documented. Further improvements in birth weight depend, in particular, on the weights of babies from lower social class backgrounds increasing to resemble those in higher classes.

Dr Susan Cole and the Scottish Health Service Common Services Agency provided the Scottish data. Colleagues in the Department of Epidemiology, Institute of Child Health, gave constructive comments.

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Axillary sweating in clinical assessment of dehydration in ill elderly patients

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Dehydration is common in elderly patients¹ and may precipitate confusion, renal failure, infection, pressure sores, and constipation. It can be difficult to assess clinically in older patients since collagen changes reduce skin turgor,² the tongue may be dry from mouth breathing, and eyes may be sunken due to reduced periorbital fat.³ We have examined the value of axillary moisture in assessing hydration in ill elderly patients.

Subjects, methods, and results

We studied people aged 70 or above consecutively admitted with acute medical conditions. Exclusion criteria were terminal illness; previous intravenous fluids; skin disorders; hypothermia ($\leq 34^{\circ}\text{C}$); bathing in past four hours; use of antiperspirants in past 24 hours. Within 24 hours of admission, one of us applied preweighted tissue paper to the patients' right axilla for 15 minutes (left axilla if the patient had right hemiparesis). Patients held the arm at their right side. The paper was then placed in a preweighed plastic bag and reweighed. Two blinded observers graded axillary moisture by feeling the axillae (0=dry, 1=moist). The observer order was random (interval 1-6 hours).

Subjects were classified as dehydrated or not dehydrated. Dehydrated subjects had a serum urea:creatinine ratio (mmol/l: $\mu\text{mol/l}$) above 1:10 and plasma osmolality above 295 mmol/kg.⁴ Weight gains and serum urea concentrations were logarithmically transformed to achieve normal distribution.

We recruited 38 men and 62 women (age 70-98 (mean 80.2) years). The geometric mean (95% confidence interval) urea concentration was 15.5 (12.4 to 19.8) mmol/l for the 26 dehydrated subjects and 6.8 (6.3-7.5) mmol/l for the 74 without dehydration. Mean plasma osmolality was 308 (SD 19.3; range 295-369) mmol/l for dehydrated subjects and 290 (9.3; 269-312) mmol/l for non-dehydrated subjects.

Thirty three subjects were examined by only one observer, and three only had weight of paper assessed.

Twenty one (24%) axillae were graded as dry by one observer and 24 (32%) by the other. There was agreement of grading in 80% of cases ($\kappa=0.5^5$).

Observer grading and weight gain of tissue paper were related (first observer: geometric mean weight gains 1.78 mg for dry axillae ($n=22$) and 6.87 mg for moist axillae ($n=64$); $t=6.43$; $P<0.001$). Similar data were obtained for the second observer.

The mean weight gain for dehydrated subjects (3.25 (range 0.0-51.7) mg) was lower than for non-dehydrated subjects (5.54 (0.4-145.2) mg; $t=1.85$, $P=0.06$). Weight gain was associated with plasma urea concentration ($r=-0.20$, $P=0.022$; $n=99$), plasma:urine osmolality ratio ($r=-0.23$, $P=0.016$; $n=53$), and difference between urine and plasma osmolalities ($r=0.16$, $P=0.050$; $n=53$).

The table shows the results for the first observer (similar results were obtained for the second observer). Sensitivity of absent axillary moisture in detecting dehydration (percentage of dehydrated subjects without sweating) was 50% (10/20), and the positive predictive value (percentage without sweating who were dehydrated) was 45% (10/22). Specificity (percentage of non-dehydrated subjects with sweating) was 82% (54/66), and the negative predictive value (percentage with sweating who were not dehydrated) was 84% (54/64).

Comment

Axillary sweating is a reproducible and reliable sign of hydration in ill elderly patients with a high negative predictive value and moderate positive predictive value. Overall, 26% of patients were dehydrated but among patients without sweating prevalence of dehydration was 45%.

Interobserver variation may have been increased because some subjects were assessed over a short time and the tissue paper could have dried the axilla before grading. Biochemical classification of hydration is crucial. We used established strict criteria,⁴ which may have classed some mildly dehydrated patients as not dehydrated, reducing the predictive value of the sign.

Despite the possible confounding effects of autonomic impairment we included patients with diabetes as this is common among old people in hospital. Predictive values in patients without diabetes were almost identical to the overall results.

The study was conducted as part of the Manchester Medical School fifth year options course.

Correlation between axillary moisture and hydration

	Biochemical status		
	Dehydrated	Not dehydrated	Total
Observer grading:			
Dry	10	12	22
Moist	10	54	64
Total	20	66	86

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