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 breast feeding

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
- Born to mothers with diabetes

Action
- Identify babies at risk
- Immediate skin to skin contact at birth and breast feed 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
<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>≥3/day</td>
<td>&gt;2/day, changing in colour and consistency</td>
</tr>
<tr>
<td>5-6</td>
<td>≥5/day</td>
<td>&gt;2/day, yellow in colour</td>
</tr>
</tbody>
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- Weigh between 72 and 96 hr
- Refer all who have lost more than 10% weight
- weight loss % = weight loss (g)/birth-weight (g) × 100

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
**MANAGEMENT**

- Signs or symptoms of dehydration
  - 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 Milk expression guideline
    - Top up baby with EBM/formula milk 100 mL/kg/day by cup or syringe
    - Check U&E after 12 hr
    - Check blood glucose and calcium
    - Aim to establish breastfeeding and reduce top-up once sufficient EMB
    - If Na+ returns to normal before sufficient EBM, liberate 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
Baby admitted to neonatal unit

Examine and exclude other cause of hypernatraemia

Moderate or severe hypernatraemia

- Unwell baby
- Signs of shock?
  - Yes
    - Resuscitate with sodium chloride 0.9% 10 mL/kg
    - Tolerate enteral feed
      - No
    - 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
    - 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 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

- No
  - Well baby
  - Tolerate enteral feed
    - Yes
      - 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
  - Wean off formula feeds or IV fluids on to breast or EBM as tolerated by baby

Mild hypernatraemia

- 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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