Dehydration in hospital admitted stroke patients

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Purpose
- Evaluate the causes of dehydration after stroke
- Assess how dehydration is measured
- Investigate the timing, frequency and risks factors
- Examine risks and benefits of hydration therapy

Dehydration is common after stroke
- 13% - 70% classified as dehydrated on admission to hospital
- Differences between studies:
  - Patient selection, study methods and the definitions and timing of measures of malnutrition/dehydration.
  - Lack of gold standard tests to determine nutrition/hydration status

Why?
- Difficulties with swallowing
- Weakness of limbs
- Inability to communicate
- Vision loss
- Increased confusion
- Reduced conscious level
- Unaware thirsty/hungry
- Hospital food/drink
- Lack of staff

Impact of dehydration
- Increases blood viscosity
- At risk of thromboembolism
- Associated with renal disease
- Potentially could reduce cerebral blood flow to potentially viable brain tissue
- Reduce the chance of a good clinical recovery

How is dehydration measured?
- Assessment of clinical signs
  - Skin turgor, sunken eyes, dry mouth
- Low cell volume
  - Headache, lethargy, confusion, dizzy
- Fluid intake/output
- Blood tests
- Bioelectrical impedance
- Change in body weight
- Urine indicators
**Hydration in Stroke Study (HISS):**
a pilot study (n=20) to assess if urine specific gravity and colour charts are useful indicators of dehydration

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**Results**

- Practical difficulties to collect urine samples
- Poor agreement between different measures of urine (USG and Ucoil) compared to blood test (urea-creatinine ratio) indices of hydration
  - Test strips underestimate dehydration compared to refractometer USG
  - Colour chart (Ucoil) over-estimates dehydration
  - USG/Ucoil do not provide an early warning of impending dehydration when compared to blood indices of hydration (U:C ratio).
- Research is needed to develop a simple nurse led tool for early detection of dehydration

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**Cochrane Review of Diagnostic Test Accuracy of impending dehydration in older people**

- Includes 24 data sets (3412 participants, including stroke)
- Reference standard = plasma osmolality
- No clear evidence for use of any single sign of impending dehydration in 67 tests/signs
- Promising combined clinical signs
  - missing drinks between meals & expressing fatigue (sensitivity = 71%, specificity=92%)
- Lack of evidence
  - urine indices (USG, Ucoil), fluid intake, heart rate, dry mouth, feeling thirsty and bioelectrical impedance

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**Dehydration: timing, frequency, risk factors**

- 2591 stroke patients
- 19,503 routine blood urea and creatinine (U:C) ratio results
- Median 4 tests per patient
- Median length of admission 17 days
- Severe dehydration (U:C >80mmol)
  - 927 (36%) dehydrated on hospital admission
  - 1606(62%) dehydrated at some point during admission
  - 998 (39%) dehydrated >2 tests

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**Dehydration: timing & pattern of blood testing**

- The number of blood tests per patient depends on length of stay and stroke severity
- Proportion of patients who had blood tested compared to total still in hospital reduces over time
  - (day 0 = 92% versus day 30 = 18%)
  - More tests showing dehydration between days 11-30 (60%) versus days 1-10 (49%)

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**Nurses judgement**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Dehydrated Median (IQR)</th>
<th>Hydrated Median (IQR)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Indices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood U/C ratio mmol/mmol (&gt;40)</td>
<td>105 (72, 122)</td>
<td>62 (51, 94)</td>
<td>0.02</td>
</tr>
<tr>
<td>Blood Sodium mmol/L (&gt;145)</td>
<td>142 (139, 144)</td>
<td>138 (135, 140)</td>
<td>0.01</td>
</tr>
<tr>
<td>Plasma Osmolality mOsm/kg (&gt;300)</td>
<td>308 (298, 312)</td>
<td>298 (296, 303)</td>
<td>0.04</td>
</tr>
<tr>
<td>Urine Indices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test strip USG (&gt;1.020)</td>
<td>1.020 (1.000, 1.035)</td>
<td>1.010 (1.005, 1.015)</td>
<td>0.30</td>
</tr>
<tr>
<td>Refractometer USG (&gt; 1.020)</td>
<td>1.022 (1.000, 1.032)</td>
<td>1.014 (1.011, 1.019)</td>
<td>0.09</td>
</tr>
<tr>
<td>Median Ucoil (IQR) (&gt;4)</td>
<td>6 (4, 7)</td>
<td>5 (3, 6)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

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Hopper et al, 2014 Cochrane database of systematic reviews
Dehydration: stroke severity and other risk factors
Dehydration was more likely
- Older
- Severe stroke (Total Anterior Circulation Syndrome, TACS)
- Woman (lower muscle mass)
- Prescribed diuretics

Dehydration: outcomes at discharge
Dead or dependent
- 687 of 1580 (43%) severe dehydration
- 177 of 969 (18%) normal hydration/borderline dehydration
- Chi-square = 170.5; df=2; p<0.0001
- More research needed to reduce frequency and duration of dehydration in hospital

Current clinical guidelines
- Guidelines state that acute stroke patients unable to swallow orally should be considered for enteral tube feeding
- Increase risk of dehydration
  - Dysphagia v not (56% v 44%)
  - Enteral tube feeding (26%)
  - Parenteral fluids (66%)
- No stroke specific guidelines of hydration therapy
  - How much free water should be given to patients able to take fluids orally or via feeding tubes?
  - Additional fluids more often administered parenterally

Hydration interventions
Benefits
- Hydration
- Reduce stroke in evolution
  - Protect the ischaemic penumbra
  - Increase cerebral blood flow & restore blood volume
- Reduce hypotension

Risks
- Overhydration
  - Cerebral oedema
  - Cardiac failure
- Renal stress
- Hypertension
- Infection risk

Dehydrated stroke patients: hydration therapy & the occurrence of stroke in evolution (SIE) in the first 3 days of admission

Lack of evidence to guide parenteral fluid treatments
- Methods of administration
  - Intravenous versus subcutaneous
- Types of fluids
  - Saline, glucose, balanced crystalloids, colloids
- Volumes
  - Fixed versus targeted volume
- Duration
  - Continuous versus intermittent; short versus longer
- Long term outcomes
  - Mortality, morbidity and quality of life

Visvanathan et al (2013) Cochrane database of systematic reviews (protocol)
**Recommendations**

- Develop methods to screen and recognise the early signs of dehydration after stroke
- Identify those stroke patients most at risk of dehydration
- Understand fluid regimes associated with adequate hydration status
- Evaluate whether increasing fluid intake improves stroke outcomes

**Thank you**

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