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Original Article

Does long-term proteinuria alter the correlation between 24-h urine protein and spot urine protein / creatinine ratio and have an impact on body composition?

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Abstract

Aim: We aimed to evaluate the accuracy of the protein-to-creatinine ratio (PCR) and whether or not PCR could be used instead of 24-hour proteinuria in profound glomerular diseases. Additionally, we investigated the impact of proteinuria on body composition.

Material and Methods: Fifty subjects were enrolled in the study. Twenty of the participants were patient and had been following for glomerular diseases. All patients had over 1500 mg proteinuria for the last 3 months which has been detected by 24 hours urine sample. Control group was selected from 30 healthy volunteers.

Results: In the patients group, the correlation between the 24-hour proteinuria and the proteinuria obtained from the ratio of spot urine PCR was investigated and a statistically significant correlation was found between the two parameters (p = 0.000, r = 0.731). To reveal if there is the effect of proteinuria on body composition between the two groups, the body composition parameters were compared. There was no statistically significant difference between the two groups in terms of body composition parameters, such as fat mass (p=0.500), lean body mass (p=0.280), muscle mass (p=0.277).

Conclusion: Determination of proteinuria by spot urine technique in profound glomerular diseases can be used safely instead of the 24-h measurement method. Another finding of our study is that glomerular diseases do not affect body components.

Keywords: Glomerular diseases; body composition; protein/creatinine ratio; proteinuria.

INTRODUCTION

Proteinuria is the leading cause of glomerular injury and high urinary protein excretion is known to be associated with an increased risk of kidney disease progression (1). Abnormal proteinuria is defined as the excretion of more than 150 mg daily protein, while fewer proteinuria levels may reflect the early renal disease course (2). Therefore, proteinuria measurement is required during the clinical evaluation of all patients with glomerular diseases, since it is the most important predictor of renal prognosis (3).

Although there are diverse methods for quantifying proteinuria (4), 24-hour urine collection technique is the gold standard method for predicting protein excretion (4-6). However, it is not convenient technic because of the difficulties and errors in collecting the 24-hour urine sample (5). For this reason, another useful method to evaluate protein extraction is the spot urine protein-to-creatinine ratio (PCR) and recommended by National Kidney Foundation Kidney Disease Outcomes Quality Initiative (6). Correlation between these two techniques has been shown in various patient groups in various studies and reported that PCR could be an alternative method to 24-hour urine protein excretion (5,7,8).

Although the PCR may be used for quantifying proteinuria, there are some limitations of this method. There is a strong relationship between body muscle mass and urinary creatinine excretion, and also creatinine excretion is affected by factors such as meat and protein intake (9). Therefore calculations may be misleading in patients

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with very high or low muscle mass (10). Body protein metabolism is greatly affected by the rate of plasma protein turnover, dietary protein intake, and the degree of proteinuria lost in daily urine. Nephrotic syndrome may cause negative nitrogen balancing (11). Protein loss may have specific effects on body composition (12).

The accuracy of PCR in patients with glomerulonephritis is too important. There is insufficient data about the correlation between PCR and 24-h protein levels in long-term profound non-diabetic proteinuria patients. Also, the impact of the proteinuria on body composition such as muscle mass, lean body mass, fat mass is not known enough. In our study, we aimed to evaluate the relationship between two proteinuria measurement techniques and whether or not PCR could be used instead of 24-hour proteinuria In addition, we investigated the effect of long-term proteinuria on body composition.

MATERIAL and METHODS

This cross-sectional study was carried out in the Nephrology Outpatient Clinic of Fırat University Hospital. Approval for the study was taken from the local ethics committee (date: 28/03/2019 decision number: 28). 50 subjects were enrolled in the study. Twenty of participants were patient and had been following for profound proteinuria (Patient, n=20). Control group was selected from 30 healthy volunteers (Control, n=30). Written consent was obtained from all of the participants. Patients were selected from that who had been followed-up for the primary glomerular disease. All patients had over 1500 mg proteinuria for the last 3 months which has been detected by 24 hours urine sample. Patients who had malignancy, infection, diabetic nephropathy, advanced chronic kidney disease, followed by proteinuria except for primary glomerular diseases and those who refused to participate in the study were excluded. All participants age were older than 18 years and patients were selected from non-response to the treatment either immunosuppressive or supportive therapy. Control group was consist of healthy subjects who have not illness which may affect the study results.

Tanita SC 330, a body composition analyzer, was used to evaluate the body composition of the participants. Measurements were made in accordance with the manufacturer's recommendation and patients were allowed to stand with the bare feet on the device. Parameters such as lean body mass, fat mass, fat mass percentage, weight, visceral fat ratio, body mass index, basal metabolic rate, and muscle mass were measured by the device. The results were taken as output and evaluated.

To assess the diagnostic accuracy of random urine PCR and 24-hour urine protein, two methods were obtained simultaneously from these special population. Results were evaluated in the same laboratory with the same device named ADVIA 1800 manufactured by SIEMENS. Demographic and laboratory data from the participants were recorded. Biochemical data was detected by the ADVIA 2400 device produced by the same manufacturer.

Continuous variables were expressed as mean ± standard deviation or median values and ranges, and categorical variables as absolute numbers. Differences between the two groups were evaluated by T-test (continuous variables) and Mann-Whitney Test. Intercorrelations between the parameters were assessed by Pearson and Spearman correlation test. Values less than p <0.05 were considered significant. All analyses which were obtained from the study were performed with the SPSS software program (Version 20.0).

RESULTS

The study included 50 subjects, 20 of whom were proteinuric and 30 healthy controls. Patients that of 12 were males and 8 were females and the mean age was 45.2±14.9. The control group consisted of 25 male and 5 female patients with a mean age of 46.9±9.5 years. To reveal if there is the effect of proteinuria on body composition between the two groups, the body composition parameters were compared. There was no statistically significant difference between the two groups in terms of body composition parameters, such as fat mass (p=0.500), lean body mass (p=0.280), muscle mass (p=0.277), and also others. The comparison of demographic, laboratory and bioimpedance data of the groups is summarized in Table 1.

Urinary parameters of the patient group summarized in Table 2. Intercorrelation between 24-h proteinuria and spot urine PCR levels and body components was evaluated in patients, and there was a moderate correlation between the 24-h protein extraction and the lean body mass (P=0.05; r=0.444). There was no significant relationship between body composition parameters and the amount of 24-hour protein except in lean body mass. Relationship between body composition and 24-hour protein and also spot urine protein/creatinine ratio was summarized in Table 3.

In the patient group, the correlation between the 24-hour proteinuria and the amount of proteinuria obtained

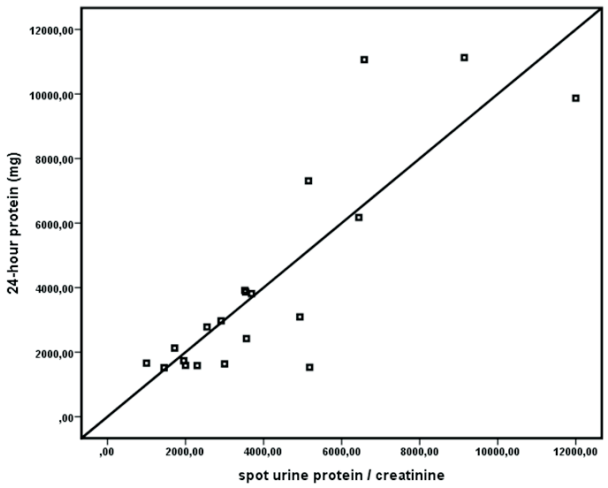

Figure 1. Correlation between 24-hour protein and spot urine PCR

Table 1. Comparison of demographic, biochemical, and bioimpedance parameters of the groups

	Patient (n=20)	Control (n=30)	P value
Age (year)	45.2±14.9	46.9± 9.5	0.653
Weight (kg)	72.00±13.70	75.26±10.58	0.354
Fat mass percentage (%)	22.59±9.53	21.84±6.03	0.757
Fat mass (kg)	18.71±11.45	16.83±5.31	0.500
Lean body mass (median)	54.05 (39.80-74.4)	60.00 (39.60-77.10)	0.280
Muscle mass (kg)	52.59±10.25	55.51±8.45	0.277
Total Body Water (L)	39.07±7.82	40.58±6.00	0.446
Total Body Water (%)	54.61±7.23	54.00±4.38	0.739
BMI	26.09±4.94	25.20±2.63	0.469
e-GFR (ml/dk)	81 (45-90)	90 (90-90)	0.001**
Urea (mg/dl)	50 (21-88)	28.50 (15-40)	0.014*
Creatinine (mg/dl)	0.96 (0.55-1.87)	0.80 (0.53-1.10)	0.015*
Uric acid (mg/dl)	6.95±1.75	5.56±1.24	0.002*
Albumin (g/dl)	3.57±0.70	4.48±0.27	0.001**

BMI: body mass index

Table 2. Urinary parameters of the patient group

	Mean±SD
Spot urine PCR	4130.90±2744.33
24-hour urine protein excretion (mg)	4088.90±3246.31
Urine volume (ml)	2168.00±865.06
Spot urine protein (mg/dl)	272.18±224.51
Spot urine creatinine (mg/dl)	66.62±38.59

PCR: protein-to-creatinine ratio

Table 3. Correlation between body composition and 24-hour protein and spot urine PCR

	24-hour urine protein	Spot urine PCR
Age	p=0.793	p=0.940
Weight	p=0.887	p=0.073
Fat mass percentage (%)	P=0.063	P=0.654
Fat mass	P=0.054	P=0.118
Lean body mass	P=0.05; r=0.444	P=0,460
Muscle mass	P=0.220	P=0.116
Total Body Water	P=0.181	P=0.116
Total Body Water (%)	P=0.062	P=0.686
BMI	P=0.423	P=0.371

BMI: body mass index

from the ratio of spot urine PCR was investigated and a statistically significant correlation was found between the two parameters (p = 0,000, r = 0,731) (Figure 1). Also the correlation between the 24-hour proteinuria and the ratio of spot urine protein / muscle mass was found to be moderately correlated (p = 0,005, r = 0,620). We think that this technique may be used as another method to predict the 24 -h protein extraction.

DISCUSSION

According to our study results, the P/C ratio can be used safely instead of 24-hour proteinuria in profound proteinuric glomerular diseases. Correlation coefficient was found between the two parameters (p = 0,000, r = 0,731). A study evaluated the correlation of 24-hour measurement and spot urine PCR on HIV patients, revealed statistically significance (5). Nischintha et al. (4) detected moderate correlation in preeclamptic women (r = 0.373, P < 0.001) between two methods. Moaid Mohseni et al. (7) examined 66 pregnant women and reported the correlation coefficient of 0.502 (p<0.001). Veronica Verleine Horbe et al. (13) revealed a significant relationship between 24-hour protein extraction and PCR in 6 months follow-up of 41 patients with primary glomerulonephritis and offered that P/C ratio can be used in the clinical setting readily and has low cost. A study which examined retrospectively 1038 urine samples detected relevant correlation between two measurement tool (r=0,80, p<0,001). In the same study, an inverse correlation was found between serum albumin level and methods (14). In contrast to these positive results, Akın et al. (15) revealed a weak correlation between the two methods in diabetic subgroup (R2:0.68).

Glomerular diseases are prominent causes of renal diseases and can progress to ESRD if remission is not achieved. (16). In particular, prolonged proteinuria is correlated with adverse kidney outcomes in these patients, and the degree of proteinuria is used to monitor the therapeutic response. Therefore, proteinuria slopes should be included in follow-up strategies for predicting the kidney outcomes (1). Changes in proteinuria have been proposed to predict the progression of kidney disease (17). Juan JC et al. (18) showed that changes in proteinuria over a period of 1, 2 or 3 years were linearly related to subsequent ESRD risk. For this reason, ıt is important to evaluate profound proteinuric patients accurately. In this patient group, spot urine PCR is intensely used. Although, there have been reported a correlation between spot urine PCR and 24 h protein excretion in varies patients groups (4-6), it has not been examined in primary sustained glomerular diseases. Given the importance of proteinuria

in the decision to initiate or withdraw immunosuppression (3), it means that the accuracy of spot PCR is more important in this private group.

Muscle mass differences between individuals significantly affect the value of urine albumin-to-creatinine ratio (ACR) calculated by urinary albumin and creatinine excretion. Because of this effect, people with low muscle mass could have increased ACR without an increase in absolute albumin excretion. Therefore, ACR has weak predictive power for the definition of microalbuminuria due to low urine creatinine excretion in whom with low muscle mass (19). Similar to the previous study results, Mori et al. (20) demonstrated that body size and body composition reflecting muscle mass could affect the urinary creatinine extraction and also PCR. In contrast, in a study investigating the accuracy of PCR in morbidly obese patients, found that proteinuria was falsely lower than the real quantity and ıt attributed to over-extraction of urinary creatinine amount (21).

It is known that weight loss reduces proteinuria and provide the renoprotective effect (22). It shows this effect by reducing glomerular hyperfiltration (23). However, the effect of proteinuria on body composition is unknown. There is no data available in the literature. Our study seems to be the first study on this issue. We observed no differences between two groups in terms of body composition. Several factors might have caused to this results. Firstly, disease perception may have stimulated overeating desire and prevent weight loss reduction. The short duration of follow-up might have confounded the impact of proteinuria on body composition. Also, the gender difference in groups might be another reason.

CONCLUSION

In conclusion, our study has shown that the determination of proteinuria by spot urine technique in glomerular diseases can be used safely instead of the 24-h measurement method. Difficulties in 24-h measurement method such as incorrect collection, time-consumption are not observed in spot urine method and it is more practical in clinical use. Another finding of our study is that glomerular diseases do not affect body components. This result was found interesting for us. There may be several reasons for this situation. But there is no clear information to explain this in the available literature. Study results indicate that in order to have a more detailed opinion, more detailed studies should be performed with large patient groups.

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