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Clinical and laboratory features of 496 cases of biopsy-proven lupus nephritis; a study at Shiraz University of Medical Sciences, Iran

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ABSTRACT

Introduction: Systemic lupus erythematosus (SLE) is a systemic autoimmune disease that can involve various organs. Renal involvement has been seen in about 60% of SLE patients, while the most common presentation of lupus nephritis (LN) is proteinuria.

Objectives: This study aimed to investigate the clinical and laboratory features of LN patients, confirmed by kidney biopsy and compare these among different classes of LN.

Patients and Methods: This cross-sectional study was conducted on clinical and laboratory data of patients with LN from 2001 to 2016. All patients diagnosed with definite LN by biopsy and electron microscopy (EM) were included in this study.

Results: A total number of 496 patients were enrolled. The mean age of all patients was 28.32 ±11.41 years; 82.4% (409) were females. The biopsies were classified into LN classes II, III, IV, V, and VI, whose frequencies were 98 (20.6%), 93 (19.5%), 225(47.3%), 46 (9.7%), and 14 (2.9%), respectively. Tubular atrophy ($P<0.001$) and interstitial fibrosis ($P<0.001$) were found to be significantly associated with classes of LN. Additionally, 72.7% (8) and 48.2% (92) of patients in classes VI and IV of LN had blood urea nitrogen (BUN) levels more than the normal range ($P<0.001$). Regarding serum creatinine levels, 81.8% (9) and 42.9% (81) of patients in classes VI and IV of LN had high levels ($P<0.001$). Moreover, nephrotic syndrome (NS) was reported in 47.5% (47) of patients with class II of LN followed by 38.8% (36) in class III. Besides, edema was significantly more dominant in classes IV (74.3%, 133) and VI (75%) of LN patients ($P=0.03$).

Conclusion: Tubular atrophy and interstitial fibrosis were more commonly seen in LN class VI followed by class IV. Edema, hypertension, and proteinuria are common presentations in class IV. Complete assessment of renal biopsy is still helpful for the definite classification of LN.

Implication for health policy/practice/research/medical education:
Lupus nephritis is one of the most dreaded complications of systemic lupus erythematosus (SLE), which can have numerous clinical and paraclinical presentations. This study aimed to provide evidence on the prevalence of different lupus nephritis presentations and its laboratory abnormalities at a major electron microscopy center in Iran, which can in turn guide physicians towards better diagnosis, management and prognosis.

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Original Article

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune disease that can involve many organs throughout the human body (1). Previous studies have estimated the global prevalence rate of SLE between 13-51 patients per 100 000 population (2). Some studies have also shown that the prevalence of SLE has recently increased in Greece and the United States; on the other hand, it has decreased in the United Kingdom, Spain, and southern Sweden (3). About 60% of patients with SLE develop lupus nephritis (LN) (4). Around 10% of patients with LN develop end-stage renal disease (ESRD) in the first five years after diagnosis (5). The most common presentation of LN is with proteinuria reported in almost all patients. Other clinical manifestations of LN include casts, hematuria, and impaired kidney function (6). Hypertension is another presentation in LN patients. It is prevalent in patients with SLE which is the main risk factor for cardiovascular disease (7). Although the pathogenesis of hypertension in SLE is not yet well-understood, some factors, such as age, obesity, gender, ethnicity, inflammatory process, dysfunction of the immune system, side effects of medications, and involvement of kidneys may lead to increased blood pressure in patients with SLE (8).

Objectives

This study aimed at investigating the clinical and laboratory features of patients with confirmed diagnosis of LN from 2001 to 2016 and comparing them among different classes of LN.

Patients and Methods

Study design

This cross-sectional study was conducted on clinical and laboratory data of patients with biopsy-proven LN admitted to Shiraz hospitals from 2001 to 2016. All kidney samples were sent to the electron microscope (EM) unit affiliated to Shiraz University of Medical Sciences, Fars province, Iran. Light microscopy (LM), immunofluorescence (IF), and EM were used to study the biopsies. All patients diagnosed with definite LN by complete pathologic evaluation (including EM study) were included in this study. Finally, 496 patients fulfilled the inclusion criteria. There was only one case of class I of LN, which was excluded from the analysis for the convenience of statistical analysis.

For EM evaluation of biopsies, renal biopsies were cut into pieces of 1 mm, put into 3% glutaraldehyde, and postfixed in osmium tetroxide. After embedding in Agar 100 resin, the ultra-thin sections were put on copper grids and double-stained with Uranyl acetate and lead citrate. The grids were evaluated by a transmission EM (Leo 906, Germany).

According to biopsy findings, each biopsy was morphologically categorized into one of six classes of LN by ISN/RPS classification (2003) (9).

Data collection

The patients' age, gender, history of chronic kidney disease (CKD), nephrotic syndrome (NS), proteinuria, edema, hematuria, hypertension, serum level of blood urea nitrogen (BUN), creatinine and C3, and 24-hour urine volume were extracted from pathology request sheets filled in the hospital. Hypertension was defined as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg.

Statistical analysis

All the statistical analyses were performed using SPSS software version 19.0. Descriptive statistics were reported as number (%) for qualitative variables and as mean ± standard deviation (SD) for quantitative (mean ± SD) variables. The chi-square or Fisher's exact tests were used to examine the association between different variables, as appropriate. A P value of less than 0.05 was considered as statistically significant.

Results

In total, 496 patients were enrolled from all 2770 kidney biopsies performed over the study period. The mean age of all patients was 28.4 ±11.9 years with a maximum age of 78 years, while the majority of patients (420, 84.7%) were females. Meanwhile, 17.9% (89) of patients were in the pediatric age group (≤18 years old.)

The mean ± SD values of systolic and diastolic blood pressures were 129.7 ±19.3 mm Hg (range; 80-200) and 81.7 ± 11.0 mm Hg (range: 50-120), respectively.

The frequencies of LN classes of II, III, IV, V, and VI were 98 (20.6%), 93 (19.5%), 225(47.3%), 46 (9.7%), and 14 (2.9%), respectively. There were also 19 cases of two combined LN classes therefore, the most common combined classes were III and VI. Figure 1 shows EM photographs of LN classes of II to VI.

Table 1 shows the association between clinical and laboratory characteristics and different classes of LN. As seen in Table 1, proteinuria is more prevalent in LN class IV (n=177, 78.3%); however, it is not statistically significant ($P=0.33$). Edema is also significantly more dominant in LN classes of IV (n=133, 74.3%) and VI (n=6, 75%) patients ($P=0.03$). Moreover, percentage of hypertension was 77.8% (7) in LN class VI which was significantly higher compared to other classes ($P<0.001$).

Moreover, 72.7% (8) and 48.2% (92) of patients with class VI and class IV LN had a BUN level more than the normal range ($P<0.001$). For creatinine levels, 81.8% (9) and 42.9% (81) of patients with classes VI and IV LN had

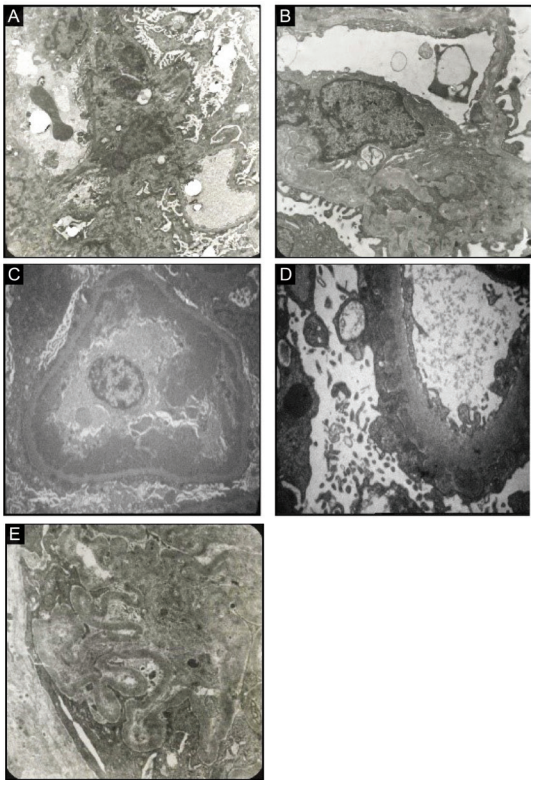

Figure 1. Electron microscopic photographs of different classes of lupus nephritis. **A.** Lupus nephritis class II. Electron micrograph shows dense deposits in the mesangial area with mesangial matrix expansion (EM, ×2784). **B.** Lupus nephritis class III. Focal segmental glomerulosclerosis with wrinkling of the basement membrane in the mesangial area (EM, ×6000). **C.** Lupus nephritis class IV. Dense subendothelial deposits (EM, ×1670). **D.** Lupus nephritis class V. Subepithelial deposits (EM, ×4646). **E.** Lupus nephritis class VI. Global glomerulosclerosis in the glomerulus (EM, ×7750). All of EM sections were stained with uranyl acetate and lead citrate.

a high level of serum creatinine ($P<0.001$). Furthermore, no association was detected between C3 level and 24 hours urine volume with different classes of LN (Table 1).

To evaluate the severity of renal injury, we extracted LM data including tubular atrophy and interstitial fibrosis in different classes of LN (Table 2). Tubular atrophy ($P<0.001$) and interstitial fibrosis ($P<0.001$) were significantly associated with classes of LN with higher levels in class VI LN.

Discussion

This study on clinical and para-clinical data of 496 patients with LN showed that LN is a common secondary glomerulonephritis in the south of Iran and almost half of cases belong to class IV. The results obtained from the patients, who were mostly females, revealed that CKD was more common in LN class III. Proteinuria was more prevalent in LN class IV. Edema was more prevalent in LN classes IV and VI. Hypertension and abnormal BUN and creatinine levels were more frequently seen in LN class VI.

Previous studies also showed that renal function could be predicted by the extent of interstitial fibrosis (10). In a study by Roberts et al in 2009, it was shown that in IgA nephropathy, severity of the decline in renal function was associated with higher interstitial fibrosis (11). In another study by Yung and Chan in 2015, lack of interstitial fibrosis was described as an important prognostic factor for the preservation of renal function (12). In line with Yung and Chan's study, we found that the extent of interstitial fibrosis as well as increased serum creatinine

Table 1. Association between clinical and laboratory characteristics and different classes of lupus nephritis

Variable	Subgroup (sum)	Total	Lupus nephritis class II	Lupus nephritis class III	Lupus nephritis class IV	Lupus nephritis class V	Lupus nephritis class VI	*P* value
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Proteinuria	No	118 (24.8)	25 (25.8)	27 (29.0)	49 (21.7)	11 (23.9)	6 (42.9)	0.33
	Yes	358 (75.2)	72 (74.2)	66 (71.0)	177 (78.3)	35 (76.1)	8 (57.1)	
Edema	No	110 (32.1)	24 (38.1)	28 (46.7)	46 (25.7)	10 (30.3)	2 (25.0)	**0.03**
	Yes	233 (67.9)	39 (61.9)	32 (53.3)	133 (74.3)	23 (69.7)	6 (75.0)	
Hematuria	No	249 (87.4)	46 (85.2)	40 (85.1)	129 (86.0)	26 (100)	8 (100)	0.23
	Yes	36 (12.6)	8 (14.8)	7 (14.9)	21 (14.0)	0 (0)	0 (0)	
Hypertension	No	160 (57.3)	40 (72.2)	29 (64.4)	68 (47.9)	21 (75.0)	2 (22.2)	**0.001**
	Yes	119 (42.7)	15 (27.3)	16 (35.6)	74 (52.1)	7 (25.0)	7 (77.8)	
BUN	Non increased	263 (67.1)	66 (85.7)	65 (85.5)	99 (51.8)	30 (81.1)	3 (27.3)	**<0.001**
	Increased	129 (32.9)	11 (14.3)	11 (14.5)	92 (48.2)	7 (18.9)	8 (72.7)	
Serum creatinine	Non increased	273 (70.0)	68 (88.7)	62 (80.5)	108 (57.1)	33 (86.8)	2 (18.2)	**<0.001**
	Increased	117 (30.0)	7 (9.3)	15 (19.5)	81 (42.9)	5 (13.2)	9 (81.8)	
Serum C3	Non low	47 (48.5)	9 (50.0)	9 (52.9)	25 (50.0)	4 (40.0)	0 (0)	0.79
	Low	50 (51.5)	9 (50.0)	8 (47.1)	25 (50.0)	6 (60.0)	2 (100)	
24 hours urine volume	<600	16 (7.6)	3 (6.5)	4 (8.2)	7 (7.8)	1 (4.8)	1 (20.0)	0.89
	Normal (600-1600)	135 (64.0)	30 (65.2)	30 (61.2)	56 (62.2)	15 (71.4)	4 (80.0)	
	>1600	60 (28.4)	13 (28.3)	15 (30.6)	27 (30.0)	5 (23.8)	0 (0)	

Table 2. Comparison of tubular atrophy and interstitial fibrosis of patients in different classes of lupus nephritis

Characteristic	Sub group/ total	Class II (n=98)	Class III (n=93)	Class IV (n=225)	Class V (n=46)	Class VI (n=14)	*P* value
Interstitial fibrosis on electron microscopy	No (n=280)	94 (95.9)	73 (78.5)	76 (33.8)	33 (71.7)	4 (28.6)	<0.001
	Mild (n=178)	4 (4.1)	18 (19.4)	140 (62.2)	13 (28.3)	3 (21.4)	
	Moderate (n=16)	0 (0)	2 (2.2)	7 (3.1)	0 (0)	7 (50.0)	
	Sever (n=2)	0 (0)	0 (0)	2 (0.9)	0 (0)	0 (0)	
Tubular atrophy on light microscopy	No (n=228)	68 (69.4)	48 (51.6)	83 (36.9)	26 (56.5)	3 (21.4)	<0.001
	Mild (n=225)	27 (27.6)	45 (48.4)	128 (56.9)	20 (43.5)	5 (35.7)	
	Moderate (n=20)	3 (3.1)	0 (0)	12 (5.3)	0 (0)	5 (35.7)	
	Sever (n=3)	0 (0)	0 (0)	2 (0.9)	0 (0)	1 (7.1)	

were higher in classes VI and IV of LN.

On the other hand, Yu et al reported that tubular atrophy could be a predictor of poor renal function in patients with LN in China (13). Other studies also have confirmed this finding (14, 15). Leatherwood et al in 2019 further showed that interstitial fibrosis and tubular atrophy were associated with high levels of serum creatinine (16). Results of the present study are in line with Leatherwood's study in that the extent of tubular atrophy was high in LN classes of IV and VI and therefore with the level of serum creatinine.

Additionally, in this study, proteinuria and hematuria were seen in 75.2% (373) and 12.6% (62) of the patients, respectively. In a study by Farah et al, it was reported that all patients in classes I, II, III, and VI had proteinuria and hematuria (17). The difference between the two studies may be due to small number of patients in the study by Farah's et al since they reported only 79 patients.

Moreover, in the current study, 42.7% (212) of the patients had hypertension. Farah et al (2019) reported that 74.7% (59) of the patients suffered from hypertension (17). Another study by Sharma et al reported hypertension in 41.4% (205) of patients with LN in India, which is closer to this study (18). Hu et al, also reported that 93.9% of patients with class IV of LN had hypertension for an average time of 24 months, which is higher than that in the present study (77.8%) (19). Based on a mouse model, Taylor and Ryan showed that several factors, such as Tumor necrosis factor (TNF)-α, inflammatory cytokines, hyperactivity of B-cells, and production of autoantibodies, and oxidative stress could lead to the development of hypertension in patients with SLE (20). In another study on 64 patients with LN, the duration of SLE, complete remission interval, the numbers of relapses, and prescription of cyclosporine A were independently linked to persistent hypertension (7).

Moreover, in this study, 12.6% of patients with LN suffered from hematuria. Another study reported macroscopic hematuria in 24.2% of patients with class IV LN (19). We also observed that serum creatinine level was higher in 81.8% and 42.9% of patients with classes of VI and IV LN, respectively. Guo et al conducted a study on 82 hospitalized LN patients. They noticed that creatinine level was higher in class IV of LN (145.2 µmol/L) in comparison to other classes. No patient had class VI of LN in their study (21).

Apart from the concerns associated with multiple treatment-associated comorbidities and complications, between 5-20% of patients with LN require kidney replacement therapy within 10 years of initial diagnosis; therefore, early and accurate diagnosis of LN and prompt initiation of therapy are of vital importance to improve outcomes in these patients (22). In 2020, in Johns Hopkins cohort of 2528 patients, Petri et al found that individuals younger than 30 years old with low C3 could be at risk for renal failure (23). Mean age of patients in this study was 28.4 years and about half of them had low C3 which was indicator of the severity of LN in this study's population. According to the latest update on LN (24), patients with proliferative forms of LN (classes III, IV, or III/IV + V) are at the highest risk for kidney replacement therapy. About 75% of the present study's cases also fell into the above-mentioned classes underlining the importance of early intervention.

This study took advantage of a high number of patients, which made the results more reliable and valid; also, the final diagnosis was based on both LM study and EM.

However, further studies are also recommended on patients' follow-up to determine the progression of LN in each subclass. Furthermore, we suggest that a comparison should be made between the clinical data of SLE patients with no renal involvement to determine the relevance of kidney involvement and clinical features.

Conclusion

Among 2770 kidney biopsies received in EM Unit affiliated to Shiraz University of Medical Sciences, Iran, LN was the most common diagnosed disease. Almost half of LN cases belonged to class IV, while classes I (n=1) and VI (n=14) were rare. Tubular atrophy and interstitial

fibrosis, indicative of chronic renal injury, were more frequent in LN class VI followed by class IV. Edema, hypertension, and proteinuria were also common in LN classes IV and VI. Therefore, clinical manifestations and laboratory findings could be helpful in early diagnosis and subsequent early treatment. Hence, we believe that complete pathologic evaluation of renal biopsy could still be helpful for the definite diagnosis of LN classification.

Limitations of the study

The main limitation of this study was its retrospective design, which led to some missing data because pathology request sheets in hospitals were not completely filled in some cases. Another limitation was the lack of information on patients' follow-up.

Authors' contribution

SMO is the first author and responsible for study design, data acquisition, critical revision and final approval of the work. AK is the corresponding author and contributed to data acquisition, critical review and final approval of the study. SHO contributed to the conception of the work, data acquisition, critical review and final approval of the study. HRS contributed to data analysis, critical revision and final approval of the study. BB was responsible for data acquisition and interpretation, drafting and final approval of this work. FD contributed to data interpretation, critical review and final approval of the study.

Conflicts of interest

The authors declare no conflict of financial interest.

Ethical issues

The study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences (# IR.sums.med.rec.1397.207). The study was conducted based on the principles of updated Declaration of Helsinki (1996). Additionally, the study was extracted from the MD thesis of Amirhossein Kamalinia, supported by this university (Grant# 1396-01-01-15250). Written informed consent was taken from all patients before renal biopsies. Moreover, ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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Reference

1. Almaani S, Meara A, Rovin BH. Update on Lupus Nephritis. Clin J Am Soc Nephrol. 2017;12(5):825-835. doi:10.2215/CJN.05780616
2. Gergianaki I, Fanouriakis A, Repa A, Tzanakakis M, Adamichou C, Pompieri A, et al. Epidemiology and burden of systemic lupus erythematosus in a Southern European population: data from the community-based lupus registry of Crete, Greece. Ann Rheum Dis. 2017;76:1992-2000. doi: 10.1136/annrheumdis-2017-211206.
3. Stojan G, Petri M. Epidemiology of systemic lupus erythematosus: an update. Curr Opin Rheumatol. 2018;30(2):144-150. doi: 10.1097/BOR.0000000000000480.
4. Nishi H, Mayadas TN. Neutrophils in lupus nephritis. Curr Opin Rheumatol. 2019;31(2):193-200. doi: 10.1097/BOR.0000000000000577.
5. Davidson A, Aranow C, Mackay M. Lupus nephritis: challenges and progress. Curr Opin Rheumatol. 2019;31(6):682-688. doi:10.1097/BOR.0000000000000642.
6. Medina-Rosas J, Touma Z. Proteinuria: assessment and utility in lupus nephritis. J Rheumatol Musc Syst. 2015;1:001.
7. Shaharir SS, Mustafar R, Mohd R, Mohd Said MS, Gafor HA. Persistent hypertension in lupus nephritis and the associated risk factors. Clin Rheumatol. 2015;34(1):93-97. doi: 10.1007/s10067-014-2802-0.
8. Taylor EB, Ryan MJ. Understanding mechanisms of hypertension in systemic lupus erythematosus. Ther Adv Cardiovasc Dis. 2016;11(1):20-32. doi: 10.1177/1753944716637807
9. Weening JJ, D'Agati VD, Schwartz MM, Seshan SV, Alpers CE, Appel GB, et al. The classification of glomerulonephritis in systemic lupus erythematosus revisited. J Am Soc Nephrol. 2004;15:241-50. doi: 10.1097/01.asn.0000108969.21691.5d.
10. Giannico G, Fogo AB. Lupus nephritis: is the kidney biopsy currently necessary in the management of lupus nephritis?. Clin J Am Soc Nephrol. 2013;8(1):138-145. doi: 10.2215/CJN.03400412.
11. Working Group of the International IgA Nephropathy Network and the Renal Pathology Society, Roberts IS, Cook HT, et al. The Oxford classification of IgA nephropathy: pathology definitions, correlations, and reproducibility. Kidney Int. 2009;76(5):546-56. doi: 10.1038/ki.2009.168.
12. Yung S, Chan TM. Mechanisms of Kidney Injury in Lupus Nephritis - the Role of Anti-dsDNA Antibodies. Front Immunol. 2015;6:475. doi: 10.3389/fimmu.2015.00475.
13. Yu F, Wu LH, Tan Y, Li LH, Wang CL, Wang WK, et al. Tubulointerstitial lesions of patients with lupus nephritis classified by the 2003 International Society of Nephrology and Renal Pathology Society system. Kidney Int. 2010;77:820-9. doi: 10.1038/ki.2010.13.
14. Rijnink EC, Teng YKO, Wilhelmus S, Almekinders M, Wolterbeek R, Cransberg K, et al. Clinical and Histopathologic Characteristics Associated with Renal Outcomes in Lupus Nephritis. Clin J Am Soc Nephrol. 2017;12:734-743. doi: 10.2215/CJN.10601016.
15. Wilson PC, Kashgarian M, Moeckel G. Interstitial inflammation and interstitial fibrosis and tubular atrophy predict renal survival in lupus nephritis. Clin Kidney J. 2018;11(2):207-18. doi: 10.1093/ckj/sfx093.

16. Leatherwood C, Speyer CB, Feldman CH, D'Silva K, Gómez-Puerta JA, Hoover PJ, et al. Clinical characteristics and renal prognosis associated with interstitial fibrosis and tubular atrophy (IFTA) and vascular injury in lupus nephritis biopsies. Semin Arthritis Rheum. 2019;49:396-404. doi: 10.1016/j.semarthrit.2019.06.002.
17. Farah RI, Dannoun E, Abu Shahin N, AlRyalat SA. Characteristics and histological types of lupus nephritis in a Jordanian Tertiary Medical Center. Biomed Res Int. 2019;2019:7087461. doi:10.1155/2019/7087461
18. Sharma M, Das HJ, Doley PK, Mahanta PJ. Clinical and histopathological profile of lupus nephritis and response to treatment with cyclophosphamide: A single center study. Saudi J Kidney Dis Transpl. 2019;30(2):501-7. doi: 10.4103/1319-2442.256857
19. Hu WX, Liu ZZ, Chen HP, Zhang HT, Li LS, Liu ZH. Clinical characteristics and prognosis of diffuse proliferative lupus nephritis with thrombotic microangiopathy. Lupus. 2010;19(14):1591-8. doi: 10.1177/0961203310376523
20. Taylor EB, Ryan MJ. Understanding mechanisms of hypertension in systemic lupus erythematosus. Ther Adv Cardiovasc Dis. 2016;11(1):20-32. doi: 10.1177/1753944716637807.
21. Guo Q, Lu X, Miao L, Wu M, Lu S, Luo P. Analysis of clinical manifestations and pathology of lupus nephritis: a retrospective review of 82 cases. Clin Rheumatol. 2010;29(10):1175-80. doi: 10.1007/s10067-010-1517-0.
22. Anders HJ, Saxena R, Zhao MH, Parodis I, Salmon JE, Mohan C. Lupus nephritis. Nat Rev Dis Primers. 2020;6(1):7. doi: 10.1038/s41572-019-0141-9.
23. Petri M, Barr E, Magder LS. Risk of renal failure within ten or twenty years of SLE diagnosis. J Rheumatol. 2020;jrheum.191094. doi: 10.3899/jrheum.191094.
24. Parikh SV, Almaani S, Brodsky S, Rovin BH. Update on lupus nephritis: core curriculum 2020. Am J Kidney Dis. 2020;S0272-6386(19)31170-9. doi: 10.1053/j.ajkd.2019.10.017