‘NICE-otonic’ Fluids:
Isotonic Maintenance IV Fluids in Infants Under 3 Months: A Quality Improvement Project

Oxford University Hospitals

Apphia Bunting (FY2)
Janith Chandrakumara (Consultant)
Rhiannon Furr (Consultant)
Andrew Marshall (Consultant)

Introduction

Historically, IV maintenance fluids included 0.18% saline +/- dextrose (severely hypotonic). Following reports of fatal iatrogenic hyponatraemia and an MHRA alert[1], this was largely replaced by 0.45% saline +/- dextrose (also hypotonic). Evidence still demonstrated an association with hyponatraemia, prompting NICE[2] to recommend 0.9% saline +/- dextrose as standard for all children, including most term neonates. Local compliance with this was known to be low, partly due to concerns about hypernatraemia in young infants on 0.9% saline. The aforementioned evidence[3-5] largely excluded infants < 3 months except one study[6] which *did* find an increased risk of hypernatraemia in neonates on 0.9% saline.

Methods

Data were obtained from the electronic patient record system, for infants < 3 months in Oxford (tertiary) or Banbury (DGH) paediatric wards. We excluded neonatal wards, critical care and ED. Maintenance fluid prescriptions and sodium levels (within 24hrs) were analysed during three data collection periods, identifying any hyponatraemia (<135) or hypernatraemia (>145). After collecting baseline data (Apr 2015-Jul 2016), local guidelines were updated and promoted through team meetings. Following a second period of data collection (Jan-Oct 2017), an electronic prescription ‘Powerplan’ was created to make isotonic fluids the default, before final data collection (Oct 2017-Aug 2018).

Quality Improvement Cycles & Results

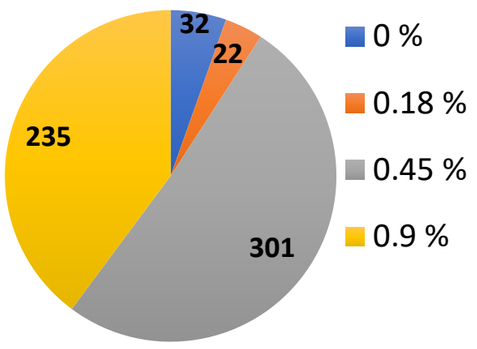
Aims:
- Encourage and audit NICE-adherence
- Address concerns of hypernatraemia in small infants

Audit
- 40% prescriptions were isotonic (235/590)

See Baseline Data →

Actions:
- Updated local guidelines
- Disseminated at team meetings / teaching
- Ensured ward stocks of isotonic fluids

Baseline Data



No. Prescriptions + NaCl %

- 12 incidents of hyponatraemia:
  - 11 of them after hypotonic fluids
    - 2 of these had Na < 130
- 4 incidents of hypernatremia
  - All while on hypotonic fluids

Hypo-/Hyper-natraemia

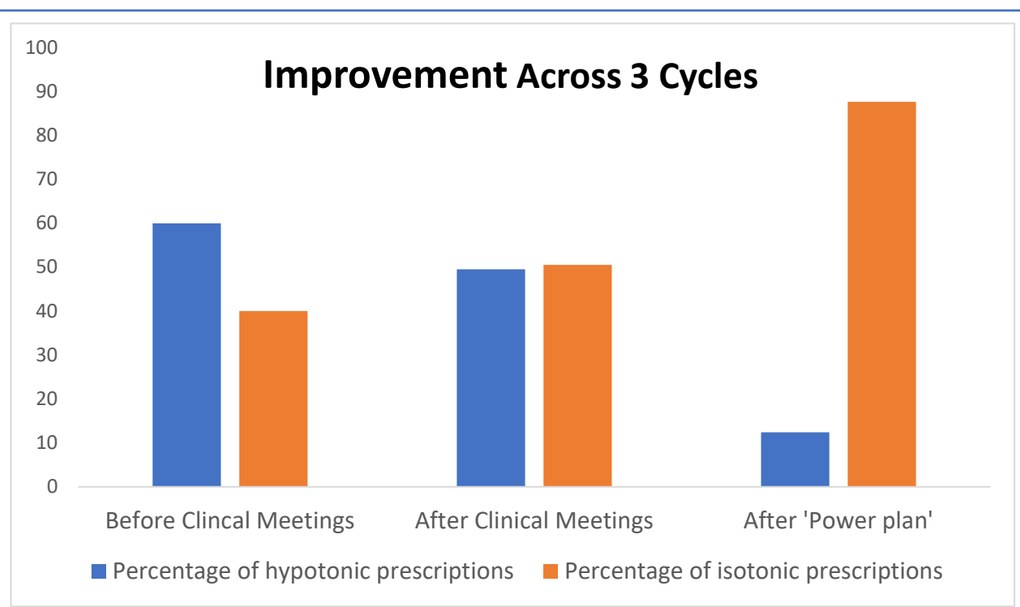
Aim:
- Assess change in practice
- Monitor for potential iatrogenic hypernatraemia

Audit
- 51% prescriptions were isotonic (49/97)
- 1 incident of hyponatraemia, 1 of hypernatraemia. Both after hypotonic fluids

Actions:
- Isotonic fluids made default on e-prescribing

Aim:
- As in 2nd cycle

Audit
- 88% prescriptions were isotonic (156/178)
- No iatrogenic hypo- or hyper-natremia



- Guideline adherence **(orange)** improved marginally following dissemination via ‘clinical meetings’: **40 → 51 %**
- Improvement was more substantial following introduction of an e-prescribing default (‘PowerPlan’): **51 → 88 %**

Conclusions

- Isotonic fluid usage increased significantly following a system-targeted intervention: an e-prescribing ‘default’
- This had a much greater impact than encouraging individuals to adhere to evidence-based national guidelines
- Hypernatremia was rare, even in infants < 3 months. Changing standard maintenance fluids to 0.9% saline was not associated with a detectable increase in hypernatremia
- Hyponatraemia was much more common and – in keeping with previous literature – was associated with hypotonic fluids

Future Plans

- Since our latest QI cycle, *balanced* fluids have become increasingly available + promoted, and NICE have altered IV fluid recommendations to exclude neonates < 8 days old (Jun 2020)
- Future QI cycles will address these changes

References
1. National Patient Safety Agency (2007) Patient Safety Alert - Reducing the risk of hyponatraemia when administering intravenous infusions to children
2. www.nice.org.uk/guidance/ng29
3. Moritz, Michael L., and Juan C. Ayus. "Intravenous fluid management for the acutely ill child." *Current opinion in pediatrics* 23.2 (2011): 186-193.
4. McNab, Sarah, et al. "140 mmol/L of sodium versus 77 mmol/L of sodium in maintenance intravenous fluid therapy for children in hospital (PIMS): a randomised controlled double-blind trial." *The Lancet* 385.9974 (2015): 1190-1197.
5. Choong, Karen, et al. "Hypotonic versus isotonic maintenance fluids after surgery for children: a randomized controlled trial." *Pediatrics* 128.5 (2011): 857-866.
Wang, Jingjing, Erdi Xu, and Yanfeng Xiao. "Isotonic versus hypotonic maintenance IV fluids in hospitalized children: a meta-analysis." *Pediatrics*(2013): peds-2013.
6. Balasubramanian, Karthik, et al. "Isotonic versus hypotonic fluid supplementation in term neonates with severe hyperbilirubinemia–a double-blind, randomized, controlled trial." *Acta Paediatrica* 101.3 (2012): 236-241.