Fluid requirements

Sick and low birthweight newborns start:

Day 1 10% dextrose iv
Day 2 10% dextrose plus calcium gluconate iv

TABLE 1
Suggested Daily Fluid Intake

DAY	ml/kg/day	
	BW > 1000g	BW < 1000g
1	60	80
2	90	110
3	120	140
4	150	160

This table is a starting point. The absolute requirements of water and electrolytes are difficult to predict for individual babies. Adjustments should include consideration of the baby's weight (including birth weight, current weight and age), urine output, serum electrolytes and urea, any current disorders such as asphyxia, RDS, meningitis or sepsis, and requirements for other losses.

TABLE 2
Water requirements in sick newborns

Factors Increasing Requirements: FactorsDecreasing Requirements:

-Radiant warmers. -Heat shields.
-Conventional single walled incubators. -Thermal blankets.
-Phototherapy. -Double walled incubators.
-Ambient temperature above thermal range. -High ambient humidity.
-Respiratory distress. -Humidification of warmed inhaled
-Elevated body temperature. endotracheal gas.
-Diuretic therapy. -Renal oliguria.
-Diarrhoea.
-Glycosuria (with osmotic diuresis).
Consider adding 30 ml/kg/day for each
- phototherapy
- overhead radiant heater

Fluids may need to be restricted in

babies with a significant PDA - decrease by one third
babies with birth asphyxia - decrease by one third
babies with renal failure - 30 ml/kg/day + urine output recalculated 8 hourly

When such changes are made, hydration and electrolyte balance should be assessed daily by some of the following: weight, 24 hour urine output, serum and urine electrolytes and osmolality or specific gravity.

10% Dextrose is used unless there is glycosuria (more than 1/4%) when 5% Dextrose is used. Once the sugar tolerance is resolved 10% Dextrose should be reintroduced.

SGA babies and hypoglycaemic babies who do not need to be restricted start at 90 ml/kg/day with 10% Dextrose (6.3 mg/kg/min). See hypoglycaemia protocol for use of higher Dextrose concentration regimes.

Fluids are calculated on birth weight until this has been regained and on actual weight thereafter

Calcium and Phosphate Supplements
CALCIUM
Premature formulae contain approx 75mg/100ml. at 150ml/kg/day the infant receives 115mg/kg/day. Preterm formulas therefore contain sufficient calcium.

PHOSPHATE
Unsupplemented breast milk contains approx 15 mg phosphorus/100ml (4.8mmol/litre). Additives are required to increase this to 30 mg/100ml

Electrolytes

Mineral requirements must be assessed regularly. In very sick infants with risk factors for hypernatraemia or hyperkalaemia (first week of life, ELBW, IVH), twice daily sodium and potassium may need to be monitored. Careful monitoring of urine output, urine specific gravity and the baby's daily weight are also needed for evaluation of fluid and electrolyte status.

An adequate sodium and phosphate intake is needed for efficient protein synthesis.

ELBW neonates, who are on prolonged TPN, are most at risk of phosphate deficiency. This is a major factor in the development of bone disease of prematurity. Hypophosphataemia and hypercalcaemia are early biochemical indications of phosphate deficiency.

To calculate additives it is assumed that the baby is nil by mouth initially and thereafter the maintenance fluids may be increased or decreased accordingly depending on tolerance of oral fluids.

Sodium Normal range 138 - 146 mmol/l

Requirements vary according to age

<30/40	5 mmol/kg/day
30-35/40	4 mmol/kg/day
>35-40	3 mmol/kg/day

'Maintenance fluids' = fluid requirements - volume from ia or extra iv infusions
= A (eg Dopamine etc)

All the daily supplements will be added to maintenance fluids A (line 1)

Na requirements (mmol/kg/day) = ... (3,4, or 5)
Na requirements (mmol/day) = ... (x wt (kg)
= X

Na obtained from arterial line = Ymmol
= 0.9 mmol if 0.45% saline @ 0.5 ml/hr
= 1.8 mmol if 0.45% saline at 1.0 ml/hr

Na to be added to fluids A = X - Y
= Z mmol

Na to be added to 500 ml bag = $\frac{500}{A} \times Z$
Dextrose (mmol)

NaCl 30% = 5 mmol in ml

Hypernatraemia

- if dehydration is present increase clear fluids by 25%
- if not dehydrated reduce supplementary sodium

Hyponatraemia

- consider appropriate investigations
- if patient is fluid overloaded reduce fluid intake by 25%
- if not and Na< 133 give supplementary sodium:
  Na supplement = (138 - serum sodium) x 0.6 x body weight (kg)
  This should be given in addition to the usual Na supplements

Potassium

Potassium requirements generally 2 mmol/kg/day
K to be added to fluids A (mmol) = 2 x wt (kg)
K to be added to 500 ml bag = $\frac{500}{A} \times 2 \times$ wt (kg)
Dextrose

15% KCL = 20 mmol in 10 ml

Hypokalaemia

- if serum potassium is < 3 mmol/l a supplement of 1 mmol/kg/day may be given.

Calcium

2.29 mmol/l +/- 0.27 in preterm infants in first week of life
1.6 - 2.3 mmol/l in term infants

Give maintenance calcium from day 2 in all sick and preterm infants 1 mmol/kg/day.

Supplement 1 mmol/kg/day only if corrected calcium < 1.8 mmol/l.
Corrected calcium = actual calcium + (0.025 (40 - serum albumin)).

Ca to be added to fluids A (mmol) = 1 x wt (kg)
Ca to be added to 500 ml bag = $\frac{500}{A}$ x wt (kg)
Dextrose (mmol)
1 mmol Ca is provided by 4.5 mls 10% calcium gluconate

Ca to be added to 500 ml bag = $\frac{500}{A}$ x wt x 4.5
Dextrose (mls 10% Ca gluconate)

Other
When replacing naso-gastric aspirates 0.9% saline is usually used with added potassium 1g to 500 ml NaCl.

Enhancing Lactation in Nursing Mothers

Breast feeding has well known benefits for both mothers and infants. Many of the mothers in the Neonatal Unit have to establish and maintain lactation by milk expression until their baby is fit to feed directly from the breast. We find that some mothers have problems providing sufficient milk to feed their baby successfully under these conditions. If, despite attempts to increase this with advice, support and encouragement, the milk supply is still insufficient then medical treatment with antidopaminergic drugs may be helpful.
Dopamine suppresses the excretion of prolactin from the anterior pituitary. By antagonising its action with antidopaminergic drugs the level of serum prolactin and hence breast milk production rise.
Metoclopramide has been used for this purpose and is recommended ini obstetric texts at doses of 10mg t.d.s. and its effect of enhancing milk lactation is well documented. In studies it has not caused significantly more side-effects than in mothers treated with placebo and no adverse effects have been noted in the infants. The levels of metoclopramide that infants (>1 month of age) are exposed to are less than the recommended daily dose (300 mcg/kg/day).
Domperidone has similar effects to metoclopramide in enhancing lactation. It has advantages over metoclopramide in that:

1. It is not an alkaline drug like metoclopramide and so does not have the same tendency to be concentrated in the acidic breast milk

	Serum drug level	**Breast milk level**
Metoclopramide 10 mg t.d.s.	17 - 76 ng/ml	28 - 157 ng/ml
Domperidone 10 mg t.d.s.	10.3 ng/ml	2.6 ng/ml

2. Domperidone does not cross the blood-brain barrier as readily as metoclopramide and is less likely to cause central side effects such as sedation and acute dystonic reactions.

3. In reference to Domperidone the BNF in Appendix 5 states that “the amount is too small probably to be harmful” but for Metoclopramide states that “although the amount in milk is small, avoid unless essential”.

We would recommend that Domperidone can safely be given to enhance lactation in mothers who wish to continue the benefits of breast feeding but have an insufficient supply when other measures have been unsuccessful.

- Treatment: Domperidone 10 mg tds orally for 10-14 days.

- Contra-indications: known history of neuroleptic malignant syndrome.

- Potential side effects: drowsiness, increased frequency and/or looseness of stool and abnormal movements.