Table 1—*Results of tests for hepatitis B markers in 126 patients with chronic hepatitis C*

	No of patients	Comment
Hepatitis B surface antibody alone	3	All were vaccinated
Hepatitis B surface antibody and hepatitis B core antibody	12	7 were vaccinated
Hepatitis B core antibody alone	33	
Hepatitis B core antibody and hepatitis B surface antigen	2	
Hepatitis B surface antigen alone	1	
No marker	75	52 had history of intravenous drug misuse

this approach. Despite having contact with health workers, our patients said that they had not been advised about vaccination—though it may have been offered.

Little change has been observed in high risk behaviour among intravenous drug misusers, despite educational programmes. This population is difficult to identify in the community, and people who misuse intravenous drugs rarely approach healthcare professionals about vaccination. Sexual transmission of hepatitis B has increased in the United States, and the incidence of infection among misusers and their sexual contacts has probably increased.[5]

Our results suggest that opportunities for vaccination are being missed. The reasons that vaccination might not have been offered include a failure to recognise that patients with hepatitis C are at risk of hepatitis B and a failure to appreciate that intravenous drug misusers have inconsistent contact with health care professionals. Some healthcare professionals may believe that vaccination is not their primary responsibility. Cost is unlikely to be an important issue as the vaccine is comparatively cheap and the current potential cost saving for the NHS in preventing acute or chronic hepatitis B undoubtedly offsets the costs of vaccination.

Patients with chronic hepatitis C who are at risk of hepatitis B should be offered vaccination at their first contact with health care professionals.

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1 Esteban R. Epidemiology of hepatitis C virus infection. *J Hepatol* 1993;**17**:567-71.
2 Ilan Y, Ashuv Y, Tur-Kaspa R, Shouval D. Chronic hepatitis C virus infection with exposure to to hepatitis B virus. *Isr J Med Sci* 1994;**30**:259-63.
3 Catterall AP, Murray-Lyon IM. Strategies for hepatitis B immunisation. *Gut* 1992;**33**:576-9.
4 Centers for Disease Control, US Department Health and Human Services, Atlanta, Georgia. *Update on Hepatitis B Prevention* 1987;**107**:353-7.
5 Alter MJ, Hadler SC, Margolis HS, Alexander WJ, Hu PY, Judson SN, *et al.* The changing epidemiology of hepatitis B in the United States. *JAMA* 1990;**263**:1218-22.

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Specificity of pH and osmolality of early morning urine sample in assessing distal renal tubular function in children: results in healthy children

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A simple method of evaluating distal tubular function in children would be useful because water deprivation tests are potentially dangerous and acid loading tests are unpleasant. Osmolality of an early morning urine sample is often taken as a measure of urinary concentration in children with a history of polydipsia and polyuria, and the pH of an early morning sample is used to evaluate urinary acidification in several renal and metabolic disorders. A pH of 5.4 or less is usually taken as adequate acidification[1] and an osmolality of 600 mmol/kg or more as excluding clinically significant impairment of urinary concentration.[2] We determined the likelihood of achieving these values in a single early morning urine sample from healthy children.

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Subjects, methods, and results

We collected an early morning urine sample from 322 healthy children and adolescents (age range 3 years 11 months to 18 years 8 months, median 9.8 years; 170 males) from five local schools. The study was approved by the ethics and education management committees, and informed written consent was obtained from subjects or their parent or guardian. Subjects were asked to avoid drinking after going to bed, unless they found it uncomfortable to do so. No one had a personal or family history of renal or urinary tract disease or was receiving potentially nephrotoxic drugs. pH was measured with a digital pH meter and osmolality with a freezing point osmometer on the morning of collection. The cumulative distribution function was calculated for each value to determine the probability of observing a value above or below a specified point. Smoothing was performed by means of Gaussian kernels.[3] Reference ranges were determined from the resultant density estimates as the values between the 2.5th and the 97.5th centiles.

One child admitted to drinking after bedtime and eight to collecting the second urine sample of the day after breakfast; 313 (98%) subjects collected the first early morning sample. Osmolality was measured in all 322 samples and pH in 318. Median pH was 6.0 (range 4.8-7.7). The reference range was 5.16-7.07; only 12.8% of children had a value of 5.4 or less. Median osmolality was 845 mmol/kg (range 275-1344). Males had significantly higher osmolalities than females (median 896 *v* 781 mmol/kg; Mann-Whitney U test, $P<0.005$); no sex difference was observed for pH. The reference range of urine osmolality was 417-1218 mmol/kg for the males and 329-1194 mmol/kg for the females; only 82.2% of males and 74.8% of females had an osmolality of 600 mmol/kg or more.

Comment

To our knowledge, this is the first study to establish reference ranges for osmolality and pH of an early morning urine sample in healthy children and adolescents after an overnight thirst, although these variables are widely measured by paediatricians and used in clinical assessment. The only other study of urinary concentration in normal children used a longer period of formal fluid deprivation.[4] So far as we know, urinary acidification has never been studied in this way.

Our study clearly shows that not to have a urinary pH of 5.4 or less, or an osmolality of 600 mmol/kg or more, in a single early morning urine sample cannot be taken as evidence of impairment of urinary acidification or concentration because the specificity of these measures is low. Only about one child in eight will have a pH of 5.4 or less, making this an almost useless screening test. Although osmolality is more useful for evaluating urine concentration, only around four children out of five will have an osmolality of 600 mmol/kg or more. The use of early morning urine pH and osmolality is attractive in its simplicity, but failure to appreciate the limitations of these tests may lead to an incorrect diagnosis of distal tubular impairment.

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1 Rodriguez-Soriano J, Vallo A. Renal tubular acidosis. *Pediatr Nephrol* 1990:4:268-75.
2 Swift PGF. Polyuria. *Current Paediatrics* 1991;1:177-82.
3 Silverman BW. *Density estimation for statistics and data analysis*. London: Chapman and Hall, 1986.
4 Edelmann CM Jr, Barnett HL, Stark H, Boichis H, Soriano JR. A standardised test of renal concentrating capacity in children. *Am J Dis Child* 1967;114:639-44.

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Determining the approximate area of a burn: an inconsistency investigated and re-evaluated

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For assessing the area of small or irregular burns a projection of the patient's whole hand is used as an approximation to 1% of the total body surface area.[1] In the advanced trauma life support course manual,[2] however, the palm (not including the fingers) has been quoted as representing 1%. This study was undertaken to determine which method is the better approximation.

Subjects, methods, and results

Twenty adults from the medical school and 10 children from the hospital took part in this project. Their heights (cm) and weights (kg) were recorded on calibrated equipment and their total body surface area was calculated by the method of Gehan and George.[3] The projections of each subject's palm and whole hand were delineated using their non-dominant hand. The area of each projection was determined using the DispImage computer program.[4]

Among the adults the means of each individual's projected palm and whole hand areas expressed as a percentage of their total body surface area, with 95% confidence intervals, were 0.41 (0.39 to 0.43)% and 0.77 (0.74 to 0.80)% respectively. Among the children the corresponding values were 0.45 (0.42 to 0.48)% and 0.82 (0.78 to 0.87)% (fig 1). For the two groups combined the mean projected whole hand area was 0.79 (0.76 to 0.81)%.

Comment

The purpose of this investigation was to determine which of a person's projected palm or whole hand area is a better approximation to 1% of their total body surface area. The results (fig 1) clearly indicate that the whole hand and not the palm is the better measure, and this conclusion is not altered when all determinable errors are taken into account.

Although the subjects were from the hospital and medical school, they were from varying cultural and social backgrounds, and we feel they are representative of the general population for the variable being measured. The between observer variation was removed by the study design while the within observer variability was assessed to be about 6% for the projected palm and 4% for the projected whole hand areas.

The DuBois and DuBois formula is routinely used for calculating a subject's total body surface area. However, the constant powers used in this formula were determined by a study in only nine subjects.[5] Subsequent larger studies have generated new values for these variables,[3] which were used in this project.

In neither the adults nor the children did the 95% confidence interval for the mean of the projected whole hand area contain the 1% value it is supposed to be approximating. Hence, we propose that the projected whole hand should be taken to approximate to 0.8% of total body surface area, the actual mean value for the combined groups (0.79%) being too cumbersome for easy calculations. We also propose that this new value should be used for both adults and children because, although the means of the adult and child samples did differ significantly ($0.05 > P > 0.02$ for the null hypothesis), this difference is too small to affect the overall conclusion.

Consistency in determining the area of a burn would allow more accurate comparison of results of treatment protocols between hospitals. Achieving consistency between hospitals is often difficult, but within a hospital consistency can be obtained by a unit basing its burns admission policy and treatment protocol on one documented method of approximating the area of tissue damage which is known to all staff.

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1 Ellis H, Calne R. *Lecture notes on general surgery*. 8th ed. Oxford: Blackwell Science, 1993: 12-6.
2 Alexander RH, Proctor HJ. *Advanced trauma life support course for physicians*. 5th ed. Chicago: American College of Surgeons, 1993.
3 Gehan EA, George SL. Estimation of human body surface area from height and weight. *Cancer Chemother Rep* 1970;54:225-35.
4 Plummer DL. DispImage: a display and analysis tool for medical images. *Rivista di Neuroradiologia*. 1992;5:489-95.
5 DuBois D, DuBois EF. A formula to estimate the approximate surface area if height and weight be known. *Arch Int Med* 1916;17:863-71.

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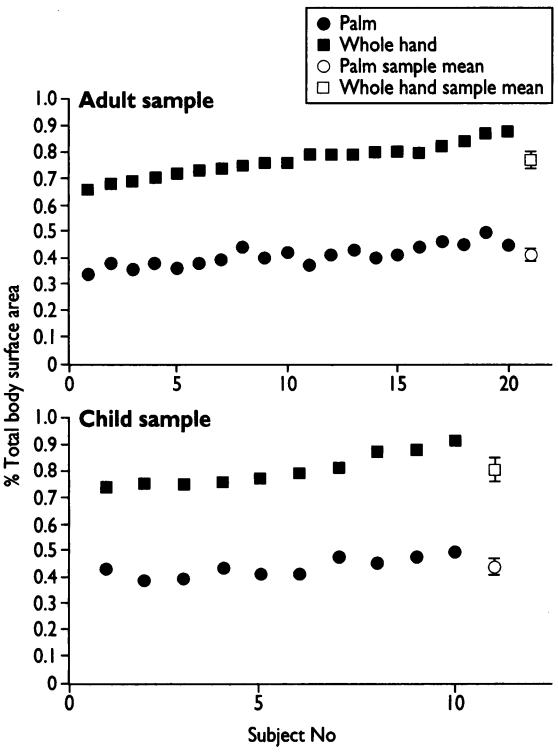

Fig 1—*Plots of each individual's projected palm and whole hand area expressed as a percentage of their total body surface area together with means and 95% confidence intervals in adult and child groups*

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