

Quantitating proteinuria using the urinary protein creatinine index

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Summary

Quantitating proteinuria by the 24 hour urine protein estimation (24 HUP) is cumbersome and fraught with error. We therefore investigated the relationship between the 24 HUP and the protein creatinine index (PCI) in a spot morning urine in 20 normal controls and 63 urine samples from 58 patients. The latter had proteinuria ranging from 0.2 gm to 31.6 gm and serum creatinines between 54 to 837 $\mu\text{mol/L}$. The Pearson correlation coefficients between PCI and 24 HUP, PCI and 24 HUP excretion per kg, PCI and 24 HUP excretion per 1.73m^2 were 0.87, 0.87, 0.87 and 0.91 respectively ($p < 0.001$ in each case). The PCI for normal controls (mean 24 HUP 0.2 gm) was < 0.02 gm/mmol. That for nephrotic range proteinuria (24 HUP > 3 gm) was > 0.45 gm/mmol. Our results agree with those of other workers and show that a spot morning urine PCI (preferably corrected to 1.73m^2) can and should replace a 24 HUP estimation.

Introduction

Proteinuria is one of the diagnostic indices of renal disease and its magnitude reflects the severity of the underlying condition. Up to now, 24 hour urine protein (24 HUP) estimation was the only means of quantitating proteinuria. However, this test involving 24 hour collection of urine is cumbersome and fraught with errors, especially in children. On the basis of encouraging reports of the correlation between 'protein-creatinine index' (PCI) in a spot urine sample and 24 HUP excretion, we investigated this relationship and its usefulness in the local subjects.

Materials and method

The subjects studied included 20 normal controls and 58 proteinuric patients who contributed 63 sets of urine. Most of the urine specimens were collected on an outpatient basis. The method of 24 hour urine collection was explained in detail to the subjects. On completion of the 24 hour

collection, the next urine voided was also collected and both urines were then sent to the laboratory. The subject's age, height, weight and serum creatinine (renal profile) were also measured.

Urine protein was estimated by the turbidity method using a spectrophotometer.¹

Urine and serum creatinines were estimated by the Jaffe method using the Technicon 6/60 autoanalyser.

The PCI was plotted against 24 HUP excretion, 24 HUP excretion per kg. body weight, and 24 HUP excretion corrected to 1.73m². Logarithmic transformations (base 10) of both the PCI and 24 HUP excretion were also plotted. The Pearson correlation coefficient (r), and probability (p) were also calculated.

Results

The 20 normal controls were aged between 23-28 years. Their serum creatinines were all within the normal range (62-124 $\mu\text{mol/L}$). Their mean 24 HUP excretion was 0.2 gm (range 0.1-0.4) with a mean PCI of 0.02 gm protein/nmol. creatinine (range 0.01-0.05).

The 58 patients, aged between 12-66 years, had serum creatinines ranging from 54-837 $\mu\text{mol/L}$ and 24 HUP excretions ranging from 0.2-31.6 gm (mean 5.3 gm).

The correlation coefficient (r), slope (A) and intercepts (B) between PCI and 24 HUP excretion, log PCI and log 24 HUP excretion, PCI and 24 HUP per kg. body weight and PCI and 24 HUP per 1.73m² body surface area were respectively:-

$$r = 0.87, A = 0.15, B = 0.0022, p < 0.001$$

$$r = 0.87, A = 0.991, B = 0.89, p < 0.001$$

$$r = 0.87, A = 0.0124, B = 0.022, p < 0.001$$

$$r = 0.91, A = 0.14, B = 0.018, p < 0.001$$

PCI and 24 HUP/1.73m² showed the most satisfactory correlation (Fig. 1).

Discussion

In 1983, Shaw² first proposed that a random urine PCI could be substituted for the 24 HUP estimation. Since then, many workers³⁻⁵ including Gupta⁴ and Houser⁵ have confirmed this correlation. However, Mogensen⁶, Viberti⁷ and Jefferson⁸ noted the variability of urinary albumin excretion in response to exercise in diabetic patients. Subsequently, Davis⁹, Rowe¹⁰ and Hutchinson¹¹ reported a wide variation in albumin excretion and albumin to creatinine ratios in nondiabetic subjects and cautioned against the use of random urine samples for determination of the PCI.

However, Price¹² and Wilkin¹³ found that the early morning urine samples for PCI best correlated with the 24 HUP excretion. Hence the reason for our using the early morning specimen in our study. The relevance of this is well reflected by the highly significant correlation coefficient of 0.87 even in the raw plot of PCI versus 24 HUP.

Although the correlation was increased slightly to 0.91 by plotting PCI against the 24 HUP standardised to 1.73m² surface area, this requires height and weight measurements. In our study, only 39 out of 63 patients had these additional parameters measured and only 50 of these 63 were weighed. Omissions were mainly from the inpatient group who were probably more ill and more dependent on nursing supervision.

We therefore advocate the use of the early morning urine PCI as a simple and valid replacement for 24 HUP estimation.

Acknowledgement

The authors thank Assistant Nurse Azizah, Cik Khairun Zabaai and Puan Miskiah Ahmad for their invaluable help.

This paper was read at the 21st Malaysia-Singapore Congress of Medicine 15-18 October 1987, Kuala Lumpur.

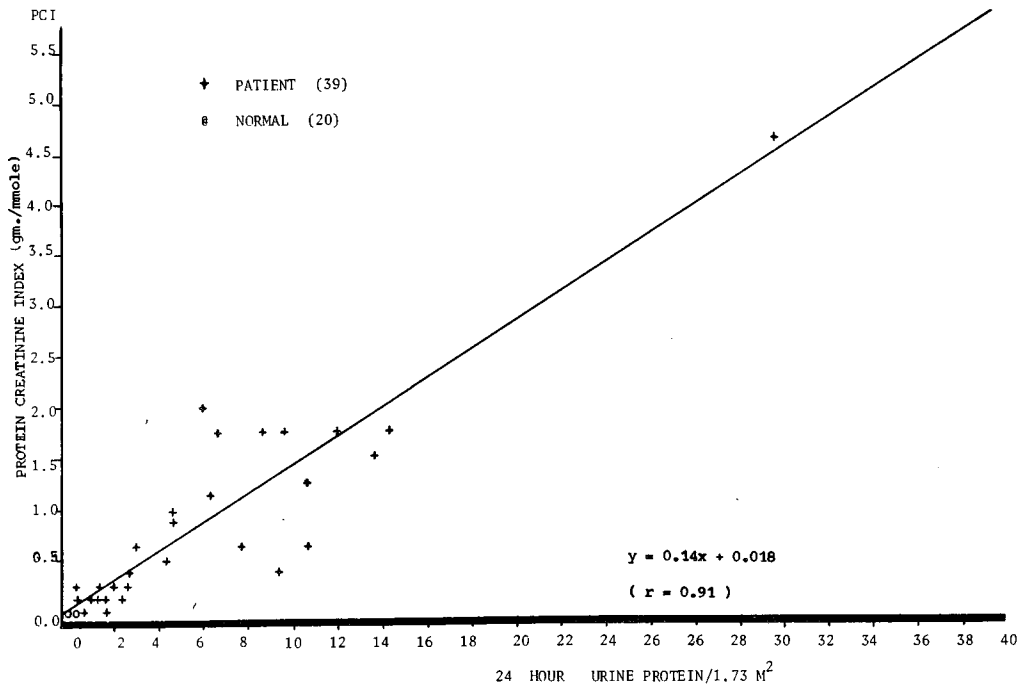


Figure 1

Relationships between the spot urinary protein creatinine index and the 24 hour urine protein excretion/1.73m. ($p < 0.0001$).

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