HYPERNATRAEMIC DEHYDRATION

DEFINITION
In breast fed babies
- Serum sodium >145 mmol/L
  - mild: 146–149 mmol/L
  - moderate: 150–169 mmol/L
  - severe: >170 mmol/L

AIM
To prevent/treat hypernatraemic dehydration while encouraging breastfeeding

Other causes of hypernatraemia
- Diarrhoea
- Excessive perspiration
- Renal dysplasia
- Obstructive uropathy
- Osmotic diuresis
- Diabetes insipidus
- Idiopathic causes
- Infection (meningitis, encephalitis)
- Improperly mixed formula
- Sodium bicarbonate or sodium chloride administration

PREVENTION
Babies at high risk
- Born to primiparous women
- Maternal prolonged second stage of labour >1 hr
- Caesarean section with delayed initiation of feeding
- Maternal breast abnormalities (flat, inverted nipples)/surgery
- Use of labour medications
- Maternal illness, haemorrhage
- Preterm <37 weeks
- Maternal obesity
- Maternal diabetes

Action
- Identify babies at risk
- Immediate skin-to-skin contact at birth and breastfeed within 1 hr of life
- Offer breastfeeding assistance within 6 hr of life
- Ensure babies feed at least 6 times within 24 hr
- If baby reluctant to feed, express breast milk (see Breast milk expression guideline) and offer by cup or syringe
- Calculate required volume of feeds using local guidelines
- Avoid bottle feeding and dummies
- Avoid early discharge in at-risk babies
- Assess baby to ensure feeding adequate
  - assess feeding, number of wet nappies and stools using following table

Breast milk expression guideline

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### Symptoms and signs
- Lethargy
- Irritability: fussy or unsettled during breastfeeding
- Prolonged feeding >45 min
- Delayed change from meconium to transitional stools
- Demanding <6 feeds in 24 hr
- Reduced urinary frequency
- Weight loss
- Jaundice
- Tremor
- Increased tone
- Fever
- Doughy skin
- Seizures (usually during rehydration)
- Fullness of anterior fontanelle
- Physical examination can be unremarkable
  - usual signs (sunken fontanelle, reduced skin turgor) of dehydration can be absent

### Complications
- Venous and arterial thrombosis
- Subdural and capillary haemorrhage
- Cerebral oedema
- Seizures (especially following rehydration)
- Apnoea and bradycardia
- Cognitive and motor deficits
- Hypertension
- Cerebral infarction
- Death

### Investigations
- U&E
- Calcium
- Total bilirubin
- Blood glucose
- CRP
- Blood culture

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<table>
<thead>
<tr>
<th>Day</th>
<th>Wet nappies</th>
<th>Stool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–2</td>
<td>&gt;2/day</td>
<td>&gt;1/day</td>
</tr>
<tr>
<td>3–4</td>
<td>&gt;3/day</td>
<td>&gt;2/day, changing in colour and consistency</td>
</tr>
<tr>
<td>5–6</td>
<td>&gt;5/day</td>
<td>&gt;2/day, yellow in colour</td>
</tr>
</tbody>
</table>

- Weigh between 72 and 96 hr
- Refer all who have lost more than 10% weight
  - Weight loss % = weight loss (g)/birth weight (g) × 100
MANAGEMENT

Signs or symptoms of dehydration or clinical suspicion of hypernatraemia

Send blood for U&E

Mild hypernatraemia

- Manage in postnatal ward
- Put baby to the breast and encourage mother to express breast milk (EMB), see Breast milk expression guideline
- Top up baby with EBM/formula milk 100 mL/kg/day by cup or syringe
- Check U&E and calcium after 12 hr
- Monitor blood glucose as per Hypoglycaemia guideline
- Aim to establish breastfeeding and reduce top-up once sufficient EMB
- If Na+ returns to normal before sufficient EMB, liberalise feeds calculated according to local guidance

Oral feeds not tolerated
- Baby unwell
- Repeat U&E shows worsening hypernatraemia, moderate or severe hypernatraemia
- Associated hypocalcaemia

Admit to neonatal unit

Baby improving
- continue routine postnatal care

Routine postnatal examination
- Follow-up with GP and community midwife

Admit to neonatal unit

Send blood for U&E
Hypernatraemia 2011-13

**Baby admitted to neonatal unit**
- Examine and exclude other cause of hypernatraemia

**Moderate or severe hypernatraemia**
- Unwell baby
  - Signs of shock?
    - No
    - Resuscitate with 10 mL/kg sodium chloride 0.9%
  - Yes
    - Tolerate enteral feed
      - Start IV fluids 100 mL/kg/day
      - If blood glucose >2.5 mmol, use sodium chloride 0.9%
      - If blood glucose <2.5 mmol, use sodium chloride 0.45% and glucose 5% or 10%
      - Subtract resuscitation fluid from calculated maintenance fluid

**Mild hypernatraemia**
- Well baby
  - Put baby to breast
  - Top up with EBM/formula at 100 mL/kg/day via cup or syringe
  - If cup and syringe feeds not tolerated, pass NG tube and administer feeds (breast milk and/or formula milk)
  - If total enteral feeds not tolerated, give IV fluids to make up deficit

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**Wean off formula feeds or IV fluids on to breast or EBM as tolerated by baby**
- U&E and blood glucose 4-hrly
- Aim for rate of fall in Na⁺ of 0.5 mmol/L/hr. If Na⁺ falling any faster, reduce rate of rehydration
- If severe hypernatraemia, contact consultant
- If low blood glucose, see Hypoglycaemia guideline
- If renal failure or Na⁺ >170 mmol/L, discuss with paediatric nephrologist
- Monitor 4-hrly:
  - temperature
  - heart rate
  - blood pressure
- Keep strict fluid balance chart
- Monitor weight daily
- Aim to correct dehydration over 48–72 hr or slower in severe cases
- **Do not correct hyperglycaemia with insulin**, this can reduce plasma osmolality rapidly and precipitate cerebral oedema
- Once sufficient EBM, aim to establish breastfeeding and reduce top-up
- Neurodevelopmental follow-up for all babies with moderate and severe hypernatraemia
- Encourage mother to continue expressing breast milk in addition to breastfeeding