Significance of Urinary Albumin Index in the Urine Collected Arbitrarily in the Morning

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To evaluate urinary albumin index (UAI), the relationship between albumin excretion rate (AER) in the urine stored for 24 h and UAI in the urine collected arbitrarily on the morning of the same day was studied in 123 inpatients. The patients were admitted to our hospital from September 1, 1988 to August 31, 1989, consisting of 67 non-insulin dependent diabetics (Group 1), 40 patients with collagen disease (Group 2), and 16 patients with primary renal disease (Group 3). The relationship between log_c AER and log_e UAI was plotted on a graph. Pearson's rank correlation coefficients of Groups 1–3, Group 1, Group 2, and Group 3 were as follows: $r = 0.725$, $r = 0.691$, $r = 0.855$, and $r = 0.611$, respectively. The formula obtained by using Pearson's rank correlation coefficients to estimate log_cAER from log_e UAI in 123 cases of Groups 1–3, 67 cases of Group 1, 40 cases of Group 2, and 16 cases of Group 3 were: log_eAER/log_e UAI $= 0.815$, log_eAER/log_cUAI $= 0.860$, log_cAER/log_eUAI $= 0.830$, log_cAER/$log_e = 0.722$, respectively. In the present study, log_cUAI was found to correlate well with log_eAER. As AER is generally accepted to be the most reliable index to know the stage of albuminuria, UAI is considered to be clinically useful.

Key words : albumin excretion rate, urinary albumin index, morning urine, non-insulin dependent diabetes mellitus, diabetic nephropathy

The protein creatinine index (1) is, now, considered to be a useful index to the stages of renal disease. Another important index, the urinary albumin index (UAI, mg/g · Cr) (2,3) is not as well established. However, albuminuria, usually expressed as the albumin excretion rate (AER, μg/min) (4) is a reliable clinical indicator of renal disease.

We have examined the relationship between the AER and the UAI to determine if UAI is useful for assessing AER. The AER of urine stored for 24 h and the UAI of urine collected arbitrarily in the morning were compared.

Subjects and Methods

One hundred twenty-three inpatients admitted to our hospital from September 1, 1988 to August 31, 1989 were studied (Table 1). The patients consisted of 67 diabetics (Group 1), 40 patients with collagen disease (Group 2), and 16 patients with primary renal disease (Group 3) (Table 1).

AER was calculated from the albumin concentration

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Table 1　Laboratory test results of the patients

	Age and laboratory test values (mean±SD)			
	Disease groups			Total
	Group 1 NIDDM (n=67)	Group 2 Collagen disease (n=40)	Group 3 Primary renal disease (n=16)	Primary and secondary renal disease (n=123)
Age (Years)	57.4±11.3	49.5±17.0	37.4±17.5	52.2±15.7
Laboratory tests				
BMI (Kg/m^2)	22.5± 3.9	20.6± 2.9*	21.1± 1.8	21.7± 3.5
SCR (mg/dl)	1.1± 1.1	1.1± 1.5	2.9± 2.9	1.3± 1.7
BUN (mg/dl)	19.0±10.9	23.2±22.6	30.7±21.0	21.9±17.2
FBG (mg/dl)	110.5±27.4	85.1± 9.5	86.5± 8.9	99.1±24.5
HBAIC (%)	7.1± 1.1	5.7± 0.5	5.5± 0.4	6.5± 1.2
SBP (mm/Hg)	129.6±18.7	124.8±19.6	124.6±12.8	127.4±18.4
DBP (mm/Hg)	76.4±12.0	72.2±11.6	74.0±10.2	74.7±11.7
LUAI	2.6± 2.5	3.7± 2.1	5.2± 2.6	3.3± 2.6
LAER	2.0± 3.4	2.7± 2.8	3.7± 3.4	2.5± 3.2

NIDDM: Non-insulin dependent diabetes melletus; BMI: Body mass index; SCR: Serum creatinine concentration; BUN: Blood urea nitrogen; FBG: Fasting blood glucose; HBAIC: HbA_{1C}; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; LUAI: Log_e urinary albumin index; LAER: Log_e albumin excretion rate.
* One patient was not examined for BMI.
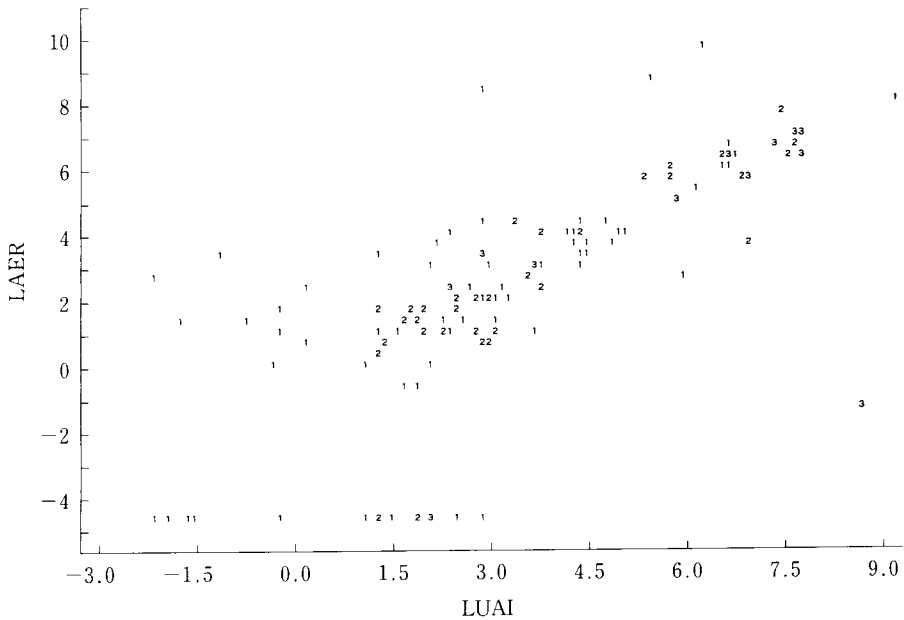
Fig. 1　Relationship between log_e albumin excretion rate (LAER) and log_e urinary albumin index (LUAI).
1, (Group 1): patients with non-insulin dependent diabetes melletus; 2, (Group 2): patients with collagen disease; 3, (Group 3): patients with primary renal disease.

(5) in the urine stored exactly for 24 h. Simultaneously, UAI was calculated from the concentrations of creatinine (6) and albumin (5) in the urine voided arbitrarilly on the morning of the same day. Normal distribution was found to be obtainable on a graph from AER as well as UAI by logarithmically transforming them.

Pearson's correlation coefficient was obtained from $\log_e$AER (LAER) and $\log_e$UAI (LUAI). Then Pearson's rank correlation coefficient was calculated from LAER and LUAI to obtain the formula to estimate AER from UAI. The grade of obesity was expressed by body mass index (BMI), while the state of renal function was expressed by serum creatinine concentration (SCR) and blood urea nitrogen (BUN).

Metabolic state was indicated by fasting blood glucose level (FBG) in the early morning and HbA_{1c} (HBA1C). Blood pressure (systolic BP, SBP; diastolic BP, DBP) was measured at the A. brachialis dextra of patients lying on their backs at 9–10 in the morning after resting for a fixed time (ca. 90min).

Results

The relatiosship between LAER and LUAI was plotted on a graph (Fig 1). Pearson's rank correlation coefficients of Groups 1-3 (n = 123), Group 1 (n = 67), Group 2 (n = 40), and Group 3 (n = 16) were as follows: r = 0.725 (p < 0.0001), 0.692 (p < 0.0001), 0.856 (p < 0.0001), and 0.611 (p < 0.01), respectively.

The formula obtained by using Pearson's rank correlation coefficients to estimate LAER from LUAI in 123 cases of Groups 1-3, 67 cases of Group 1, 40 cases of Group 2, and 16 cases of Group 3 were:

LAER = 0.815386 × LUAI, for Groups 1-3,
LAER = 0.860443 × LUAI, for Group 1,
LAER = 0.830067 × LUAI, for Group 2, and
LAER = 0.722665 × LUAI, for Group 3,
respectively.

Discussion

The significance of the protein creatinine index

of urine collected at random and in the early morning is well known (1). However, the correlation between UAI in urine collected arbitrarily in the morning and the AER of urine stored for 24 h had not been previously demonstrated.

The results of this study demonstrate a fairly high correlation between LUAI and LAER. The correlation coefficient of the patients was, in descending order, as follows: r = 0.856 (p < 0.0001) in patients with collagen disease, r = 0.692 (p < 0.0001) in diabetics, and r = 0.611 (p < 0.0001) in primary renal disease, respectively.

The reason for variation in the correlation coefficient among the three groups is probably related to the mechanisms by which albumin leaks into the urine among these groups.

Because the AER is generally considered as the most reliable index to the stage of albuminuria (4), the significant correlation between LUAI and LAER in this study implies that UAI may also be of high value clinically.

This technique is further recommended by the fact that UAI is obtainable even from outpatients without difficulty. Then, AER is obtained simply by calculating the formula using UAI as mentioned above.

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