating “not applicable in the Neonatal Care Unit” are not helpful
- Need age criteria
 - NPSA suggests one month
 - Presumably this should be corrected for gestation!
- This needs more work – perhaps intermediate criteria from one to two months corrected age?



Other considerations for “uniform” guidelines

- How are guidelines “enforced”?
 - Limiting availability of specific fluid types relatively simple
 - Defining which fluids should be used when – and amounts – not so straightforward



Where to start?

- Is there interest? If yes,
- Which CAPHC centres have formal guidelines?
 - On what points do these agree
 - On what points do they differ?



Where to start?

- Are guidelines audited or enforced in some way?
- How does this occur?



Where to start?

- For centres without existing guidelines - don't reinvent the wheel!
- Consider role of CAPHC centres with respect to local hospitals in their regions



THANK YOU!

- Comments or questions?