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Quantitative Evaluation of Proteinuria with Urinalysis Test and Comparing Its Correlation with Random Spot Urine PCR and 24-Hour Urine Protein in SLE Patients

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A B S T R A C T

Introduction: Lupus nephritis is an important concern among systemic lupus erythematosus (SLE) patients in Asia, and its mortality rate was reported to be 6 times higher compared to the general population. 24-hour urine protein collection has long been used as the gold standard test to assess proteinuria. This study aimed to assess the correlation of urinalysis test with random spot urine protein-creatinine ratio (PCR) compared with 24- hour urine protein. **Methods:** This was a retrospective study. The electronic medical records of all SLE patients seen in the rheumatology clinic of Hospital Sultan Ismail from 1st January 2017 to 1st January 2021 were reviewed. Patients who had urinalysis, urine protein-creatinine ratio, and 24-hour urine protein tests were identified. Data on demography, urinalysis, random spot urine protein-creatinine ratio, and 24-hour urine protein were obtained and analysed. **Results:** The correlation between urinalysis and 24-hour urine protein was strong (r=0.702), whereas the correlation between urinalysis and urine PCR was stronger (r=0.797). Our study also showed the correlation between random urine protein-creatinine ratio and 24-hour urine protein is strong (r=0.782). **Conclusion:** Urinalysis correlates well with both random spot urine protein-creatinine ratio and 24-hour urine protein, and the correlation is stronger with urine protein-creatinine ratio.

1. Introduction

Lupus nephritis is an important concern among systemic lupus erythematosus (SLE) patients in Asia, and its mortality rate was reported to be 6 times higher compared to the general population.[1] Without prompt treatment, it can lead to end-stage renal failure and affect the quality of life. The key diagnostic and prognostic measures for the management of numerous renal diseases are early detection and precise quantification of protein excretion.[2]

24-hour urine protein collection has long been used as the gold standard test to assess proteinuria. Unfortunately, it is laborious, inconvenient, and prone to inaccuracy. Besides this, it is unreliable and difficult for disobliging patients such as young children unless catheterization is done, which further increases the risk of urinary tract infection. The risk of under or over-collection can cause imprecise results.[3]

Hence due to its cumbersome process, random spot urine protein-creatinine ratio is used as an alternative to replacing the former in some centers before subjecting patients to renal biopsy. The US

National Kidney Foundation K/DOQI Guidelines in 2000 advocate the use of spot urine protein-to-creatinine ratio for the assessment of proteinuria as a matter of choice for 24-hour urine collection.[4] In a study done by Matar HE et al. in 2012 showed that there was a significant correlation between 24-hour urine protein and urine protein creatinine ratio in his 95 subjects.[5]

Urinalysis (UFEME), on the other hand, is a semi-quantitative screening tool for the early detection of potential kidney disorders. A survey done by Siedner MJ et al. on practice preferences among American Rheumatologists in 2005 reported that 64.6% of them preferred to use urinalysis as the primary tool to screen for proteinuria.[6]

The choice to use which screening tool to quantify proteinuria before the renal biopsy is usually based on the clinician's preference or recommendations. This study aimed to assess the correlation of the urinalysis test with random spot urine protein-creatinine ratio compared with 24-hour urine protein.

2. Methods

This was a retrospective study. A total of 131 SLE patients were recruited from the medical wards and rheumatology clinics of Hospital Sultan Ismail from 1st January 2017 to 1st January 2021.

Patients who had urinalysis, urine protein-creatinine ratio, and 24-hour urine protein tests were identified via electronic medical records. The characteristics of the 131 patients are shown in Table 1. There were 7 male and 124 female patients with a mean age of 34 years (range 13-67 years). Each of the patients was asked to collect all voided urine during a 24-hour period, and a spot urine sample was obtained at a random time point before or after the completion of 24-hour urine protein collection. Total urinary protein and creatinine concentrations were determined by Modified Jaffe Method using the Atellica CH analyser and the dye-binding method using the Atellica CH analyser, respectively. All of our study data were entered into SPSS 2020. Spearman rank correlation test was used to measure the degree of association between urinalysis and 24-hour urine protein test and urine protein-creatinine ratio, whereas the Pearson Correlation test was used to measure the degree of association between 24-hour urine protein test and urine protein-creatinine ratio.

3. Results

The urinalysis test demonstrated that 34 of them had negative results, 37 of them had urine protein of 1 +, 18 of them had urine protein of 2+, 23 of them had urine protein of 3+, and the rest of them had urine protein of 4+. The 24-hour urine protein excretion in our study ranged from 0.04g/day to 12.365g/day. The mean 24-hour urine protein excretion and urine protein-creatinine ratios were 0.93 ± 1.55 g/day and 1.47 ± 2.54 mg/mg creatinine, respectively.

The statistics showed a significant correlation, as demonstrated in Figure 1, Figure 2, and Figure 3. The correlation between urinalysis and 24-hour urine protein was strong ($r = 0.702$, $p < 0.0001$), whereas the correlation between urinalysis and urine protein-creatinine ratio was stronger ($r = 0.797$, $p < 0.0001$). At the same time, our study also showed the correlation between random urine protein creatinine ratio and 24-hour urine protein is strong ($r = 0.782$, $p < 0.0001$).

4. Discussion

Identification and determination of urine protein content are of utmost importance and useful in reaching a diagnosis, monitoring therapeutic effects, and predicting the prognosis of renal diseases.

Urine dipstick assessment of proteinuria as the first evaluation in an outpatient clinic is an easy method to detect the presence of proteinuria, even though there are arguments for its reliability and susceptibility to inter-observer variations.

24-hour urine protein collection, which is the gold standard used to estimate proteinuria, is time-consuming, inconvenient, prone to inaccurate collection, and aesthetically unacceptable. A study by Shaw et al. noted that the collection errors for 24-hour urine protein could reach about 30 %.[7]

Table 1. Characteristics of the patients.

	Number of patients
Gender	
Male	7
Female	124
Ethnics group	
Malays	75
Chinese	45
Indian	9
Others	2
Age group	
< 20 years old	16
20 - 30 years old	43
30 - 40 years old	32
40-50 years old	27
>50 years old	13

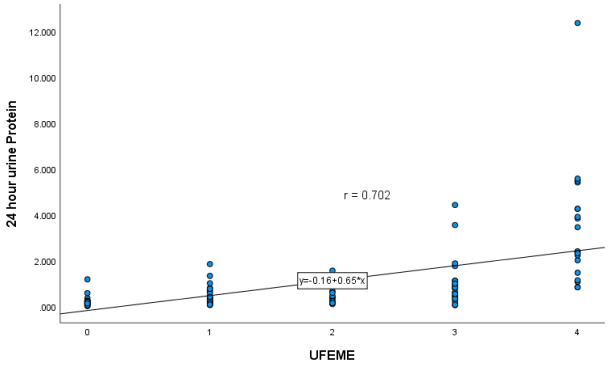

Figure 1. The correlation between 24-hour urine protein and UFEME.

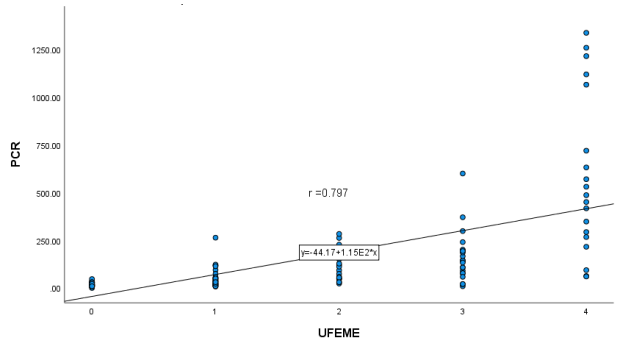

Figure 2. The correlation between urine PCR and UFEME.

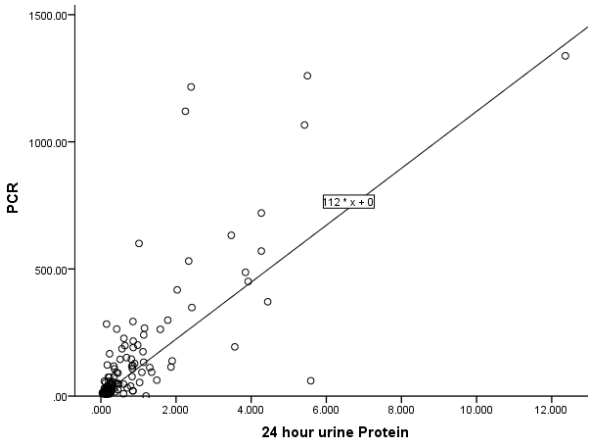

Figure 3. The correlation between urine PCR and 24-hour urine protein.

The urine protein-creatinine ratio recently stands out as a method of rapid quantitative measurement of proteinuria in patients presenting with renal disease. The protein creatinine ratio will take into consideration that the creatinine and protein excretion remains equitably constant in the presence of stable renal function (eGFR). Therefore, after canceling out the time factor, the ratio of these two in a single voided sample will reflect the cumulative protein excretion over the day.[8]

Hence a spot urine examination will be more easily accepted and less laborious, and the purpose of this study is to determine the usefulness of spot urine sampling using protein-creatinine ratio and urinalysis against the regularly used 24-hour urine protein excretion.

A correlation analysis of the urine dipstick method with standard urinary tests for lupus nephritis, such as spot urine protein-creatinine ratio and 24-hour urine protein collection, demonstrated the dipstick method correlated stronger (r = 0.792) with spot urine-protein creatinine ratio as compared to the 24-hour urine protein excretion (r = 0.702). Since there is a strong correlation between the urine protein-creatinine ratio and 24-hour urine protein, the urine protein-creatinine ratio can be a great alternative tool for a patient with lupus nephritis.

5. Conclusion

Urinalysis correlates well with both random spot urine-protein creatinine ratio and 24-hour urine protein, and the correlation is stronger with urine protein-creatinine ratio.

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