

## Dehydration in hospital admitted stroke patients



Anne Rowat  
Edinburgh Napier University  
Scotland

### 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

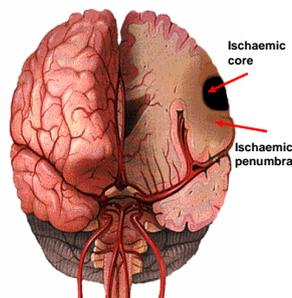
### Why?

- 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 thrombo-embolism
- 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

Dehydration = Ucol >4

Urine colour chart (Ucol)

Urine Specific Gravity using an urine test strip

Urine Specific Gravity using a digital handheld refractometer

Dehydration = USG >1.020

Rowat et al, 2011 JAN 67:1976-83

## Nurses judgement

Characteristic (cut-off for dehydration)	Dehydrated n=9		Hydrated n=11		P*
	Median	(IQR)	Median	(IQR)	
<b>Blood Indices</b>					
Blood U:C ratio mmol:mmol (>60)	105	(72, 122)	62	(51, 94)	<b>0.02</b>
Blood Sodium mmol/L (>145)	142	(139, 144)	138	(135, 140)	<b>0.01</b>
Plasma Osmolality mOsm/kg (>300)	308	(298, 312)	298	(290, 303)	<b>0.04</b>
<b>Urine Indices</b>					
Test strip USG (>1.020)	<b>1.020</b>	(1.000, 1.025)	1.010	(1.005, 1.015)	0.30
Refractometer USG (> 1.020)	<b>1.022</b>	(1.020, 1.032)	1.014	(1.011, 1.019)	0.09
Median Ucol (IQR) (>4)	6	(5, 7)	5	(3, 6)	0.24

## Results

- Practical difficulties to collect urine samples
- Poor agreement between different measures of urine (USG and Ucol) compared to blood test (urea-creatinine ratio) indices of hydration
  - Test strips underestimate dehydration compared to refractometer USG
  - Colour chart (Ucol) over-estimates dehydration
  - USG/Ucol 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

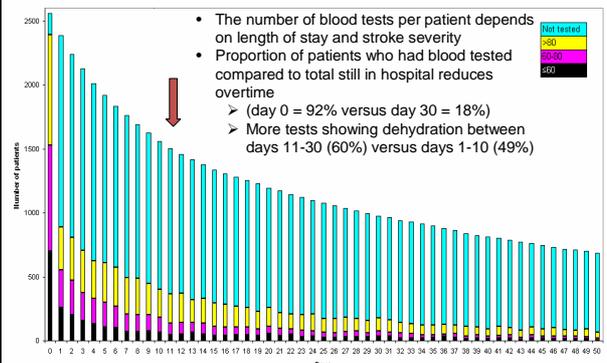
## Cochrane Review of Diagnostic Test Accuracy of impending dehydration in older people

- 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, Ucol), fluid intake, heart rate, dry mouth, feeling thirsty and bioelectrical impedance

## 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

## Dehydration: timing & pattern of blood testing



### 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

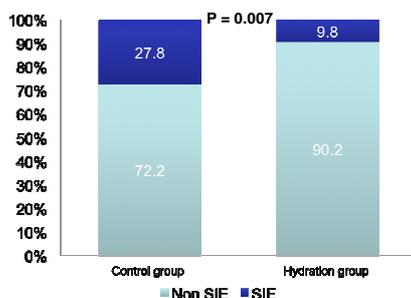
### Current clinical guidelines

- 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	Risks
<ul style="list-style-type: none"> <li>• Hydration</li> <li>• Reduce stroke in evolution                             <ul style="list-style-type: none"> <li>➢ Protect the ischaemic penumbra</li> <li>➢ Increase cerebral blood flow &amp; restore blood volume</li> </ul> </li> <li>• Reduce hypotension</li> </ul>	<ul style="list-style-type: none"> <li>• Overhydration                             <ul style="list-style-type: none"> <li>➢ Cerebral oedema</li> <li>➢ Cardiac failure</li> <li>➢ Hyponatraemia</li> </ul> </li> <li>• Renal stress</li> <li>• Hypertension</li> <li>• Infection risk</li> </ul>

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



Lin, LC et al (2014) American Journal of Emergency Medicine 32:709-12.

### 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

- Martin Dennis
- Catriona Graham
- Dorothy Horsburgh
- Dawn Lyle
- Mike McDowall
- Laura Smith
- Tom Walsh
- Joanna Wardlaw