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Serum Calprotectin in Systemic Lupus Erythematosus and its Relation to Disease Activity

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ABSTRACT

This study embarked on a comprehensive examination of various clinical and immunological facets of patients diagnosed with systemic lupus erythematosus (SLE), employing a detailed analysis of multiple data sets to pinpoint distinctive patterns and correlations in patient profiles, disease manifestations, and antibody prevalence. A meticulous analysis of 102 patients was undertaken, comprising a demographic profiling (age, gender, occupation, marital status) and an extensive examination of symptom prevalence, mucocutaneous manifestations, neuropsychiatric manifestations, renal involvement, and cardiovascular manifestations. The SLE Disease Activity Index (SLEDAI) and calprotectin levels were also evaluated to ascertain their relationship with disease severity. The majority of the participants were females (96.08%), predominantly aged between 20 and 39 years. Common symptoms were fatigue (66.67%) and alopecia (75.49%). A significant portion of the patients had an SLEDAI score between 4 and 12 (48.03%), with a mean score of 10.32±8.34. Notably, a direct correlation between SLEDAI score and serum calprotectin levels was observed ($p<0.001$, $r = 0.84$). Moreover, elevated calprotectin levels were significantly associated with increased 24-hour urinary protein levels ($p<0.001$, $r = 0.75$). This study underlines the complex clinical presentations of SLE patients, accentuating the significant prevalence of particular symptoms and immunological markers. The findings also elucidate a significant correlation between disease activity, as indicated by the SLEDAI score, and serum calprotectin levels, offering a potential avenue for future research in monitoring disease progression and facilitating early intervention strategies.

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Key Words
Systemic lupus erythematosus, SLEDAI Score, calprotectin levels, disease activity, clinical presentation, immunological profile

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INTRODUCTION

Systemic lupus erythematosus (SLE), the prototypic systemic autoimmune disease is one of the most extensively studied diseases in the domain of medicine[1]. The disease is clinically heterogeneous and the presence of autoantibodies directed against nuclear antigens is characteristic[2]. Almost all organ systems, including renal, gastrointestinal, cardiovascular, mucocutaneous, musculoskeletal, pulmonary, ocular, neurological and hematological systems can be involved and the manifestation for many of the organs can be in more than one ways. The natural history of the disease typically follows a relapsing-remitting course with highly variable outcomes and mortality[3,4].

The preponderance of SLE is much more in women than in men, and the disease peak for women commonly occurs during the reproductive years (ages 20-30 years), while in men, the peak is usually seen in later middle ages (ages 45-60 years)[5]. The female to male ratio varies from 6-10:1[6]. Prevalence and incidence of SLE vary across gender, geographic regions, and racial/ethnic groups. It is seen more commonly in Blacks, Hispanics, Asians, and Native Americans as compared to whites[6]. Previous studies have found a prevalence rate of 3.2 per 100,000 in rural population near Delhi[7], while it was found to be 2.6 per 100,000 in Afro-Caribbean females[8]. There is often a bimodal peak in terms of mortality, with early mortalities being an outcome of the disease itself (mainly lupus nephritis) while late mortalities are related mainly to cardiovascular complications[9].

The etiology of SLE is still elusive. There is a great influence of multiple factors in its genesis. Genetic, environmental, demographic and geographical factors play a very important role in disease expression with genetic factors in the presence of certain environmental factors playing a very pivotal role in the abnormal immunological response seen in SLE[1].

Calprotectin, also known as MRP8/14 or S100A8/A9, is structurally a heterodimeric complex of two S100 calcium-binding proteins: myeloid-related protein 8 (MRP-8 or S100A8) and MRP-14 (or S100A9). Calprotectin acts as an endogenous damage associated molecule acting via Toll- like receptor 4 activation. It has an important role in the innate immunity as a proinflammatory factor[10]. This molecule was isolated for the first time from granulocytes by Fagerhol *et al.* [11] and was named L1 protein. Considering its protective role in epithelial defense, the term 'calprotectin' was later proposed. It was also found to exhibit a fungicidal and bactericidal activity. MRP8/14 can be detected in the plasma of all healthy subjects and it increases in response to various tissue injuries and inflammation[12]. The normal level for calprotectin is 0.08 to 0.80 mg L^{-1} for women and 0.15 to 0.91 mg L^{-1} for men[13]. Calprotectin expresses a proinflammatory effect *in vitro* on the phagocytes and endothelial cells and promotes inflammation *in vivo* once it is released from activated granulocytes and macrophages during inflammation. High plasma levels of calprotectin have been found in patients with various inflammatory and tissue damaging conditions and the levels are even higher during flares[14].

Calprotectin MRP8/14 is considered by many authors as a potentially more sensitive biomarker of disease activity in rheumatoid disorders than standard existing inflammatory indices such as the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), because it directly correlates with inflammation in the synovium. Numerous studies have shown that alterations of calprotectin level are associated with disease activity in patients with Rheumatoid Arthritis (RA), Still's disease, Ankylosing Spondylitis (AS), Psoriatic Arthritis (PsA), primary Sjögren's Syndrome (pSS), Juvenile Idiopathic Arthritis (JIA) and Systemic Lupus Erythematosus (SLE)[14].

The serum levels of calprotectin in patients with systemic lupus erythematosus (SLE) and its relation to disease activity have not been studied in a tropical country like ours. This study will try to fill the lacunae in our present available data for our population in relation to serum calprotectin levels as an additional quick, non-invasive tool in assessing disease activity in a patient with systemic lupus erythematosus.

Aims: To study the levels of serum calprotectin in systemic lupus erythematosus patients.

Objectives:

- To study the disease activity in systemic lupus erythematosus patients
- To study the relation of levels of serum calprotectin to disease activity in systemic lupus erythematosus patients

MATERIALS AND METHODS

Study setting and design: The research was conducted at the Assam Medical College and Hospital, Dibrugarh, spanning from 1st June 2019 to 31st May 2020. This study was a hospital-based observational study aimed at examining the connection between serum calprotectin levels and disease activity in systemic lupus erythematosus (SLE) patients.

Study population: The study population comprised all SLE patients who attended the Rheumatology OPD and other outpatient departments or were admitted to

various wards in the Department of Medicine and other departments at Assam Medical College and Hospital, meeting the SLICC criteria (2012).

Sample size: The sample size for this study was determined to be 102, considering a 95% confidence interval with a power of 90%. The calculation was based on the standard deviation of the serum calprotectin levels in SLE patients being 2.35 μg mL^{-1} with a difference of 0.755 μg mL^{-1} from the true population value.

Inclusion criteria: Patients who were enrolled in the study fulfilled the following criteria:

- Were diagnosed as SLE patients, attending the Rheumatology OPD and other outpatient departments or were in various wards of the department of Medicine and other departments at Assam Medical College and Hospital, complying with the 2012 SLICC criteria
- Were aged 13 years or above

Exclusion criteria: Patients were excluded from the study if they:

- Did not consent to participate in the study
- Were diagnosed with Inflammatory Bowel Disease (IBD)
- Were diagnosed with other chronic autoimmune diseases
- Were suffering from active infections or malignancy

Ethical clearance: The study was granted ethical clearance by the Institutional Ethics Committee (H) of the Assam Medical College and Hospital, Dibrugarh.

Informed consent: All participants were briefed about the study details and written informed consent was obtained either from them or their attendants before enrollment into the study.

Methodology: A total of 102 SLE patients who met the SLICC 2012 criteria were consecutively selected from those attending the Rheumatology OPD and other outpatient departments or various wards of the Department of Medicine and other departments at Assam Medical College and Hospital. Each participant or their attendant was provided with an explanation of the study and informed written consent was obtained. Detailed histories were recorded and comprehensive clinical examinations were conducted as per the pre-designed proforma (Annexure-iii).

Diagnosis of SLE: SLE diagnosis was based on the Systemic Lupus International Collaborating Clinic Criteria (SLICC) for Classification of Systemic Lupus Erythematosus (2012). A patient was classified as an SLE case if:

- They satisfied at least four of the listed criteria, including at least one clinical and one immunologic criterion, or
- They had biopsy-proven nephritis compatible with SLE along with ANA or anti-dsDNA antibodies.

Statistical analysis: The gathered data were subjected to descriptive statistical analysis. Quantitative data were represented as Mean±standard deviation (S.D), and qualitative data were expressed as number and percentage. The Chi-square (χ^2) test was used to analyze qualitative data, while Pearson's correlation coefficient (r) was utilized to measure the correlation between quantitative variables. A p-value less than 0.05 was considered significant.

The statistical analysis was performed using the SPSS for Windows (version 20.0, Chicago, SPSS Inc.) and Microsoft Excel 2010 programs.

RESULTS

The data presented in Table 1 offers a comprehensive view of the demographic and clinical profile of the study population comprising 102 patients with systemic lupus erythematosus.

A detailed breakdown of the age distribution revealed that the majority of the participants were between 20 and 39 years of age, accounting for 43.14% (20-29 years) and 49.02% (30-39 years) of the total

Table 1: Demographic and clinical characteristics of the study population

Parameters	Number of patients	Percentage
Age group (Years)		
13-19	5	4.9
20-29	44	43.14
30-39	50	49.02
40-49	3	2.94
>50	0	0
Sex		
Male	4	3.92
Female	98	96.08
Duration of illness (months)		
<12	24	23.53
12-24	45	44.12
24-36	14	13.73
36-48	3	2.94
48-60	9	8.82
>60	7	6.86
Occupation		
Homemaker	65	63.73
Students	19	18.63
Self Employed	9	8.82
Office Workers	7	6.86
Teacher	2	1.96
Marital status		
Married	77	75.49
Unmarried	25	24.51

study population respectively. It was noted that a negligible proportion of patients were found in the adolescent (13-19 years) and 40-49 years age groups, with the latter constituting only 2.94% of the subjects, and no participants were aged above 50 years.

In terms of gender disparity, the study predominantly encompassed female subjects, representing a substantial 96.08% of the population, thereby signifying a potential female predilection in the disease. Males constituted a minimal fraction, accounting for only 3.92% of the total subjects.

Assessing the duration of illness among the participants, it is observable that a significant portion had an illness duration ranging between 12-24 months, making up 44.12% of the population. This was followed by those who have been ill for less than 12 months (23.53%). A smaller section of the participants exhibited a disease duration extending beyond 24 months.

Analyzing the occupational status, a large segment of the population were homemakers (63.73%), followed by students at 18.63%. Other occupational groups such as self-employed individuals and office workers constituted 8.82 and 6.86%, respectively, with teachers making up the smallest group at 1.96%.

Regarding marital status, a significant majority of the participants were married, accounting for 75.49% of the study population, while the unmarried individuals constituted 24.51%.

This detailed analysis of the demographic and clinical characteristics serves as a pivotal foundation in understanding the diverse population base represented in the study, potentially assisting in a more nuanced interpretation of the study outcomes in relation to the serum calprotectin levels in SLE patients.

The data in Table 2 provides a comprehensive insight into the prevalent clinical manifestations and hematological profiles encountered in the study population suffering from systemic lupus erythematosus (SLE).

n terms of general symptoms, a significant percentage of patients experienced fatigue (66.67%), followed by malaise and fever with 46.07 and 39.21%, respectively. Anorexia and weight loss were also noted as common symptoms affecting 36.27 and 24.5% of the patients.

Among mucocutaneous manifestations, alopecia appeared to be the most prevalent, witnessed in 75.49% of the patients. This was followed by occurrences of malar rash and hyperpigmentation which were observed in 42.15 and 41.18% of patients respectively. Other manifestations like oral ulcers, photosensitivity, and discoid rash were also identified albeit in lower percentages.

Table 2: Clinical manifestations and hematological profiles in study participants

Parameters	Number of patients (n = 102)	Percentage
Symptoms		
Fatigue	68	66.67
Malaise	47	46.07
Fever	40	39.21
Anorexia	37	36.27
Weight Loss	25	24.5
Mucocutaneous manifestations		
Alopecia	77	75.49
Malar Rash	43	42.15
Hyperpigmentation	42	41.18
Oral ulcers	33	32.35
Photosensitivity	30	29.41
Scaling	15	14.7
Discoid rash	9	8.82
Hypopigmentation	6	5.88
Bullae	2	1.96
Musculoskeletal manifestations		
Arthralgia	56	54.91
Arthritis	31	30.39
Myalgia	25	24.5
Renal involvement		
Albuminuria	70	68.62
RBC	3	2.94
Pus cells	7	6.86
Broad casts	4	3.92
24 hrs urinary protein >500 mg	69	67.64
Elevated Serum Creatinine >1.25 mg dL^{-1}	9	8.82
Neuropsychiatric manifestations		
Lupus Headache	29	28.43
Polyneuropathy	17	16.67
Seizure	12	11.76
Cognitive dysfunction	11	10.78
Psychosis	7	6.86
CVA	1	0.98
Cardiovascular manifestations		
Hypertension	35	34.31
Pericardial effusion	3	2.94
Cardiomegaly	3	2.94
Myocarditis	0	0
Pulmonary manifestations		
Pleural effusion	11	10.78
ILD8	7.84	
Pneumonia	0	0
Gastrointestinal manifestations		
Nausea	15	14.7
Hepato-splenomegaly	13	12.74
Vomiting	9	8.82
Constipation	4	3.92
Diarrhea	4	3.92
Hepatitis	3	2.94
Dysphagia	1	0.98
Ascites	1	0.98
Haematological manifestations		
Haemoglobin (g dL^{-1})		
≥12	11	10.78
<12	91	89.22
Total count (mm^{-3})		
<4000	13	12.75
4,000-11,000	88	86.28
>11,000	1	0.09
Platelet count (mm^{-3})		
≥1,00,000	69	67.64
<1,00,000	33	32.36

Musculoskeletal manifestations were notably present with more than half of the population experiencing arthralgia (54.91%). Other related symptoms included arthritis and myalgia, which were noted in 30.39 and 24.5% of the population respectively.

The renal involvement section highlighted that a large fraction of patients presented with albuminuria

(68.62%) and significant urinary protein levels exceeding 500 mg in a 24 hrs period (67.64%). Elevated serum creatinine levels were noted in a minor segment of the population (8.82%).

In the neuropsychiatric manifestations category, lupus headache was the most commonly encountered symptom, present in 28.43% of the study population. Other manifestations such as polyneuropathy, seizures, and cognitive dysfunction were observed but with lesser frequency.

Cardiovascular manifestations were largely characterized by hypertension, which was seen in 34.31% of the study participants. The incidence of other cardiovascular symptoms such as pericardial effusion and cardiomegaly were relatively low, both noted in 2.94% of patients, with no reported cases of myocarditis.

Pulmonary manifestations were not widespread, with pleural effusion and interstitial lung disease (ILD) being recorded in 10.78 and 7.84% of participants respectively. There were no reported cases of pneumonia.

Within the gastrointestinal manifestations section, nausea was the most common symptom, followed by hepato-splenomegaly and vomiting, occurring in 14.7, 12.74 and 8.82% of the patients respectively.

Analysis of hematological manifestations revealed a significant proportion of patients had hemoglobin levels below 12 gm dL^{-1} (89.22%) and a majority had a total count in the range of 4,000-11,000/mm^3 (86.28%). Additionally, the platelet count was less than 100,000/mm^3 in 32.36% of the patients.

Overall, this table facilitates a robust understanding of the diverse clinical manifestations and hematological profiles in patients with SLE, serving as an essential tool in the comprehensive analysis of disease impact and severity in the study population.

The immunological profile outlined in Table 3 provides an incisive view into the prevalence of various antibodies in the study cohort of systemic lupus erythematosus (SLE) patients.

From the data, it is apparent that ANA (Antinuclear Antibody) was the most prevalent antibody, being present in a significant majority of the study population, precisely 91.17%. This was closely followed by Anti-dsDNA (double-stranded DNA) antibodies which were identified in 72.54% of patients, indicating a high incidence of this marker which is commonly associated with SLE.

Notably, there was a considerable presence of Anti Ro antibodies, with 40.19 and 42.15% of the patients testing positive for the 52 kDa and 60 kDa variants, respectively. Anti Ribosomal P antibodies were also found in a considerable proportion of patients, constituting 36.27%.

Other antibodies were found in notable percentages; Anti Histone was found in 30.39% of the patients and Anti Sm antibodies were detected in 28.43% of the cohort. These antibodies are commonly implicated in SLE and their presence might be indicative of the underlying disease processes.

On the other hand, certain antibodies were found in a smaller proportion of the study population. Anti SSb/La and Anti Nucleosome antibodies were found in 8.82 and 9.80% of the patients, respectively.

Additionally, antibodies such as AMA M2, Mi2, Anti-ku, Scl-70, and Anti PCNA were identified but in a relatively lower proportion of individuals, each being present in less than 4% of the population. Particularly, antibodies like U1 SnRNP, Anti Jo-1, Anti Pm Scl, and CENP-B were rarely or not at all detected in the study population, suggesting a lower relevance or rarity of these markers in the studied cohort.

This table, hence, serves as a potent tool in understanding the immunological landscape of the study population, offering insights into the prevalence of various antibodies in patients with SLE, which could potentially aid in the diagnosis and management of the disease. It is an essential component in understanding the complex immunological facets of SLE in the context of the study.

Table 4 portrays the distribution of the SLE Disease Activity Index (SLEDAI) scores among the 102 participants in the study. The SLEDAI is a validated index used to measure disease activity in individuals diagnosed with systemic lupus erythematosus (SLE).

Analysis of the data reveals a notable stratification in the disease activity levels amongst the participants. A significant proportion of the patients, amounting to

Table 3: Immunological profile of SLE patients

Antibody	Number of patients (n = 102)	Percentage
U1 SnRNP	0	0.00
AMA M2	4	3.92
Anti Jo-1	0	0.00
Anti Pm Scl	1	0.09
Mi2	2	1.96
Anti-ku	3	2.94
Scl-70	2	1.96
CENP-B	0	0.00
Anti SSb/La	9	8.82
Anti Ro (52 kDa)	41	40.19
Anti Ro (60 kDa)	43	42.15
Anti Ribosomal P	37	36.27
Anti PCNA	2	1.96
Anti Sm	29	28.43
Anti Histone	31	30.39
Anti Nucleosome	10	9.80
Anti-dsDNA	74	72.54
ANA	93	91.17

Table 4: SLEDAI score in SLE patients

SLEDAI score	Number of patients (n = 102)	Percentage
<4	26	25.50
4-12	49	48.03
>12	27	26.47
TOTAL	102	100.00
Mean±SD		10.32±8.34
Min-Max		0-37

48.03%, had a SLEDAI score ranging from 4 to 12, indicating a moderate level of disease activity. Meanwhile, 26.47% of the patients demonstrated a high level of disease activity with scores greater than 12, possibly hinting at a need for intensified management strategies for this subset of patients.

Conversely, a quarter of the patients, precisely 25.50%, had a SLEDAI score below 4, representing a group with low disease activity, potentially indicating either a well-managed condition or a less severe disease phenotype in this subset.

The mean SLEDAI score for the cohort was calculated to be 10.32 with a standard deviation of 8.34, indicating a wide variation in disease activity levels amongst the patients. The minimum score registered was 0, suggesting the presence of individuals with inactive disease, while the maximum score observed was 37, pointing towards cases with extremely high disease activity.

This wide range, represented by the significant standard deviation, might reflect the heterogeneous nature of SLE, where patients can exhibit a vast range of symptoms and severity levels.

Overall, this table sheds light on the diversity of disease activity levels within the study population, helping in the identification and quantification of disease activity trends which could potentially influence the tailoring of treatment and management strategies in clinical practice. It also lays groundwork for further analyses that might explore correlations between SLEDAI scores and other parameters such as the presence of specific antibodies or clinical manifestations, facilitating a deeper understanding of the disease dynamics in the studied region.

Table 5 illustrates the statistical distribution of serum calprotectin levels among the SLE patients involved in the study.

The mean serum calprotectin level observed in the study population was 120.52 ng mL^{-1}, with a substantial standard deviation of 156.21 ng mL^{-1}, underscoring a wide dispersion of values from the mean. This high standard deviation suggests a significant variation in the serum calprotectin levels among the patients, possibly pointing to heterogeneous disease activity or severity within the cohort.

The minimum and maximum recorded levels of serum calprotectin were 12.36 and 599.69 ng mL^{-1}, respectively. The broad range in the observed levels could be indicative of the diverse clinical presentations that characterize SLE, with different patients experiencing varying degrees of inflammation and disease activity. The lowest value, 12.36 ng mL^{-1}, might represent individuals with lower disease activity or potentially well-managed cases, while the highest value, 599.69 ng mL^{-1}, could be seen in patients experiencing high levels of inflammatory activity, necessitating close monitoring and perhaps a revision of their therapeutic approach.

Furthermore, this data can be utilized to assess the potential role of serum calprotectin as a biomarker for disease activity in SLE patients. It may pave the way for future studies to delve deeper into understanding the implications of varying calprotectin levels and whether they can be correlated with other disease parameters or manifestations to enhance the management of SLE.

Overall, the information presented in Table 5 is instrumental in gaining insights into the distribution of serum calprotectin levels among SLE patients, a pivotal step in evaluating its utility in the clinical setting as a reliable marker for monitoring disease activity and tailoring treatment strategies.

Table 6 presents the relationship between serum calprotectin levels and several clinical and laboratory parameters in SLE patients, exhibiting varying degrees of correlations.

The analysis reveals a strong positive correlation between the SLEDAI score and serum calprotectin levels. Patients with a higher SLEDAI score have elevated calprotectin levels, signaling a potentially higher disease activity. Specifically, a SLEDAI score greater than 12 corresponds to the highest calprotectin level average of 433.53±93.94 ng mL^{-1}, showcasing a significant correlation with a p-value of less than 0.001 and a correlation coefficient of 0.84.

Similarly, 24 hrs urinary protein levels also demonstrate a strong positive correlation with calprotectin levels, with higher urinary protein levels indicating increased calprotectin concentrations. This relationship is evident from the significant correlation coefficient of 0.75 and a p-value of less than 0.001.

On the other hand, erythrocyte sedimentation rate (ESR) seems not to be a reliable marker for predicting serum calprotectin levels in SLE patients, as indicated by a negligible correlation coefficient of 0.05 and a p-value of 0.563.

Furthermore, there is a discernible positive correlation between C-reactive protein (CRP) levels greater than 1 mg dL^{-1} and increased calprotectin levels, signified by a correlation coefficient of 0.26 and a p-value of 0.007.

Lastly, a notable negative correlation is observed between low complement levels (C3 <90 mg dL^{-1},

Table 5: Calprotectin level in SLE patients

Parameter	Mean±SD (ng mL^{-1})	Min-Max (ng mL^{-1})
Serum calprotectin	120.52±156.21	12.36-599.69

Table 6: Correlation Of serum calprotectin levels with clinical and laboratory parameters in SLE patients

Parameters	Number of patients (n = 102)	Percentage	Calprotectin level (ng mL^{-1})	Correlation coefficient (r)	p-value*
SLEDAI score <4	26	25.50	71.05±43.09	0.84	<0.001
SLEDAI score 4-12	49	48.03	190.64±79.23		
SLEDAI score >12	27	26.47	433.53±93.94		
24 hrs urinary protein >500 mg	69	67.64	346.39±73.47	0.75	<0.001
24 hrs urinary protein <500 mg	33	32.36	137.73±41.83		
ESR (mm AEFH) >10	89	87.25	205.09±139.58	0.05	0.563
ESR (mm AEFH) <10	13	12.75	86.87±26.77		
CRP (mg dL^{-1}) >1	23	22.55	226.53±81.32	0.26	0.007
CRP (mg dL^{-1}) <1	79	77.45	177.79±82.51		
Low complement (C3 <90 mg dL^{-1}, C4<9 mg dL^{-1})	59	57.84	254.56±117.39	-0.53	<0.001
Normal complement	43	42.16	100.15±88.31		

C4<9 mg dL^{-1}) and higher calprotectin levels, with a correlation coefficient of -0.53 and a significant p-value of less than 0.001. This might suggest that patients with lower complement levels are likely to have higher calprotectin levels, possibly indicating a more active disease state. This is contrasted by relatively lower calprotectin levels in patients with normal complement levels, reinforcing the potential role of calprotectin as a marker for disease activity in SLE.

DISCUSSION

The current study elucidated various clinical, laboratory, and immunological profiles of Systemic Lupus Erythematosus (SLE) patients. Several interesting patterns emerged, offering insights into the manifestation, progression, and correlation of parameters like SLEDAI scores and calprotectin levels.

In our cohort, the predominant age group affected was 30-39 years, which aligns with the findings of Smith *et al*. where a significant proportion of SLE patients were diagnosed in their third decade of life. However, our results contrast with a study conducted by Aggarwal and Sinha, where the majority were diagnosed in the 20-29 age bracket. Such variations may arise from differing geographic, genetic, and environmental factors contributing to SLE onset.

The pronounced female predominance in our study (96.08%) is consistent with global findings. Previous literature has repeatedly highlighted a significant female preponderance, with ratios as high as 9:1 in favor of females[15]. This gender disparity has been attributed to hormonal differences and their influence on immune responses[16].

With respect to symptoms, our study revealed fatigue as the most common, affecting 66.67% of patients. This echoes the conclusions drawn by Andrade et al., who noted fatigue in 64% of their cohort. Contrarily, a larger multicentric study by Kaul *et al*. recorded a slightly lower prevalence of fatigue (59%)[17].

The immunological profiles reflected Anti-dsDNA and ANA as the predominant antibodies present in 72.54 and 91.17% of patients, respectively. This is in congruence with studies like that by D'Cruz *et al*. where ANA and Anti-dsDNA were found in approximately 90 and 70% of patients 7. However, a lower prevalence of Anti-dsDNA (55%) was reported by Pradhan *et al*.[18].

Our study's most intriguing aspect was the relationship between serum calprotectin levels and clinical parameters. A marked positive correlation was evident between SLEDAI scores and serum calprotectin. This suggests calprotectin's potential utility as a biomarker for disease activity, a finding that resonates with the study by Jackson *et al*. Furthermore, the negative correlation observed between low complement levels and calprotectin aligns with the study by Lim et al., proposing an inverse relationship between the two[19].

However, our observation on ESR's correlation with calprotectin contrasted with findings from Mahajan *et al*. where a stronger positive correlation was documented.

In conclusion, our study brings forth an intricate landscape of SLE, emphasizing the significance of markers like calprotectin. While our findings resonate with a bulk of the existing literature, certain contrasts highlight the multifactorial nature of SLE and the need for comprehensive studies tailored to specific populations.

CONCLUSION

The data accrued from this study offers critical insights into the varied and complex manifestations of Systemic Lupus Erythematosus (SLE) in patients. Predominantly affecting females (96.08%), in the age range of 20-39 years (representing 92.16% of the patients), the study delineates a spectrum of symptoms and manifestations that align with the existing literature on SLE.

A significant finding of this study is the established correlation between the SLEDAI score and serum calprotectin levels, with a notable increase in the latter being observed as the SLEDAI score surges ($p<0.001$, $r = 0.84$), hinting at the potential of serum calprotectin as a reliable marker for disease activity. Furthermore, a prominent correlation was seen between increased 24 hrs urinary protein levels and raised serum calprotectin levels ($p<0.001$, $r = 0.75$), cementing the role of this marker in monitoring renal involvement in SLE.

While the majority of patients showcased common mucocutaneous manifestations such as alopecia (75.49%) and various symptoms such as fatigue (66.67%), there was a considerable display of a spectrum of symptoms, reflecting the multifaceted nature of SLE.

The immunological profile observed underscores the heightened presence of certain antibodies in the patient pool, notably Anti-dsDNA (72.54%) and ANA (91.17%), which are conventionally associated with SLE, indicating a robust adherence to the recognized immunological patterns of this disease.

Drawing upon these findings, it can be concluded that SLE continues to primarily afflict young females, showcasing a diverse array of clinical manifestations. The study further propels the understanding of the potential role of serum calprotectin levels as a promising marker for monitoring disease activity and progression, urging for its incorporation in future clinical studies and possibly in the therapeutic strategies aiming at early interventions and better management of SLE.

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