

Incidence and Risk of Infection in Egyptian Patients with Systemic Lupus Erythematosus

Dalia F. Mohamed, Reem A. Habeeb, Sherin M. Hosny and Shafika E. Ebrahim

Department of Internal Medicine and Rheumatology, Ain Shams University, Cairo, Egypt.

ABSTRACT

BACKGROUND: Infection in systemic lupus erythematosus (SLE) is common and is one of the leading causes of morbidity and mortality.

OBJECTIVE: To study the risk and occurrence of infection in Egyptian SLE patients and to determine its characteristics.

METHODS: A total of 200 SLE patients were followed up for 1 year at monthly intervals, undergoing clinical and laboratory evaluation. Disease activity was assessed by SLE disease activity measurement (SLAM) score. Infections were diagnosed on basis of clinical findings, medical opinion, positive blood and urine cultures, Gram stain results, and specific serological assays as measurement of CMV and EBV antibodies.

RESULTS: A total of 55% of patients developed infection, 45% had one infection, and the rest had multiple infection episodes. Total number of infections was 233 infections/year, 47.2% were major and 52.8% were minor infections. Urinary tract was the most commonly involved site with bacterial infection being the commonest isolated organism (46.4%), and *E. coli* the commonest isolated bacteria (14.2%). There were 51 episodes caused by systemic viral infection (CMV in 25, EBV in 22, HCV in 3, and 1 in HBV).

CONCLUSION: There is a high rate of infection among SLE patients. Disease activity, leukopenia, high CRP level, positive anti-dsDNA, consumed C3, and cyclophosphamide therapy are independent risk factors for infection in SLE.

KEY WORDS: SLE, infection, disease activity

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CORRESPONDENCE: reemhabeeb@yahoo.com

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Introduction

Systemic lupus erythematosus (SLE) is a chronic multisystem autoimmune disease characterized by clinically heterogeneous manifestations in various organs. In SLE, the skin, the musculoskeletal system, the kidneys, the cardiovascular system, and the central nervous system can all be involved.¹

Infections are an important cause of morbidity and mortality in SLE. Survival rates for SLE patients in developing countries are comparatively lower than those reported in industrialized countries, with early death from infection and active disease. In addition, immunosuppressive agents used in therapy enhance susceptibility to infection. The endemicity

of certain infections like tuberculosis further poses a special health issue in developing countries.²

Bacterial infections are most frequent, followed by viral and fungal infections. The impaired cellular and humoral immune functions seen in patients with SLE are predisposing conditions. Disease activity and high doses of methylprednisolone or cyclophosphamide are well-recognized risk factors for infection. The first 6 months after rituximab treatment and the use of more than three courses are also associated with an increased susceptibility for infection. It has not been established whether belimumab, azathioprine, and mycophenolate mofetil increase the risk of serious infections.³



Aim of the Work

The aim of this work was to assess the occurrence of infections in Egyptian SLE patients and to determine the risk and characteristics of infections in a cohort study.

Patients and Methods

The present study was a prospective cohort study that was conducted on 200 Egyptian SLE patients. SLE was diagnosed according to the revised criteria of the American College of Rheumatology (ACR) for SLE.⁴ Patients were recruited from Internal Medicine ward and Rheumatology Outpatient Clinic at Ain Shams University Hospital. The research was approved by the Ain Shams University Medical Ethics Committee. Informed consent was obtained from all participants. Patients were prospectively followed up for 1 year at monthly intervals, undergoing clinical examination and laboratory evaluation in order to detect infections and to monitor the infection risk variables. At the end of the study, patients were divided into two groups. Group A included 110 SLE patients who had experienced at least 1 infectious episode during the follow-up period. Group B included 90 SLE patients who did not have any infection episodes during the follow-up period.

For all patients, the following was done:

- Full medical history taken, with special emphasis on age, disease duration, symptoms of infection, and medications used.
- Clinical examination and assessment of disease activity using SLE disease activity measurement (SLAM) score.⁵ A score <6 was considered mild disease activity, from 6 to 12 moderate disease activity, and >12 severe disease activity.
- Laboratory investigations including:
 - Complete blood count and differential leukocytes by colter.
 - ESR in the first hour estimated by Westergren method.
 - CRP level.
 - Kidney function tests including complete urine analysis, 24 hours urinary proteins, and corrected creatinine clearance.
 - Immunological tests. Antinuclear antibody (ANA) and anti-ds DNA antibody titer were done using immunofluorescence technique. Serum complement level was done by nephelometric methods and was considered to be consumed if C3 < 89 mg/dL (normally 89–126 mg/dL), C4 < 15.5 mg/dL (normally 15.5–23 mg/dL).
 - Measurement of CMV antibodies and EBV-VCA antibodies (IgG and IgM):
- Radiological investigations: chest x-ray, echocardiography, and abdominal ultrasonography were done when needed.

Infections were diagnosed on basis of clinical findings, medical opinion, positive cultures, Gram stain results, or specific serological assays according to different clinical presen-

tations and suspected infection. Each infectious episode was consecutively recorded. Microorganism type, infection site, and outcome were also recorded. Infectious episodes were categorized as: major infections: those requiring hospitalization and intravenous therapy with antibiotics. Minor infections: those who did not require hospitalization and were treated with oral antibiotics. Frequency of infection was reported as one infection where one pathogenic organism was isolated in one anatomic site over follow-up period (1 year), or multiple infections if more than one pathogenic organism was isolated in separated anatomical sites.

Statistical analysis. Analysis of data was done by IBM computer using SPSS (Statistical program for social science) windows package. Quantitative variables were described by mean, standard deviation (SD), and range. Qualitative variables were described as numbers and percentage. Chi-square test was used to compare qualitative variables. Unpaired *t*-test was used to compare two independent groups with quantitative variables. Mann Whitney test was used instead of *t*-test in nonparametric data (SD more than 50%). Multivariate analyses using logistic regression were used to identify which of the baseline variables were significantly associated with infection (dependent variable). *P* value > 0.05 = insignificant, *P* < 0.05 = significant, and *P* < 0.01 = highly significant.

Results

This study included 200 SLE patients; 170 (85%) females and 30 (15%) males. Their age ranged from 14 to 60 years with mean 27.8 ± 8.3 and disease duration 87.7 ± 26.7 months. Patients were divided into two groups. Group A included 110 SLE patients who had experienced at least 1 infection episode during a follow-up period of 1 year. Group B included 90 SLE patients who did not have any infectious episodes during the follow-up period.

In Group A, 50 patients (45%) had one infection episode, and 60 patients (55%) had multiple infection episodes. The total number of infections was 233 infections; 47.2% (110 episodes) were major and 52.8% were minor infections (123 episodes). Fifteen patients (13.6%) had developed infection related complications; nine patients needed ICU admissions (9.3%), three patients developed septicemia (3.1%), and three patients (3.1%) died from causes directly related to infection. Coexisting infections were found in 42 patients (38.2%).

Bacterial infection was the most common (45%), followed by viral infection (24%), and fungal infection (14%). A total of 12% of infections were undetermined, 3% were parasitic and 2% were mycobacterium TB (Table 1, Fig. 1).

E. coli was the commonest isolated bacterial infection (13.2%) followed by klebsiella (8.1%). CMV was the commonest isolated viral infection (10.5%) followed by EBV (9.3%).

The urinary tract was the commonest site of infection (31.8%) with 74 infectious episodes, followed by systemic viral (21.9%) with 51 infectious episodes and the pulmonary tract (12.4%) with 29 infectious episodes (Table 2).

Table 1. Type of isolated microorganism.

PATHOGEN	N	%	PATHOGEN	N	%
Bacterial	110	45.3	Viral	57	23.4
E. coli	32	13.2	EBV	22	9.3
Klebsiella	19	8.1	CMV	25	10.5
Staphylococcus aureus	12	5.1	HCV	3	1.3
Pseudomonas	10	4.2	HBV	1	0.4
Beta-hemolytic streptococci	9	3.8	HZ	5	2.2
Proteus mirabilis	8	3.4	HPV	1	0.4
MRSA	5	2.2	Fungal	35	14.4
Staphylococcus coagulase negative	4	1.7	Candida	33	14.0
Streptococcus pneumonia	4	1.7	Tinea	2	0.8
Actinobacter	2	0.8	Parasite	6	2.5
Enterobacter	2	0.8	Entamiba	4	1.7
Haemophilus influenza	1	0.4	Giardiasis	2	0.8

Comparison between Groups A and B as regard various data showed a highly significant difference as regards SLAM score, Anti DNA, C3, CRP, 24 hours urinary protein, serum albumin, WBC, cyclophosphamide, and active nephritis (Table 3).

All SLE studied patients (200 patients) were positive for CMV and EBV-VCA IgG, while 22 patients (11%) were positive for EBV-VCA IgM and 25 patients (12.5%) were positive for CMV IgM. Eighteen patients (9.0%) had IgM antibody positive for both CMV and EBV-VCA.

Comparison between EBV-VCA IgM +ve and IgM -ve patients showed a highly significant difference as regard SLAM score, disease duration, and 24 hours urinary protein (Table 4).

Comparison between CMV IgM +ve and IgM -ve patients showed a highly significant difference as regard SLAM score, disease duration, and 24 hours urinary protein (Table 5).

Multivariate analysis of infection predictor risk factors in SLE patients revealed that high CRP titer, consumed C₃, positive anti-ds DNA, leukopenia, severe disease activity by SLAM score, and cyclophosphamide therapy were independent risk factors for infection (Fig. 2).

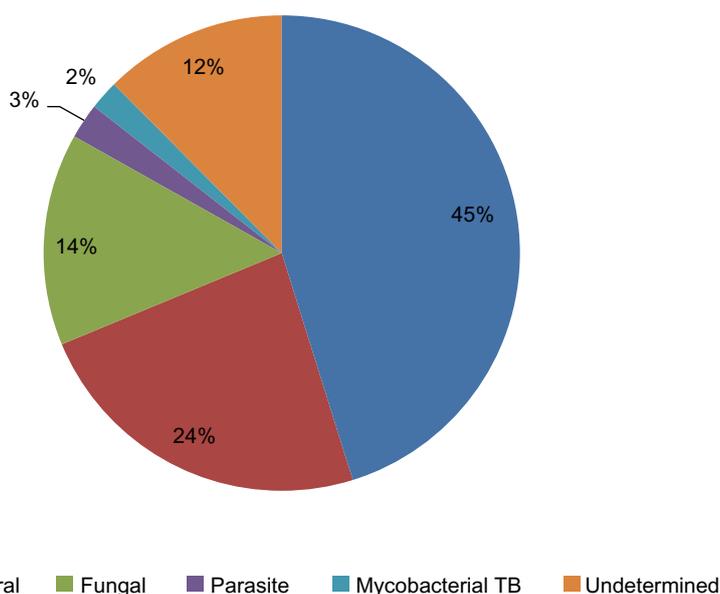
Discussion

Infection is a common problem and has become one of the leading causes of morbidity and mortality in patients with SLE. The main reasons for the high incidence of infection are immunosuppressive therapy and immune disturbances of lupus itself. Infections may mimic exacerbations of SLE, leading to confusion over the diagnosis and appropriate treatment. It can be notoriously difficult to differentiate between infection and disease flare in some cases, and they may also co-exist.⁶

The present prospective cohort study was designed to analyze the incidence and characteristics of infection in Egyptian SLE patients and determine the related risk factors.

This study showed that 55% of SLE patients (110) developed infection along a follow-up period of 1 year. Fifty patients (45%) had one infection episode, and 60 patients (55%) had multiple infection episodes. The total number of infections was 233 infections, 47.2% (110 episodes) were major and 52.8% were minor infections (123 episodes).

Various studies have recorded similar incidence of infection in SLE. In a prospective study of infection in 200 SLE patients, Zonana et al, stated that 32% had developed infection⁷ and in another study analyzing infection in 260 SLE patients, Ng et al stated that 48 major infections


Figure 1. Incidence of different infections.

**Table 2.** Site, number, and percentage of infection episodes and number of microorganism isolated.

SITE OF INFECTION AND NO. OF EPISODES	%	MICROORGANISM ISOLATED
Urinary tract (74)	31.8%	<i>E. coli</i> (26) Klebsiella (11), <i>Proteus mirabilis</i> (8), <i>Pseudomonas</i> (7) <i>Staphylococcus coagulase negative</i> (4), B-hemolytic streptococci (4) <i>Candida albicans</i> (3), <i>Enteropacter</i> , (2) <i>E. coli</i> and <i>Candida</i> (4) <i>Klebsiella</i> and <i>Candida</i> , (2) <i>Klebsiella</i> and <i>Actinobacter</i> (2), <i>Klebsiella</i> and <i>Enterococci</i> (1)
Pulmonary (29)	12.4%	<i>Streptococcus pneumoniae</i> (4), <i>Haemophilus influenzae</i> (1) <i>Klebsiella</i> (2) <i>MRSA</i> (2) <i>TB</i> (4), <i>Pseudomonas</i> (2), Undetermined (14)
Upper respiratory (12)	5.2%	hemolytic streptococcus (2), Undetermined (10)
Systemic (viral) (51)	21.9%	CMV(25), EBV(2), 2HCV (3)HBV (1)
Skin (16)	6.9%	Cellulites (6),HZ (5), <i>Tinea corpora</i> (2), <i>Staphylococcus aureus</i> (2) <i>klebsiella</i> and <i>pseudomonas</i> (1)
Vaginal (16)	6.9%	<i>Candida albicans</i> (15) HPV (1)
GIT (9)	3.9%	<i>Candida albicans</i> (oral mucosa) (2) <i>Entamoeba</i> (4) <i>Giardiasis</i> (2) <i>TB colitis</i> (1)
Nail (10)	4.3%	<i>Candida</i> (7), <i>Staphylococcus aureus</i> (3)
Soft tissue abscess (3)	1.3%	beta-hemolytic streptococci (2) <i>MRSA</i> (1)
Salivary Gland (2)	0.9%	<i>Staphylococcus aureus</i> (2)
Postoperative wound (3)	1.3%	<i>E. coli</i> (2), <i>Staphylococcus aureus</i> (1)
Bacteraemia without focus (2)	0.9%	<i>MRSA</i> (2)
Ear (2)	0.9%	<i>Staphylococcus aureus</i> (2)
Heart (1)	0.4%	<i>Streptococcus epidermidis</i> (1)
Pelvic (1)	0.4%	<i>Staphylococcus aureus</i> (1)
Joints (1)	0.4%	Beta-hemolytic streptococci (1)
IV access (1)	0.4%	<i>Staphylococcus aureus</i> (1)

and 62 minor infections were reported during the follow-up period.⁸ Ruiz-Irastorza et al, stated that in their study, 83 SLE patients (29% of the cohort) suffered at least one major infection. Fifty-five patients (66%) suffered one infection, 22 patients (27%) suffered two infections, 5 patients (6%) suffered three infections, and 1 patient suffered nine major infections.⁹

In the present study, the urinary tract was the most commonly involved site with 74 infection episodes (31.8%) and *E. coli* was the commonest isolated microorganism (26 times, 35.1%), followed by *Klebsiella* (11 times, 14.9%). For most authors, urinary tract infection is the first or second site of infection in SLE. In one study by Hussein et al, the urinary tract was the most common involved site (84.34%) of infection and 83% of the urine cultures were Gram -ve organisms and *E. coli* was the most common pathogen encountered in the study (47%).¹⁰

Regarding the isolated microorganisms in the present study, bacteria were the most commonly isolated organism (110 times, 46.4%) and *E. coli* was the most commonly isolated bacteria (32 times, 13.5%). Viruses were the second most common isolated organism (57 times, 24.1%) followed by fungal (35 times, 14.8%), parasitic (6 times, 2.5%), and mycobacterial TB (5 times, 2.1%). The microorganism was undetermined in 24 infectious episodes (10.1%). This was partially

in consistence with other studies which found that bacterial infection (44%) was the most common cause of infection in 155 SLE patients, where *E. coli* (48.4%) was the most common isolated bacteria. The second most common isolated organism was candida infection (8%) followed by viral infection (3%), parasitic infection, and unspecified in 43%.² Furthermore in another cohort of 70 SLE patients diagnosed over a 2 year period, 14 patients with confirmed antecedent tuberculosis (20.0%) were reported, which was 40 times higher than the prevalence of tuberculosis in the local population.¹¹

The current study showed that all SLE studied patients (200 patients) were positive for CMV and EBV-VCA IgG (100%), while 22 patients (11%) were positive for EBV-VCA IgM and 25 patients (12.5%) were positive for CMV IgM. Eighteen patients (9.0%) had IgM antibody positive for both CMV and EBV-VCA, which was in agreement with another study that investigated the association of CMV serology and autoantibodies in 61 Mexican patients and found that the prevalence of positive IgG anti-CMV antibodies and positive IgM anti-CMV antibodies in the SLE population was 95% (58/61) and 33% (20/61), respectively.¹²

The coexisting IgM and IgG antibody in patients of the present study may be explained by reinfection or reactivation of CMV and EBV. Also, positive IgM Ab may be false positive as a result of the presence of SLE autoantibod-

Table 3. Comparison between Groups A and B with various data.

VARIABLE	GROUP A	GROUP B	X ² /T/Z	P (SIG)	
Age (years)	29.9 ± 9.4	26.2 ± 6.5	2.4	0.02 (S)	
Disease Duration (month)	87.7 ± 20.7	65.5 ± 18.3	-2.297	0.022 (S)	
SLAM score	Mild < 6	42 (46.7%)	13.3	0.001 (HS)	
	Moderate (6–12)	27 (24.6%)			
	Severe (>12)	26 (28.9%)			
AntiDNA +ve/-ve	83/27 (75.5/24.5%)	51/39 (56.7/43.3%)	7.9	0.005 (HS)	
C3 (consumed/normal)	75/35 (68.2/31.8%)	38/51 (42.7/57.3%)	13	0.000 (HS)	
C4 (consumed/normal)	64/46 (58.2/41.8)	37/53 (41.1/58.9%)	5.7	0.02 (S)	
ESRmm/hr	65.5 ± 36.5	59.1 ± 33.8	1.3	0.2 (NS)	
CRPmg/dl g/dl	6.000–128.000	6.000–69.000	-6.011	0.000 (HS)	
24 hr urinary protein	0.100–6.600	0.020–6.000	-4.391	0.000 (HS)	
S.albumin g/dl	2.9 ± 0.7	3.2 ± 0.9	-3.3	0.001 (HS)	
S creatinine mg/dl	1.2 ± 1.5	1.0 ± 0.7	1.3	0.2 (NS)	
BUN mg/dl	25.5 ± 19.9	21.9 ± 16.5	1.2	0.2 (NS)	
WBCs 10 ³ /ml	5.9 ± 4.1	7.3 ± 2.7	-2.7	0.007 (HS)	
Drugs	Prednisone+VE/-VE	84/26 (76.4/23.6%)	37/53 (41.1/58.9%)	25.7	0.000 (HS)
	Cyclophosphamide+VE/-VE	63/47 (57.3/42.7%)	30/60 (33.3/66.7%)	11.4	0.001 (HS)
	Azathioprine+VE/-VE	35/75 (31.8/68.2%)	39/51 (43.3/56.7%)	2.8	0.09 (NS)
	Mycophenolatemofetil+VE/-VE	10/98 (9.1/90.9%)	5/85 (5.6/94.4%)	2.8	0.09 (NS)
	Nonimmunosup+VE/-VE	2/108 (1.8/98.2%)	16/74 (17.8/82.2%)	15.4	0.000 (HS)
Active Nephritis yes/no	80/30 (72.2/27.3%)	36/54 (40/60%)	21.7	0.000 (HS)	

ies, which need to be confirmed by PCR. SLE and CMV infection share common manifestations and a new infection or reactivation of CMV can mimic SLE. CMV may also be considered responsible for flare or development of SLE in some cases. Primary infection is characterized by positive IgM anti-CMV and negative IgG anti-CMV, followed by seroconversion to positive IgG anti-CMV; however, positive IgM anti-CMV is also seen frequently in patients with reactivation or reinfection of CMV.¹³

Many studies have revealed a connection between SLE and EBV infection. Essentially all adult SLE patients are infected with EBV (99.5%). However, the statistical significance of this finding is reduced by the large proportion of healthy adults infected as well (95%). Studies have detected higher EBV viral loads in SLE patients than healthy individuals and have shown that increase in the EBV viral load always occurred 1 week or more after the onset of a SLE relapse.¹⁴

Although HCV is endemic in Egypt, in the present study, we reported only three cases of HCV infection. In contrast, El Garf et al, in a study on 98 Egyptian SLE patients, reported 20 patients with positive HCV Ab and 8 of them with active viremia.¹⁵ This discrepancy could be explained by the fact that HCV Ab testing was not confirmed by HCV PCR testing in all patients of the present study.

Among virus infections, the present study detected herpes zoster infection in five infectious episodes, and all cases was localized to the skin. Similarly 5 cases of herpes zoster out of 297 infectious episodes were reported in one study.² Studies have determined herpes zoster to be a late SLE complication with some peculiar features, such as good prognosis and typical dermatome distribution. In addition, they have identified that the major trigger factor for this viral infection in SLE is therapy, particularly the concomitant use of corticosteroid and immunosuppressors, and not active disease.¹⁶

In the present study, disease activity as determined by scoring index, such as SLAM score index, and by serological features, such as anti-ds DNA and hypocomplementemia, showed that there was a high statistical significant difference between Groups A and B. Similarly, studies have stated that (low C3 and C4 level and positive anti-ds DNA were significant risk factors for infection in SLE.¹⁷ However, Khalifa et al, did not find any significant association between low complement level or anti-ds DNA positivity and infection in SLE patients.¹⁸

In the present study, there was a higher percentage of leukopenia and lymphopenia in Group A compared to Group B, while there was no statistically significant difference between the two groups regarding neutropenia. In agreement with



Table 4. Comparison between EBV-VCA IgM +ve and IgM –ve patients regarding SLAM score, age, and different laboratory findings.

VARIABLE		EBVIGM +VE (22)	EBV IGM –VE (178)	X ² /T	P (SIG)
		N %	N %		
SLAM score	Mild	3 13.6	66 37.1	18.3	0.000 (HS)
	Moderate	2 9.1	57 32.0		
	Severe	17 77.3	55 30.9		
Age/years (Mean±SD)		23.6 ± 7.8	28.3 ± 8.2	-2.5	0.01 (S)
Hb (Mean±SD)		9.3 ± 1.5	10.1 ± 1.7	-1.8	0.07 (NS)
Platelets (Mean±SD)		215.1 ± 88.3	206.7 ± 76.3	0.5	0.6 N (S)
WBCs (Mean±SD)		5.1 ± 3.3	6.7 ± 2.7	-2.7	0.03 (S)
S.albumin (Mean±SD)		2.7 ± 0.7	3.1 ± 0.8	-3.3	0.03 (S)
S. cr (Mean±SD)		1.2 ± 0.6	1.0 ± 1.3	-0.2	0.8 (NS)
BUN (Mean±SD)		23.6 ± 20.4	23.9 ± 18.3	-0.08	0.9 (NS)
ESR (Mean±SD)		56.4 ± 37.1	63.4 ± 35.2	-0.9	0.4 (NS)
C3	Consumed	17 77.3	96 53.9	6.3	0.01 (S)
	Normal	5 22.7	82 46.1		
C4	Consumed	14 58.2	87 48.9	1.8	0.2 (NS)
	Normal	8 41.8	91 51.1		
Anti-DNA+ve		20 90.9	114 64.0	6.4	0.01 (S)
		Median	Median	Z	P (Sig)
Disease duration/ m		2.5	24.0	-6.3	0.000 (HS)
CRP(mg/dl)		32.0	24.0	-2.15	0.03 (S)
24h urinary protein (g/24h)		1.9	1.1	-2.99	0.003 (HS)

Merayo-Chalico et al, who reviewed the clinical records of 167 SLE patients throughout a 5 year period, and found that lymphopenia is one of the independent risk factors for the development of severe infections in SLE patients.¹⁹ In contrast, however, Dias et al examined the relationship between infections and WBC count abnormalities and found that neutropenia was the only abnormality significantly associated with an increased risk of infection.²⁰

Consistent with various studies,¹⁸ the current study detected that lower serum albumin, proteinuria, active renal disease, and high disease activity by SLAM score index were associated with more risk for infection in SLE patients. This may be explained by the fact that active renal disease and high disease activity require the use of high dose of corticosteroid and cytotoxic drugs, which also were associated with increased infection risk in our patients.

Several studies have reported a significant relationship between cyclophosphamide therapy and infection in SLE.⁹ Cyclophosphamide causes neutropenia through both decreased production and increased destruction of neutrophils. In our study, there was a statistically highly significant increased infection risk with the use of IV solumedrol as well as cyclophosmaide. While, there was no statistically significant increase in the risk with the use of azathioprine or mycophenolate mofetil.

Multivariate analysis of infection related risk factors in patients of the present study revealed that high CRP, consumed C3, positive anti-ds DNA, leukopenia, cyclophosphamide therapy, and severe disease activity by SLAM score were independent risk factors for infection in SLE. Similarly, studies have found that according to multivariate analysis, SLE patients have greater risk of infection with high SLEDAI, low C3, and presence of anti-ds DNA Ab at the time of diagnosis.¹⁷ On the other hand; Zonana et al claimed that the only variable to independently predict infection was a SLEDAI score of ≥ 4 .⁷

In conclusion, the present study illustrates the high rate of infection in SLE. High CRP, consumed C3, positive anti-ds DNA, leukopenia, cyclophosphamide therapy, and severe disease activity by SLAM score are independent risk factors for infection in SLE.

It is recommended that clinicians should maintain a high level of suspicion and close monitoring of infection especially in SLE patients with high disease activity, hypocomplementemia, positive anti-ds DNA, and leukopenia. Screening for infectious comorbidities such as EBV, CMV, and tuberculosis should be performed as a part of the biochemical and immunological profile at the first clinical encounter in patients with lupus. Early diagnosis and proper treatment of infections, including prompt evaluation of fevers is recommended for prevention of

Table 5. Comparison between CMV IgM +ve and IgM –ve patients regarding SLAM score, age, and different laboratory findings.

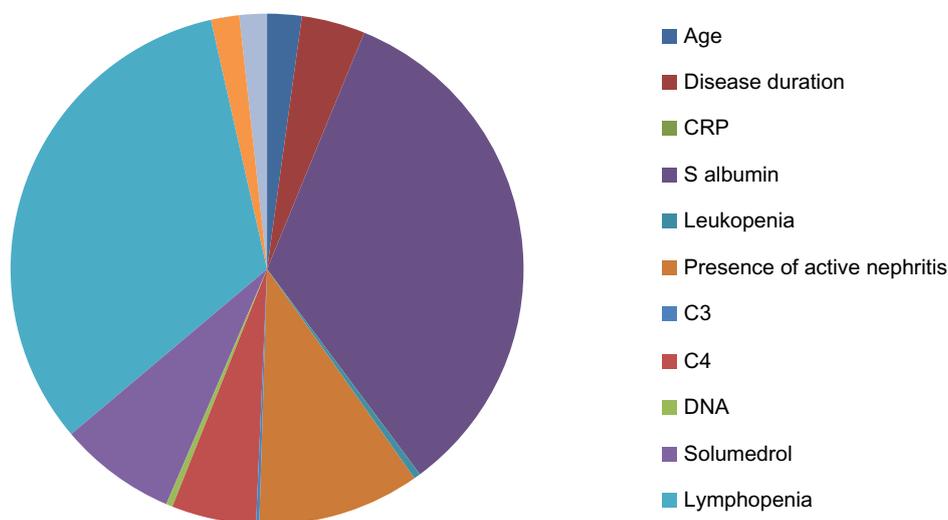
VARIABLE		CMVIGM +VE (25)	CMV IGM –VE (175)	X ² /T	P (SIG)
		N %	N %		
SLAM score	Mild	3 12.0	66 37.7	10.7	0.005 (HS)
	Moderate	6 24.0	53 30.3		
	Severe	16 64.0	56 32		
Age/years (Mean±SD)		24.0 ± 6.6	28.2 ± 8.4	–2.4	0.02 (S)
Hb (Mean±SD)		9.9 ± 1.1	10.1 ± 1.7	–1.9	0.08 (NS)
Platelets (Mean±SD)		211.4 ± 99.3	208.1 ± 74.1	0.9	0.8 (NS)
WBCs (Mean±SD)		5.0 ± 2.8	6.9 ± 3.9	–2.7	0.04 (S)
S.albumin (Mean±SD)		2.7 ± 0.6	3.0 ± 0.8	–0.08	0.4 (NS)
S. cr (Mean±SD)		1.1 ± 0.5	1.0 ± 1.3	0.08	0.9 (NS)
BUN (Mean±SD)		24.1 ± 15.5	23.9 ± 18.9	0.05	0.9 (NS)
ESR (Mean±SD)		62.9 ± 38.5	62.5 ± 34.9	0.05	0.4 (NS)
C3	Consumed	20 80.0	93 53.3	4.4	0.02 (S)
	Normal	5 20.0	82 46.6		
C4	Consumed	16 64.0	85 48.6	2.1	0.1 (NS)
	Normal	9 36.0	90 51.4		
AntiDNA+VE		22 88.0	112 64.0	3.6	0.02 (S)
		Median	Median	Z	P Value
Disease duration/ m		3.0	25.0	–5.4	0.000 (HS)
CRP (mg/dl)		29.0	25.0	–1.9	0.05 (NS)
24h urinary protein (g/24h)		1.8	1.3	–2.6	0.008 (HS)

infection related morbidity and mortality. Steroids and immunosuppressive agents should be used with caution to decrease infection related complications. Vaccination should also be considered for SLE patients as one of the preventive measures for infection.

Author Contributions

Conceived and designed the experiments: DFM, RAH, SMH. Analyzed the data: RAH, SEE. Wrote the first draft of the manuscript: RAH. Contributed to the writing of the manuscript: DFM, RAH, SMH, SEE. Agree with manuscript

Risk factors in SLE patients


Figure 2. Infection risk factors in SLE patients.



results and conclusions: DFM, RAH, SMH, SEE. Jointly developed the structure and arguments for the paper: DFM, RAH, SMH, SEE. Made critical revisions and approved final version: DFM, RAH, SMH, SEE. All authors reviewed and approved of the final manuscript.

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