

post op fluid management in children; how much sodium?

Andrew Davidson 1,2,3

1. Anaesthesia Department, Royal Children's Hospital, Melbourne, Australia
2. Head, Clinical Research Development, Murdoch Children's Research Institute, Melbourne, Australia
3. Associate Professor, Department of Paediatrics, University of Melbourne, Melbourne, Australia

Giving maintenance intravenous fluid is probably the commonest medical intervention in hospitalised children. In spite of this the evidence base on which we base this therapy is extraordinarily poor. Unfortunately it is now well known that a significant number of children are dying or suffering significant injury due to cerebral oedema from iatrogenic hyponatraemia; children are relatively susceptible to cerebral oedema from hyponatraemia. The hyponatraemia develops due to the administration of significant volumes of hypotonic fluid in the setting of raised ADH secretion. ADH is raised with many acute illnesses and surgery – the exact setting where fluids are given.

The original recommended maintenance fluids for children contained 33mmol/L (0.18%) sodium given at the “4-2-1” rate. This was based by work published in 1957 in well children. The sodium was calculated from milk intake and the water from caloric requirements. These estimates are wrong – overestimating the amount of water needed and underestimating the amount of sodium needed. This realization, along with a series of deaths, led to firm recommendations to cease using very hypotonic fluids in children. Recommendations were only partly heeded and more children died. The most effective way to stop clinicians using solutions of 30 mmol/L in children has been simply to stop stocking it in children's hospitals! Although there is now good evidence that 33mmol/L of sodium should never be routinely used in children, it is what sodium concentration is ideal. As a somewhat arbitrary compromise 70mmol/L is considered better. There is now increasing evidence that 70mmol/L is still too isotonic. Recently there has been a shift to sodium concentrations closer to plasma (140 mmol/L) but there has been a reluctance to fully adopt this due to concerns over overhydration and hypernatraemia. These concerns may be unwarranted but the evidence base to firmly refute them is still poor. There is also a shift toward using a lower rate as total volume given may contribute to hyponatraemia as well as the tonicity. Importantly any child receiving IV fluids must have daily electrolyte assessment. This simply must override any concern about the distress associated with venepuncture.

IV solutions contain more than just sodium and water. There is also very little evidence to base decisions on optimal chloride, glucose and calcium. All have potential problems: hyperchloraemic acidosis, hyperglycaemia and incompatibility with medications. The relevance of these is also debated.