INTRAVENOUS FLUIDS
Supporting information

What is the optimal timing for adding sodium?

A randomised controlled trial involving 20 infants (Shaffer, 1989) concluded that administration of sodium "is probably unnecessary during the first few postnatal days" and that hypernatraemia could result from inappropriate supplementation.
Similar conclusions were reached by a prospective randomised trial in 17 infants (Costarino, 1992).
A recent review (Modi, 2004) recommended that maintenance sodium should be deferred until weight loss of approximately 6% has occurred.

Costarino AT, Gruskay JA, Corcoran L, et al. Sodium restriction versus daily maintenance replacement in very low birth weight premature neonates: a randomized, blind therapeutic trial. J Pediatr 1992;120:99-106

Modi N. Management of fluid balance in the very immature neonate. Arch Dis Child Fetal Neonatal Ed 2004;89:F108-11

Shaffer SG, Meade VM. Sodium balance and extracellular volume regulation in very low birth weight infants. J Pediatr 1989;115:285-90

Evidence Level: II (for no early administration of sodium)

What is the evidence for appropriate volume replacement on day 1,2,3, etc?

A Cochrane review of 4 trials involving a total of 414 infants (Bell, 2001) advises that fluid be restricted to amounts that meet physiological needs without allowing significant dehydration. This would typically result in a significantly lower risk of mortality (RR 0.52, 95% CI 0.28-0.96).
This amount must be flexible, taking into account ambient humidity and gestational/postnatal age, but would be in the range of 30-60 ml/kg/day plus estimated insensible water loss (Modi, 2004). Given adequate hydration, stepwise increments on subsequent days following birth should not be necessary unless accompanied by "a clinically relevant increase in nutrition" (Modi, 2004).

Bell EF, Acarregui MJ. Restricted versus liberal water intake for preventing morbidity and mortality in preterm infants. The Cochrane Database of Systematic Reviews 2001, Issue 3. Art. No.: CD000503

Modi N. Management of fluid balance in the very immature neonate. Arch Dis Child Fetal Neonatal Ed 2004;89:F108-11

Evidence Level: I

Can chronic lung disease, necrotising enterocolitis or patent ductus arteriosus (PDA) be caused by fluid overload, rather than inappropriate sodium supplementation?

There is evidence that a positive water and sodium balance with expansion of the extracellular space in preterm infants increases morbidity (Bell, 2001). In this Cochrane Review, restricted water intake significantly reduced the risk of PDA (RR 0.40, 95% CI 0.26-0.63, NNT 5.3) and necrotising enterocolitis (RR 0.30, 95% CI 0.13-0.71, NNT 11.9), although not of chronic lung disease (RR 0.80, 95% CI 0.56-1.14). A recent review (Lorenz, 2004) concluded that, based on a metaanalysis of 3 RCTs, higher fluid intakes did not significantly increase the risk of chronic lung disease. Findings from 2 RCTs on sodium supplementation were contradictory.

Bell EF, Acarregui MJ. Restricted versus liberal water intake for preventing morbidity and mortality in preterm infants. The Cochrane Database of Systematic Reviews 2001, Issue 3. Art. No.: CD000503

Lorenz JM. Fluid and electrolyte therapy and chronic lung disease. Curr Opin Pediatr 2004;16:152-6

Evidence Level: I

Should infants receiving phototherapy be given extra fluids?

Earlier studies of phototherapy (e.g. Wu, 1985) showed increased insensible water loss during the process. This led to recommendations for fluid supplementation in infants undergoing phototherapy, and a survey in 1996 (Hansen, 1996) recorded 74% of responding neonatal ICUs following this policy. Later studies have produced contradictory results, however, with some suggesting that the earlier findings may have been due to heat stress and that phototherapy in a thermally stable infant does not increase fluid loss (Kjartansson, 1992i &ii), and another recording a 20% increase in transepidermal water loss despite tight control of both skin temperature and relative humidity (Grunhagen, 2002). If these results are accepted, an increase in maintenance fluids of 0.35 mL/kg/h is indicated to correct the deficit.

Two further examples of the more recent studies (Maayan, 2001; Wananukul, 2001) agree with Grunhagen that fluid loss is increased, even in thermally stable infants.

A randomised study in 74 term neonates with severe hyperbilirubinaemia (Mehta, 2005) found that fluid supplementation decreased the rate of exchange transfusion (RR 0.30; 95% CI 0.14-0.66) and the duration of phototherapy (52 +/- 18 hours vs 73 +/- 31 hours; P = .004).

Grunhagen DJ, de Boer MG, de Beaufort AJ, et al. Transepidermal water loss during halogen spotlight phototherapy in preterm infants. Pediatr Res 2002;51:402-5

Hansen TW. Therapeutic approaches to neonatal jaundice: an international survey. Clin Pediatr 1996;35:309-16

Kjartansson S, Hammarlund K, Sedin G. Insensible water loss from the skin during phototherapy in term and preterm infants. Acta Paediatr 1992;81:764-8

Kjartansson S, Hammarlund K, Riesenfeld T, et al. Respiratory water loss and oxygen consumption in newborn infants during phototherapy. Acta Paediatr 1992;81:769-73

Maayan MA, Yosipovitch G, Hadad E, et al. Transepidermal water loss and skin hydration in preterm infants during phototherapy. Am J Perinatol 2001;18:393-6

Mehta S, Kumar P, Narang A. A randomized controlled trial of fluid supplementation in term neonates with severe hyperbilirubinemia. J Pediatr 2005;147:781-5

Wananukul S, Praisuwanna P. Transepidermal water loss during conventional phototherapy in nonhemolytic hyperbilirubinemia term infants. J Med Assoc Thai 2001;84(Suppl 1):S46-S50

Wu PY, Hodgman JE, Kirkpatrick BV, et al. Metabolic aspects of phototherapy. Pediatrics 1985;75:427-33

Evidence Level: II

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