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Original Research Article **Nephrology**

A Study on Clinical and Laboratory Status of Active and Inactive LN Patients

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Abstract

Background*:** Lupus nephritis (LN) is a significant manifestation of systemic lupus erythematosus (SLE) that affects the kidneys. Differentiating between active and inactive LN is essential for determining disease activity, tailoring treatment strategies, and monitoring patient outcomes. The clinical and laboratory status of LN patients provides valuable insights into the severity of renal involvement, response to treatment, and the potential for disease progression. ***Objective: To asses clinical and laboratory status of active and inactive LN patients. ***Method*:** This cross sectional study was conducted in the Department of Nephrology, Dhaka Medical College Hospital, Dhaka from January, 2017 to June, 2018. This cross sectional study was performed on 60 biopsy proven lupus nephritis patients and 30 age and sex matched apparently healthy control subjects. All the patients were recruited as per inclusion and exclusion criteria. Diagnosed SLE patients who had renal involvement and undergone renal biopsy for standard clinical indications were recruited by purposive sampling and divided into two groups of active and inactive LN as per operational definition. ***Results*:** During the study, Mean age of the lupus nephritis patients in active and inactive LN was 26.60 ± 8.36 years and 28.80 ± 9.18 years respectively. Most of the patients in both groups were female. Anaemia and edema was observed significantly higher in active than that of inactive lupus nephritis. Systolic and diastolic blood pressure was significantly higher in active lupus nephritis than that of inactive lupus nephritis patients. Hb, serum C3 and eGFR were significantly lower in active LN than that of inactive LN. RBC, WBC, platelet count were also lower in active LN than that of inactive LN but no significant difference was observed between two groups. ESR, serum creatinine, proteinuria, Anti ds DNA Ab titre and uMCP-1 were significantly higher in active LN than that of inactive LN. There was no difference between active and inactive LN patients with regards the use of medications. There was no difference in renal biopsy classes in between two groups. ***Conclusion*:** According to our study findings, active lupus nephritis (LN) patients exhibited elevated systolic and diastolic blood pressure compared to those with inactive LN. Additionally, active LN patients displayed lower levels of hemoglobin, serum C3, and estimated glomerular filtration rate (eGFR) compared to inactive LN patients. While red blood cell (RBC), white blood cell (WBC), and platelet counts were also lower in active LN patients, the difference between the two groups did not reach statistical significance. Furthermore, there were no notable differences in medication usage between active and inactive LN patients, and the distribution of renal biopsy classes was similar in both groups.

Keywords: Active lupus nephritis (LN), estimated glomerular filtration rate (eGFR), clinical status.

INTRODUCTION

Lupus nephritis (LN) is a severe complication of systemic lupus erythematosus (SLE) characterized by inflammation and damage to the kidneys. The clinical and laboratory status of LN patients can vary significantly, depending on the activity of the disease. Distinguishing between active and inactive LN is crucial for accurate diagnosis, effective management, and timely intervention to prevent irreversible renal

damage. Understanding the clinical and laboratory features associated with active and inactive LN is essential for optimizing patient care and improving outcomes.

Active LN refers to a state of ongoing inflammation and disease activity in the kidneys. Patients with active LN often present with clinical manifestations such as proteinuria, hematuria, hypertension, and renal impairment. Proteinuria, specifically the presence of significant levels of urinary protein, is one of the most prominent indicators of active LN. The severity of proteinuria can range from mild to nephrotic-range proteinuria, indicating the degree of glomerular damage and leakage of proteins into the urine. Hematuria, the presence of red blood cells in the urine, is another common finding in active LN and may indicate inflammation or damage to the renal vasculature. Hypertension, often accompanying active LN, can result from impaired renal function and increased fluid retention [1-5].

Laboratory investigations play a critical role in assessing the activity of LN. Blood tests can reveal abnormalities such as elevated levels of serum creatinine, blood urea nitrogen (BUN), and reduced glomerular filtration rate (GFR), indicating impaired renal function. Additionally, markers of systemic inflammation, such as increased erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels, may be present in patients with active LN. Autoantibodies associated with SLE, such as anti-double-stranded DNA (anti-dsDNA) antibodies and anti-Smith (anti-Sm) antibodies, may also be elevated during active disease [6].

In contrast, inactive LN refers to a quiescent or remission phase of the disease, characterized by minimal or no signs of inflammation and renal damage. Patients with inactive LN may exhibit improved or normalized laboratory parameters such as reduced proteinuria, absence of hematuria, and stabilization of renal function. Inactive LN is often associated with a decrease in systemic inflammation markers, such as ESR and CRP. The presence of autoantibodies associated with SLE may also decrease or become undetectable during periods of disease inactivity [7].

Differentiating between active and inactive LN is essential for treatment decisions and monitoring disease progression. Therapeutic interventions are often intensified during active LN to suppress inflammation, preserve renal function, and prevent further damage. Conversely, during periods of disease inactivity, treatment may focus on maintaining remission and preventing relapse.

In conclusion, the clinical and laboratory status of LN patients can significantly differ between active and inactive disease states. Assessing clinical features such as proteinuria, hematuria, and hypertension, along with laboratory parameters indicative of renal function and systemic inflammation, plays a crucial role in determining disease activity and guiding treatment decisions. Regular monitoring and timely adjustments to therapy based on the clinical and laboratory status of LN patients are vital to optimize patient outcomes and prevent long-term renal complications [8-11].

OBJECTIVE

To evaluate the clinical and laboratory status of active and inactive LN patients.

METHODOLOGY

This cross sectional study was conducted in the Department of Nephrology, Dhaka Medical College Hospital, Dhaka from January, 2017 to June, 2018. This cross sectional study was performed on 60 biopsy proven lupus nephritis patients and 30 age and sex matched apparently healthy control subjects. All the patients were recruited as per inclusion and exclusion criteria. Diagnosed SLE patients who had renal involvement and undergone renal biopsy for standard clinical indications were recruited by purposive sampling and divided into two groups of active and inactive LN as per operational definition. Diagnosis of SLE was based on having four or more criteria according to the American College of Rheumatology (ACR) criteria for SLE (Tan et al., 1982). Biopsies were not done for the purposes of entry into the study but for the standard clinical indications of 24 hours UTP more than 1 gm, UTP >500mg with hematuria or cellular cast and impaired kidney function or decline in kidney functions despite appropriate therapy for SLE nephritis. Biopsies were evaluated according to the International Society of Nephrology / Renal Pathology Society (ISN/RPS) classification of lupus nephritis. The histological activity and chronicity indices were calculated.

All patients were subjected to full history taking including medication history especially immunosuppressive medications. Thorough clinical examination was performed for all patients, including vital signs, chest examination, heart examination, abdominal examination and CNS examination. All available data about LN were recorded.

Laboratory tests were carried out in the form of urine routine and microscopic examination (R/M/E), complete blood count, ESR, Serum creatinine, 24 hours UTP, anti-ds DNA Ab titre and serum C3, C4 levels. eGFR was calculated by Modification of diet in Renal Disease (MDRD) equation.

All patients were subjected to full history taking including medication history especially immunosuppressive medications. Thorough clinical examination was performed for all patients, including vital signs, chest examination, heart examination,

abdominal examination and CNS examination. All available data about LN were recorded.

Assessment of disease activity of LN was carried out by the SLEDAI-2K (renal). The SLEDAI is the assessment tool for disease activity of SLE. Twenty four features that are attributed to SLE are listed with a weighted score given to any one that is present at the time of visit or within the last 10 days. The renal SLEDAI consists of four kidney related items: 1. Proteinuria (> 0·5 gm/24 hours), 2. Hematuria (> 5 red blood cells/HPF excluding stone, infection or other cause), 3. Pyuria (> 5 white blood cells /HPF excluding infection) and 4. Urinary cast (Heme-granular or red blood cell casts). The presence of each one of the four parameters takes a score of 4 points, thus the renal SLEDAI score ranged from 0 to a maximum score of 16. Active LN was considered with renal SLEDAI score ≥ 4. Statistical analysis of the study was done by the Statistical Package for Social Science (SPSS-22). The results were presented in tables, figures and diagrams. Categorical data were presented as frequency & percentage and numerical data as mean & standard deviation.

Confidence interval was considered at 95% level. Chi square test was used for categorical data and Unpaired t test was used for numerical data. Correlation between uMCP-1 levels with relevant laboratory parameters were assessed using Pearson's correlation coefficients.

RESULTS

Table-1 shows age status of the active and inactive lupus nephritis patients. Where Mean age of the lupus nephritis patients in active and inactive LN was 26.60 ± 8.36 years and 28.80 ± 9.18 years respectively.

Table-1: Demographic profile of the patients (n=60)

	Lupus nephritis		Total n(%)	p value
	Active n(%)	Inactive n(%)		
Age (years)				
≤20	10 (33.3)	6 (20.0)	16 (26.7)	
21 - 30	13 (43.4)	14 (46.7)	27 (45.0)	
31 - 40	4 (13.3)	7 (23.3)	11 (18.3)	
>40	3 (10.0)	3 (10.0)	6 (10.0)	
Total	30 (100.0)	30 (100.0)	60 (100%)	
Mean±SD	26.60 ± 8.36	28.80 ± 9.18	27.70 ± 8.78	[a]0.336

[a]Unpaired t test and [b]Chi-square test was done to measure the level of significance

Figure-1 shows gender distribution of the patients where most of the patients in both groups were female. There was also no significant difference in gender between active and inactive lupus nephritis patients.

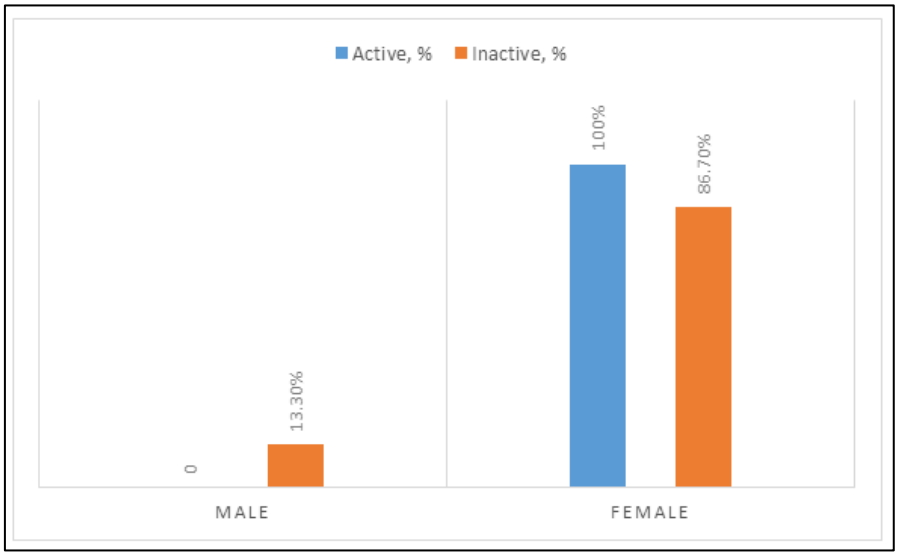

Figure-1: Gender Distribution

Table-2 shows general examination findings of the patients. Anaemia and edema was observed significantly higher in active than that of inactive lupus nephritis.

Table-2: General examination findings of the patients (n=60)

General examination	Lupus nephritis		p value
	Active n(%)	Inactive n(%)	
Anaemia	23 (76.7)	2 (6.7)	<0.001
Edema	21 (70.0)	1 (3.3)	<0.001

Chi-square test was done to measure the level of significance.

Table-3 shows clinical findings of the lupus nephritis patients. Systolic and diastolic blood pressure was significantly higher in active lupus nephritis than that of inactive lupus nephritis patients. BMI was almost similar in active LN than inactive LN, no significant difference was found between two groups.

Table-3: Clinical findings of the patients (n=60)

Clinical findings	Lupus nephritis		p value
	Active Mean±SD	Inactive Mean±SD	
Systolic BP (mm of Hg)	145.50 ± 13.92	122.00 ± 12.77	<0.001
Diastolic BP (mm of Hg)	84.00 ± 8.55	74.33 ± 7.28	<0.001
BMI (kg/m^2)	25.67 ± 2.99	25.47 ± 3.11	0.801

Unpaired t test was done to measure the level of significance.

Table-4 shows comparison between active and inactive LN patients. Hb, serum C3 and eGFR were significantly lower in active LN than that of inactive LN. RBC, WBC, platelet count were also lower in active LN than that of inactive LN but no significant difference was observed between two groups. ESR, serum creatinine, proteinuria, Anti ds DNA Ab titre and uMCP-1 were significantly higher in active LN than that of inactive LN. There was no difference between active and inactive LN patients with regards the use of medications. There was no difference in renal biopsy classes in between two groups.

Table-4: Comparison between active and inactive LN patients (n=60)

Laboratory findings	Lupus nephritis		p value
	Active	Inactive	
Hb (g/dl)	8.98 ± 1.83	10.83 ± 1.28	<0.001
RBC (10^{12}/L)	3.72 ± 0.49	4.81 ± 0.72	<0.001
WBC (10^9/L)	7.15 ± 2.79	7.77 ± 1.58	0.291
Platelet (10^9/L)	260.29 ± 536.44	203.44 ± 98.03	0.570
ESR (mm in 1st hour)	50.36 ± 28.73	22.22 ± 17.31	<0.001
Serum creatinine (mg/dl)	1.29 ± 0.69	0.94 ± 0.28	0.014
eGFR ($ml/min/1.73m^2$)	75.57 ± 38.9	91.86 ± 28.42	0.047
Proteinuria (g/24h)	2.45 ± 0.81	0.26 ± 0.11	<0.001
Serum C_3 (g/l)	0.74 ± 0.35	1.23 ± 0.28	<0.001
Serum C_4 (g/l)	0.20 ± 0.27	0.25 ± 0.10	0.335
Anti ds DNA Ab titre (U/ml)	107.61 ± 53.92	42.32 ± 25.72	<0.001
uMCP-1 (pg/ml)	578.33 ± 74.66	365.50 ± 54.88	<0.001
Renal biopsy (LN class)			
Class II	3(10.0)	5(16.6)	
Class III	14(46.6)	13(43.3)	0.768
Class IV	12(40.0)	10(33.3)	
Class V	1(3.3)	2(6.6)	
Activity index	9.4 ± 4.2	8.9 ± 4.0	0.946
Chronicity index	4.4 ± 1.6	4.2 ± 1.7	0.817
Medications			
Prednisolone	30(100)	30(100)	–
Cyclophosphomide	25(83.3)	19(63.3)	0.079
MMF	4(13.3)	3(10)	1.00
Cyclosporine	1(3.3)	1(3.3)	–
Hydroxychloroquine	30(100)	29(96.6)	1.00

Unpaired t test and Chi-square test was done to measure the level of significance. Results expressed as mean ± SD and number (percentage) as applicable.

Table-5 shows distribution of LN patients according to SLEDAI.

Table-5: Distribution of LN patients according to SLEDAI, (n=60)

SLEDAI	Lupus nephritis	
	Active n (%)	Inactive n (%)
0 or < 4	0	30 (100)
4	1(3.3)	0
8	9(30)	0
12	20(66.7)	0
16	0	0
Total	30(100)	30(100)

DISCUSSION

The clinical and laboratory status of patients with active and inactive lupus nephritis (LN) provides important insights into the disease activity, severity, and response to treatment. Distinguishing between active and inactive LN is crucial for appropriate management and intervention strategies. Understanding the differences in clinical and laboratory features between these two states is essential for optimizing patient care and improving outcomes.

Active LN is characterized by ongoing inflammation and disease activity in the kidneys. Clinically, patients with active LN often present with symptoms such as proteinuria, hematuria, hypertension, and renal impairment. Proteinuria, the presence of significant levels of urinary protein, is a hallmark feature of active LN and indicates the degree of glomerular damage and leakage of proteins into the urine. The severity of proteinuria can range from mild to nephrotic-range proteinuria. Hematuria, the presence of red blood cells in the urine, is another common finding in active LN and may indicate inflammation or damage to the renal vasculature. Hypertension, frequently accompanying active LN, can result from impaired renal function and increased fluid retention [11-13].

Laboratory investigations play a critical role in assessing the clinical status of LN patients. Blood tests can reveal abnormalities associated with active disease, such as elevated levels of serum creatinine and blood urea nitrogen (BUN), indicating impaired renal function. A reduced glomerular filtration rate (GFR) may also be observed in active LN. In addition, markers of systemic inflammation, such as an increased erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels, may be present, indicating the systemic inflammatory response associated with active LN. Autoantibodies associated with systemic lupus erythematosus (SLE), such as anti-double-stranded DNA (anti-dsDNA) antibodies and anti-Smith (anti-Sm) antibodies, may also be elevated during active disease [14-16].

In contrast, inactive LN refers to a quiescent or remission phase of the disease, where there is minimal or no evidence of inflammation and renal damage. Patients with inactive LN may exhibit improvements or normalization of clinical and laboratory parameters. Proteinuria may decrease or even resolve, indicating the absence of ongoing glomerular damage. Hematuria may also resolve, indicating the absence of ongoing inflammation or vascular damage. Renal function may stabilize or improve, as reflected by normalized levels of serum creatinine and BUN. In addition, markers of systemic inflammation, such as ESR and CRP, may decrease to normal levels during inactive disease states. The presence of autoantibodies associated with SLE may decrease or become undetectable during periods of inactivity.

The differentiation between active and inactive LN is crucial for treatment decisions and monitoring disease progression. Therapeutic interventions are typically intensified during active LN to suppress inflammation, preserve renal function, and prevent further damage. Immunosuppressive agents, such as corticosteroids and immunomodulatory drugs, are commonly used to target the underlying immune dysregulation in active LN. Conversely, during periods of disease inactivity, treatment may focus on maintaining remission and preventing relapse. Medications may be tapered or adjusted to the lowest effective dose, with an emphasis on minimizing long-term adverse effects [15].

A recent study compared the clinical and laboratory parameters of LN patients during active and inactive disease states. The researchers found that patients with active LN had significantly higher levels of proteinuria, hematuria, and blood pressure compared to those with inactive disease. Additionally, they observed elevated levels of inflammatory markers, such as ESR and CRP, in active LN patients. These findings highlight the distinct clinical and laboratory features associated with disease activity in LN [14].

Another study the researchers evaluated the renal function of LN patients during active and inactive disease phases. They found that patients with active LN had significantly higher levels of serum creatinine and BUN, indicating impaired renal function. Conversely, patients with inactive LN showed improvements in

renal function, as evidenced by normalized levels of these markers. These results emphasize the importance of monitoring renal function as a key indicator of LN activity and response to treatment [15].

CONCLUSION

According to our study findings, active lupus nephritis (LN) patients exhibited elevated systolic and diastolic blood pressure compared to those with inactive LN. Additionally, active LN patients displayed lower levels of hemoglobin, serum C3, and estimated glomerular filtration rate (eGFR) compared to inactive LN patients. While red blood cell (RBC), white blood cell (WBC), and platelet counts were also lower in active LN patients, the difference between the two groups did not reach statistical significance. Furthermore, there were no notable differences in medication usage between active and inactive LN patients, and the distribution of renal biopsy classes was similar in both groups.

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