Significance of Urinary Neutrophil Gelatinase-Associated Lipocalin Detection in Patients with Lupus Nephritis

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Abstract

**Introduction:** Clinical and laboratory markers have limited specificity and sensitivity for predicting renal disease in Systemic Lupus Erythematosus (SLE) patients.

**Aim of the Work:** In this study we investigated whether urinary neutrophil gelatinase associated lipocalin (uNGAL) predicts active nephritis with or without history of biopsy-proven lupus nephritis (LN), also to find the correlation between uNGAL with serum creatinine level, creatinine clearance, anti-double-stranded (dsDNA) antibody and disease activity score in SLE patients.

**Methods:** Sixty-three SLE patients based on the American College of Rheumatology (ACR) criteria in this cross sectional study were divided into two groups: patients with and without nephritis. For each group disease activity was measured by SLEDAI [1,2] and then divided to low (SLEDAI<8) and high activity (SLEDAI≥8) according to Annett et al., 2003 [3]. 24 hours uNGAL values were measured to each group. uNGAL sensitivity and specificity for identifying biopsy-proven nephritis were calculated, and a receiver operating characteristic (ROC) curve was constructed.

**Results:** The mean±SD of 24-hours uNGAL in patients with LN was significant higher (24.61±3.44mg/24hours) compared to patients without nephritis (16.80±3.54mg/24 hours) with p-value of (p=0.000). A significant positive correlation was found between serum creatinine and uNGAL (r=0.324; p=0.030), while there was significant negative correlation between Creatinine clearance and uNGAL (r=-0.310; p=0.013). uNGAL had high sensitivity (82%) and moderate specificity (67%) in patients with biopsy proven LN in comparison to that of anti-dsDNA which had low sensitivity (50%) and specificity (37%) in detection of renal flare in LN patients.

**Conclusions:** uNGAL predicts renal flare in LN patients with high sensitivity and specificity. Furthermore, uNGAL is a more sensitive and specific for renal flare in patients with a history of LN than anti-dsDNA antibody. So uNGAL may help in earlier diagnosis and treatment of LN with good outcomes in these patients.

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**Key Words:** Systemic lupus erythematosus – Lupus nephritis – Urinary neutrophil gelatinase-associated lipocalin – Systemic lupus erythematosus disease activity index.

**Introduction**

**SYSTEMIC** lupus erythematosus (SLE) is a chronic inflammatory autoimmune disease affecting many organ systems. Lupus Nephritis (LN) is a common and serious complication in patients with SLE. From one-third to one-half of SLE patients have different degrees of renal damage [4] ranging from asymptomatic hematuria/proteinuria to overt nephritis, rapidly progressive glomerulonephritis, nephrotic syndrome, or renal failure [5].

At present, renal biopsy remains the gold standard in establishing the diagnosis and prognosis of LN that can guide treatment decisions. However, renal biopsy is not routinely performed serially [4]. In contrast, other noninvasive procedures for monitoring LN include the measurement of serum creatinine levels, 24-hour creatinine clearance (Ccr), 24-hour urine protein amounts, anti-double stranded DNA (anti-dsDNA) antibody titers, levels of complements C3 and C4, and the presence of urine sediments [4,6].

Lupus nephritis (LN) is the main cause of mortality and disability in SLE patients. Therefore, utilizing a reliable and non-invasive method for serial measurements of renal function seems to be necessary [7].

In fact the long-term survival in SLE can be improved with early diagnosis and treatment of LN. It is thus essential to identify new biomarkers to predict, diagnose and monitor LN. Recently, lipocalin has been emerging as a novel biomarker of renal injury from several etiologies, Sharifipour et al., in 2013 concluded that measurement of
urinary Lipocalin-2 may result in earlier diagnosis of LN. While Mishra et al., in 2005 suggested that lipocalin is a renal biomarker of acute kidney injury, while its usefulness in SLE is unclear [7,8].

Neutrophil gelatinase-associated lipocalin (NGAL), a 25-kDa small protein belonging to the lipocalin protein superfamily, is specialized in binding and transporting small hydrophobic molecules including iron [9]. NGAL has been recently demonstrated to be an early biomarker in acute kidney injury, after cardiopulmonary bypass, major cardiac surgery, elective cardiac catheterization and angiography, hemolytic uremic syndrome, immunoglobulin A (IgA) nephropathy, membranous and membranoproliferative glomerulonephritis, autosomal dominant polycystic kidney disease and kidney transplantation [10,11].

In a prior cross-sectional study, Pitashny et al., found that patients with LN had higher levels of uNGAL than either SLE patients without a history of LN or normal controls [12]. These results corroborated the initial study by Brunner et al., in 2006, which showed that in childhood-onset LN, uNGAL correlated with disease activity and renal damage [13]. The same group reported that the increased level of uNGAL in pediatric lupus cohort study corresponded to worsening renal disease [14].

Aim of the work: Starting from these data, we addressed the question of whether uNGAL is a useful biomarker in early detection of renal damage in SLE patients. Also to find the correlation between uNGAL with serum creatinine level, creatinine clearance, anti-double-stranded (dsDNA) anti body and disease activity score in SLE patients.

Material and Methods

This study included Sixty-three patients with SLE fulfilling the 1997 revised American College of Rheumatology classification criteria for diagnosis of SLE. These patients were further divided into SLE without nephritis (n=18) and SLE-with nephritis (n=45) of which 17 patients of them a renal biopsy was done (biopsy proven LN). All biopsies were classified pathologically according to the modified WHO classification into six classes, i.e. normal, mesangial, focal segmental, diffuse proliferative, membranous and advanced sclerosis [15]. Beside 20 healthy individuals age and sex matched with the patients as control group. The range of age was 17-55 years (one patient only was 55 years of age) with a mean of 27.24 ±7.93 years. Sixty were females and three were males. With a disease duration range from about 1-4 years.

The SLE-with nephritis group included all patients from the SLE active nephritis group as well as SLE patients with proteinuria (>0.5g/day) alone, without abnormal urine sediments.

The SLE-active nephritis group was defined as the presence of any of the following abnormal parameters in the urine analysis: Hematuria (>5 red blood cells/high power field (HPF); exclusion of stones, infection, or other causes), Pyuria (>5 leukocytes/HPF; exclusion of infection), urinary casts (granular or red blood cell casts), >30% increase in serum creatinine levels within 3 months; or biopsy-proven nephritis [16].

Disease activity of the SLE patients was assessed by the SLE Disease Activity Index (SLEDAI) [1,2] on the day of urine collection so SLE patients were divided into 8 patients SLE without nephritis with high activity, 10 patients SLE without nephritis with low activity. Beside 23 patients with nephritis had high activity, 22 patients with nephritis had low activity. So the total patients with high activity were 31 and patients with low activity were 32 considering that the high activity group had SLEDAI score ≥8 and low activity group had SLEDAI score <8 according to Annett et al., 2003 [3].

Exclusion criteria:

All diseases affect the level of uNGAL as Patients after cardio pulmonary bypass, patients after major cardiac surgery, patients with hemolytic uremic syndrome and kidney transplantation, patients with diabetes mellitus, patient with current infection especially urinary tract infection, also all patients who refuse to be enrolled in the study were excluded.

Ethical considerations:

This study was approved by Ethical Committee of Faculty of Medicine, Assiut University. All patients, and controls envolved in this study were informed with a written consent containing the detailed description of the study.

All patients and controls included in this study were subjected to:

I- Full history taking including age, sex, duration of the disease and type of treatment.

II- Complete clinical examination including SLE disease activity index (SLEDAI) [1-3].

III- Laboratory investigations:
1- Complete blood count (CBC).
2- Erythrocyte sedimentation rate (ESR).
3- Serum creatinine.
4- Serum albumin.
5- 24 hours creatinine clearance in urine.
6- 24 hours urinary protein (mg/day).
7- Complete urine analysis.
8- Anti-dsDNA antibody.
9- Antinuclear antibodies (ANA).
10- Estimation of urinary neutrophil gelatinase associated lipocalin (uNGAL) mg/24h to all the studied groups by NGAL ELISA kit (WKEA Med Supplies Corporation, New York, USA).

Measurement of Urinary NGAL by ELISA:

Human Neutrophil Gelatinase-Associated Lipocalin (NGAL) ELISA kit (WKEA Med Supplies Corporation, New York, USA) was used for the quantitative measurement of NGAL in urine samples. This was performed in Clinical Pathology Department, Faculty of Medicine, Assiut University, Egypt.

Kit principle: It is a solid phase enzyme immunoassay which allows for the determination of Human NGAL concentration in Human serum, blood plasma, urine, and other biological fluids.

Sample: Twenty four hour-urine was collected into a clean container. Collected urine volume was measured and part of urine was centrifuged for 20 minutes at the speed of 3000 r.p.m. Then supernatant was collected into clean Wassermann tube and stored at -20⁰C till time of assay.

Assay procedure: The procedure was done according to manufacturer’s instructions.

Statistical analysis:

Statistical analysis was conducted using Statistical Package for Social Sciences version 16.0 for Window software (SPSS Inc.). Mean and standard deviations were used to express quantitative data. For continuous variables, testing between 2 groups was performed by the Mann-Whitney U test. Categorical variables were compared by Pearson’s Chi-Square test when very small proportions were analyzed. Correlations among continuous variables were calculated by the Spearman rank correlation coefficient (rs). p-values of less than 0.05 were considered statistically significant. p-values of more than 0.05 were considered statistically insignificant.

Results

Patients demographics, levels of ANA, anti dsDNA, serum creatinine, creatinine clearance, 24 hours protein excretion and serum albumin both in patients and control groups are summarized in Table (1).

The level of anti dsDNA in SLE patients with nephritis was higher (110.31 ± 71.65) compared to patients without nephritis (81.93 ± 63.45) but without significant difference (p=0.254).

Mean±SD of serum Creatinine was significant higher in patients with LN (206.82±2.0468) compared to patients without nephritis (95.50±50.05) and control (90.60±21.66) (p=0.008 and 0.003 respectively).

Mean±SD Creatinine clearance was significantly lower in patient with LN group (57.16±38) than in patients without LN (77.97±26.60) and control group (100.10±5.25) (p=0.022 and 0.000 respectively) also between patients without LN than in control group (p=0.004).

Mean±SD of 24 hours urinary protein was significantly higher in patients with LN group (1695.93±1319.62) compared to patients without LN (250.78±93.84) and control group (43.65±18.74) (p=0.000), also between patients without LN than in control group (p=0.000).

Mean±SD of Albumin was significantly lower in patients with LN group (25.67±5.55) compared to patients without LN (30.83±8.20) and control group (39.65±2.30) (p=0.007 and 0.000 respectively), also the serum albumin was significantly lower in patients without LN compared to the control (p=0.000).

Urine analysis and detection of active urinary sediments:

Number of patients with proteinuria were significantly higher (p=0.000) in SLE patients with LN (44) (97.8%) compared to patients, without LN (8) (44.4%). Other urinary sediments are shown in Fig. (1).

Assessment of uNGAL level and its correlation with other disease activity parameters:

The mean±SD of 24-hours uNGAL of patients with LN was significant higher (24.61±3.44 mg/24 hours) compared to patients without LN (16.80±3.54mg/24 hours) with p-value of (p=0.000). The mean±SD of 24-hours uNGAL of patients with high activity was significant higher (23.73±5.4 1 mg/24 hours) compared to patients with low activity (21.07±4.13mg/24 hours) with p-value of (p=0.02). Number of patients with high activity was 45 (71%) and number of patients with low activity was 18 (29%). Mean±SD of uNGAL was signifi-
Significantly higher in patients with LN with high activity (25.9±3.6) compared to patients without nephritis with high activity group (17.4±4.4) with p-value of (p=0.000). Also was significantly higher in patients with LN with low activity (23.2±2.5) compared to patients without nephritis with low activity group (15.3±4.4) with p-value of (p=0.000) these findings are summarized in Table (2).

A significant positive correlation was found between serum creatinine and uNGAL (r=0.324; p=0.030) in patients with LN, while there was significant negative correlation between Creatinine clearance and uNGAL (r=-0.310; p=0.013) in patients with LN. But no significant correlation could be detected between serum albumin, CRP, anti-dsDNA, 24 hours urinary protein and uNGAL as shown in Table (3).

**Histopathological examination and their correlation with uNGAL level:**

1- Histopathological classes of kidney biopsy in patients with LN (n=17) according to the International Society of Nephrology/Renal Pathology Society (ISN/RPS) 2003 [17] are found as the followings:

- 3 (17.5%) patients were class III with mean ±SD of uNGAL level 25.7±1.2mg/24 hours.
- 9 (52.9%) patients were class IV with mean ±SD of uNGAL level 26±3.9mg/24 hours.
- 4 (23.6%) patients class V with mean ±SD of uNGAL level was 25.8±2.7mg/24 hours.
- 1 (6%) patients class VI with mean ±SD of uNGAL level 25.5mg/24 hours.

Mean ±SD of uNGAL was significantly higher in patients with biopsy proven LN group (22.89±3.07) than in Patients without LN group (16.80±3.54) with p-value of (p=0.000) as shown in Table (4).

**uNGAL sensitivity and specificity in patients with lupus nephritis:**

uNGAL had high sensitivity (82%) and moderate specificity (67%) in patients with biopsy proven LN in comparison to that of anti-dsDNA which had low sensitivity (50%) and specificity (37%) in detection of renal flare in lupus nephritis patients. In patients with LN, the ability of uNGAL to detect positive cases (sensitivity) was 82%, and the ability to detect negative cases (specificity) was 67%. The ability to predict positive cases (PPV) was 81.8% and that to predict negative cases (NPV) was 66.7% all these findings are summarized in Table (5).

| Table (1): Demographic and some disease characteristics of SLE patients with, without lupus nephritis and controls. |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Characteristics                                | Patients                                        | Control                                          |
|                                                | With LN (n=45)                                  | Without LN (n=18)                               | Control (n=20)                                  |
| Age:                                          | No.   | %    | No.   | %    | No.   | %    | p-1    | p-2    | p-3    |
| <30 years                                     | 32    | 71.1 | 11    | 61.1 | 12    | 60.0 | 0.441  | 0.377  | 0.944  |
| ≥ 0 years                                     | 13    | 28.9 | 7     | 38.9 | 8     | 40.0 | 0.604  | 0.095  | 0.608  |
| Mean ± SD                                     | 27.24±7.93                                   | 28.67±8.91                                      | 29.55±6.71                                      |
| Sex:                                          |                                                |                                                |                                                |
| Male                                          | 2     | 4.4  | 0     | 0.0  | 0     | 0.0  | 0.910  | 0.857  | –      |
| Female                                        | 43    | 95.6 | 18    | 100.0| 20    | 100.0|                                  |        |
| ANA:                                          |                                                |                                                |                                                |
| Positive                                      | 44    | 97.8 | 18    | 100.0| 0     | 0.0  | 0.524  | 0.000* | 0.000* |
| Negative                                      | 1     | 2.2  | 0     | 0.0  | 20    | 100.0|                                  |        |
| Anti-dsDNA: (Mean ±SD)                       | 110.31±71.65                                 | 81.93±63.45                                     | 0.254                                           |
| Creatinine umol/dl: (Mean ±SD)               | 206.82±20.468                                 | 95.50±50.05                                     | 0.008 *                                         |
| Creatinine clearance ml/min: (Mean ±SD)      | 57.16±38.00                                  | 77.97±26.60                                     | 0.022 *                                         |
| 24h urinary protein mg/day: (Mean ±SD)       | 1695.93±1319.62                              | 250.78±93.84                                    | 0.000 *                                         |
| Albumin mg/dl: (Mean ±SD)                    | 25.67±5.55                                   | 30.83±8.20                                      | 0.007 *                                         |

LN: Lupus nephritis  
*p*1: Comparison between patients with LN and patient without LN  
*p*2: Comparison between patients with LN and Control  
*p*3: Comparison between patient without LN and Control
Patients with LN
Patients without LN

Fig. (1): Urine analysis among studied groups.

Table (2): UNGAL in relation to renal damage and disease activity.

<table>
<thead>
<tr>
<th>UNGAL</th>
<th>Patients</th>
<th>Control</th>
<th>p-1</th>
<th>p-2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With LN (n=45)</td>
<td>With out LN (n=18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>Low activity (n=22)</td>
<td>High activity (n=23)</td>
<td>15.3 ± 2.5</td>
<td>25.9 ± 3.6</td>
</tr>
<tr>
<td></td>
<td>Low activity (n=10)</td>
<td>High activity (n=8)</td>
<td>10.3 ± 2.2</td>
<td>17.4 ± 4.4</td>
</tr>
</tbody>
</table>

p-1: Comparison between patients with LN with low activity and patients without nephritis with low activity group.
p-2: Comparison between patients with LN with high activity and patients without nephritis with high activity group.

Table (3): Correlations between UNGAL and renal functional parameters and activity parameters in patients with Lupus nephritis.

<table>
<thead>
<tr>
<th>UNGAL</th>
<th>r-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine</td>
<td>0.324</td>
<td>0.030*</td>
</tr>
<tr>
<td>Albumin</td>
<td>-0.075</td>
<td>0.622</td>
</tr>
<tr>
<td>24 hours urinary protein</td>
<td>0.085</td>
<td>0.577</td>
</tr>
<tr>
<td>Creatinine clearance</td>
<td>-0.310</td>
<td>0.013*</td>
</tr>
<tr>
<td>CRP</td>
<td>0.076</td>
<td>0.619</td>
</tr>
<tr>
<td>Anti-double strand antibodies</td>
<td>-0.042</td>
<td>0.784</td>
</tr>
</tbody>
</table>

Table (4): UNGAL in Biopsy proven LN and Patients without Lupus nephritis.

<table>
<thead>
<tr>
<th>UNGAL</th>
<th>Biopsy proven LN (n=17)</th>
<th>Patients without LN (n=18)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>22.89 ± 3.07</td>
<td>16.80 ± 3.54</td>
<td>0.000*</td>
</tr>
<tr>
<td>Median (Range)</td>
<td>25.8 (20.51-33.20)</td>
<td>17.5 (9.20-22.92)</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Table (5): Detection of sensitivity and specificity of 24-hours UNGAL excretion and serum Anti-dsDNA in patients with biopsy proven Lupus nephritis.

<table>
<thead>
<tr>
<th>Cut-off</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNGAL &gt; 24.59</td>
<td>81.82</td>
<td>66.67</td>
<td>81.8</td>
<td>66.7</td>
<td>0.758</td>
</tr>
<tr>
<td>Anti-dsDNA ≤ 114.9</td>
<td>50.00</td>
<td>37.93</td>
<td>48.6</td>
<td>39.3</td>
<td>0.502</td>
</tr>
</tbody>
</table>

PPV: Positive predictive value.
NPV: Negative predictive value.
AUC: Area under curve.

Discussion

It is obvious that early diagnosis and treatment of lupus nephritis is associated with better disease outcome [18]. Hence, it would be very beneficial if one could detect the presence of nephritis early in disease. Although serial renal biopsies may be ideal in close monitoring of progression of renal diseases, this may be practically difficult and is not without complications [19]. Clearly, there is an urgent need for a “surrogate” marker of renal involvement to predict the onset of immune nephritis and to monitor its progression in lupus. Renal biopsy is usually suggested as the ‘gold standard’ for diagnosis and histological classification of LN [20]. But, renal biopsy is associated with important problems. Sampling bias appears a prominent problem because renal pathology may not be uniform in LN [21].

The aim of this study is to detect uNGAL as a biomarker for early detection of renal damage in SLE patients. Also to find the correlation between UNGAL with serum creatinine level, creatinine clearance, anti-double-stranded (dsDNA) anti body and disease activity score in SLE patients.

In this study ANA was significantly positive in patients with and without LN compared to the control group, but there was no significant difference between patients with and without LN. Also anti-ds DNA level in patients with nephritis had no significant difference compared to patients without nephritis, in agreement with Rubinstein et al., [22].

Mean±SD of serum Creatinine was significant higher in patients with LN compared to patients without nephritis and controls this result was similar to that of Chen Yang et al., in 2012 and Sharifipour et al., 2013 [7,16].

Mean±SD of 24 hours urinary protein was significantly higher in patients with LN group compared to patients without nephritis and controls this result was similar to that of Chen Yang et al., and Sharifipour et al., [7].

Mean±SD of 24 hours urinary protein was significantly higher in patients with LN group compared to patients without LN and control group, also between patients without LN than in control group the same result was proven by Sharifipour et al., [7].

NGAL is normally expressed at very low levels in human renal tubular cells [21]; this was also seen in our study as control group had low level of 24-hours UNGAL.
Cell types other than renal tubular cells in the body, such as various types of epithelial cells, endothelial cells, or immune cells, might contribute to urinary NGAL levels in patients even without nephritis. It is not surprising that those SLE patients without renal involvement exhibited higher urinary NGAL excretion than did normal controls [16].

In the present study the mean±SD of uNGAL was significantly higher in all patients with high activity group than in low activity group, also uNGAL was significantly higher among all patients with high and low activity compared to the control group the similar result was proven by Rubinstein et al. [22].

Also we found that, mean±SD of uNGAL was significantly higher in patients with LN with high activity (25.9±3.6) compared to patients without nephritis with high activity group (17.4±4.4) with p-value of (p=0.000). Also was significantly higher in patients with LN with low activity (23.2±2.5) compared to patients without nephritis with low activity group (15.3±4.4) with p-value of (p=0.000) which was the same results were obtained by Chen Yang et al., in 2012 [16].

Our data is compatible with those of other authors who observed that higher urinary NGAL levels in LN were not necessarily correlated with SLEDAI scores in both pediatric [14] and adult SLE patients [12]. In contrast, urinary NGAL was correlated with worsening renal disease activity in pediatric SLE patients [14]. Rubinstein et al., [22] postulated that NGAL was a significant predictor of renal disease activity and renal flares in SLE patients.

Mean±SD of uNGAL was significantly higher in patients with Biopsy proven LN group than in Patients without LN group which was also proved by Rubinstein et al., [22].

In the present study, there was statistically significant positive correlation between serum creatinine and uNGAL. There were statistically significant negative correlation between Creatinine clearance and uNGAL these results were similar to that of Chen Yang et al., [16].

In agreement with Rubinstein et al., [22] and Chen Yang et al., [16] there was no correlation between 24 hours urinary protein and uNGAL indicating that the presence of uNGAL cannot be explained by non-specific renal protein excretion, this was not proven in the study of Bolignano et al., and Sharifipour et al., [7,10].

In our study we postulated that uNGAL had high sensitivity and moderate specificity in patients with biopsy proven LN in comparison to that of anti-dsDNA which had low sensitivity and specificity in detection of renal flair in lupus nephritis patients. Similar results were also proved by Rubinstein et al., [22].

Our study demonstrates that urinary NGAL is a potential biomarker for renal damage in SLE patients. The evidence is supported by the following 3 facts:

1- Urinary NGAL excretion was significantly higher in SLE patients with LN detected by biopsy or laboratory investigations than in the SLE without nephritis or control groups.

2- Urinary NGAL excretion was positively correlated with serum creatinine levels and negatively correlated with 24-hour creatinine clearance (Ccr) in SLE patients with renal involvement.

3- UNGAL had high sensitivity (82%) and moderate specificity (67%) in patients with biopsy proven LN in comparison to that of anti-dsDNA which had low sensitivity (50%) and specificity (37%) in detection of renal flair in lupus nephritis patients.

Some of the problems in the clinical use of lipocalin may include its nonspecific nature since urinary lipocalin levels also increase after various other types of kidney injury, including ischemic and toxic injuries [7].

Although we did not measure plasma NGAL in our patients, we deduce that either enhanced local production from renal tubular cells or increased NGAL leakage from glomerular capillaries is the major source of increased urinary NGAL in the SLE renal group in this study. Bolignano et al., [10] proposed that the increase in urinary NGAL in chronic renal proteinuric diseases is due to massive protein loss that may saturate megalin-cubilin transporters on renal tubular cells leading to reduced NGAL reabsorption.

These results suggest that urinary NGAL may be a potential biomarker for SLE patients with renal inflammation or damage.

These results further confirm that the higher urinary NGAL excretion in the SLE renal group seems to derive from renal damage rather than from active immune reactions in the kidneys. Therefore, urinary NGAL excretion is a better biomarker than anti-dsDNA antibody titers for SLE patients with renal involvement in our study.
Conclusions:
In conclusion, in the current study we found that 24-hours uNGAL may act as a useful marker of lupus nephritis and provide additional clinically relevant information of renal disease activity than invasive procedures (biopsy) and other established markers.

So adding measurement of 24-hours uNGAL to the routine follow-up of SLE patients may result in earlier diagnosis of lupus nephritis and its flare, therefore less delay in institution of appropriate treatment and prevention of progression of renal damage.

Recommendations:
1- The study and follow-up SLE patients, with measurement of UNGAL together with its correlation to disease activity and treatment response.
2- Further study on larger numbers of patients with biopsy proven LN to reveal the correlation between the level of 24-hours uNGAL and different histopathological classes of lupus nephritis.
3- Routine use of 24-hours UNGAL as a new marker for accurate diagnosis of LN.

Conflict of interest:
The authors declare that they have no conflict of interest.

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References


الملخص العربي

الهدف: أن العلاجات الأكليتيبة والعملية المستخدمة حاليا لها خصوصية وحساسية محدودة لتوقع تطور مرض الكلى في مرضى الأندام الحرير.

وقد تم دراسة ما إذا كان الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول من علامات توقع تطوير المرض في مرضى الذبابة الحرير. وقد تم دراسة ما إذا كان الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول في مرضى الذبابة الحرير. وقد تم دراسة ما إذا كان الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول في مرضى الذبابة الحرير.

الأساليب: أشتمل هذا الدراسة على نتائج علاجات الأكليتيبة والعملية المستخدمة حاليا لها خصوصية وحساسية محدودة لتوقع تطور مرض الكلى في مرضى الذبابة الحرير.

النتائج: كان مستوى الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول في 44 ساعة أعلى في مرضى الذبابة الحرير. وكان هناك علاقة إيجابية بين الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول في 44 ساعة ونسبة الكرياتينين في الأدم. وقد وجد أن الانتيزيج الجيلانيتي للخلايا الببتيدية المصصوقة المصاحبة للبروتينات بالبول له علاقة عالية (78%) وخصوصية متوسطة (73.Conclusion: The results of the present study indicate a significant correlation between urine NGAL levels and the presence of glomerular inflammation, suggesting that urinary NGAL may serve as a potential biomarker for early detection and monitoring of lupus nephritis.