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Research Article

Isolation of Bacterial Bloodstream Infections in Patients with Systemic Lupus Erythematosus

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Abstract

Patients with systemic Lupus erythematosus (SLE) are at great risk of bacterial infection because of immune system dysregulation and immunosuppressive treatment. Urinary tract and bloodstream infections are some of the most frequent complications, with high morbidity. The objective of this study was to determine the etiological defined agents associated with urine and blood samples of patients with SLE and characterize them**.** A total of 110 urine and 8 blood samples were taken from patients with SLE who appeared at the hospital between March and August 2024. Cultures were handled according to standard microbiological methods, and bacterial strains were identified using Gram staining, biochemistry techniques, and Vitek $4 automated equipment. Blood samples: Gram-positive had a marginal predominance (50%), and *Escherichia coli* 3 (37.5%) was the commonest isolate, followed *by Staphylococcus aureus* 2 (25%), *K pneumoniae* 1 (12.5%), *P aeruginosa* 1 (12.5%), and *Enterococcus faecalis* 1 (12.5%). Conclusion: The epidemiology of both UTIs and BSIs, whether about Gram status or species, is mixed, with Escherichia coli and *Staphylococcus aureus* as the most common overall isolates among SLE patients. Prompt identification and optimal antibiotic treatment are important for minimizing morbidity and preventing major complications in this immunocompromised population.

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1. INTRODUCTION

Systemic Lupus erythematosus (SLE) is a lifelong autoimmune disease that results from immune dysregulation and can cause multiple organ damage and an enhanced tendency toward infections. [1] Bloodstream infections (BSIs) are one of the most severe infectious complications for patients with SLE as a result of immunosuppressive therapy and aberrant host defenses. Early recognition of the underlying bacterial pathogens is important in managing appropriate antibiotic therapy to minimize morbidity and mortality [2]. Old-fashioned microbiological techniques are necessary for the isolation of bacterial pathogens, such as Gram staining and culture on selective and enrichment media, although this process is tedious and time-consuming [3]. Automated facilities, such as Vitek $4 (bio Mérieux, France), have been more commonly used for rapid and accurate identification and susceptibility testing of clinical isolates [4]. VITEK integrated with criterion standard culture techniques provides complete identification and characterization of gram-positive and Gram-negative/hemophiles organisms in patient blood isolates [5, 6]. The goal of this study is to report and characterize bacteremia in patients with SLE using a combination of conventional culture and bacterial detection systems, combined with VITEK automated identification, as well as providing insight into pathogen distribution, which could contribute to best practice management.

2. METHOD

2.1 Demographic and clinical characteristics

Demographic and clinical data were collected from the medical records of 100 registered patients with systemic Lupus erythematosus (SLE). Variables collected included age, sex, duration of disease since diagnosis, and current immunosuppressive therapy. Immunosuppressive therapy information included the use of corticosteroids, hydroxychloroquine, azathioprine, mycophenolate mofetil, cyclophosphamide, and other prescribed immunomodulators. These data were analyzed to characterize the study population and assess its potential association with bloodstream infections.

Bloodstream infections were categorized based on the time of onset about hospital admission and clinical history. Infections detected within 48 hours of admission without prior hospitalization were considered community-acquired infections,[7] whereas those occurring after 48 hours of hospitalization or in patients with recent healthcare exposure were classified as hospital-acquired infections.

2.2. Sample Collection

The blood samples were obtained from 8 patients with systemic Lupus erythematosus (SLE) who were admitted to a hospital during the period from march 2025 to august 2025. Informed consent was obtained from all patients, and the study was approved by the institutional ethics committee. Five to 10 mL of venous blood was aseptically taken from each patient into sterile Vacutainer tubes with EDTA or sodium citrate as an anticoagulant. The skin was disinfected using 70% ethanol, and after that, using 2% iodine solution to prevent contamination during venipuncture.

2.3. Culture and Isolation of Bacteria

Blood samples were immediately transported to the microbiology laboratory and processed within 1-2 hours of collection.

- Blood culture bottles (aerobic and anaerobic) were inoculated and incubated at 37°C for up to 7 days.
- Samples showing turbidity, hemolysis, or gas production were subcultured on selective and differential media, including:
    - MacConkey agar (for gram-negative bacteria)
    - Blood agar (for gram-positive and hemolytic bacteria)
    - CLED agar (for urinary pathogens if applicable)
    - Chocolate agar (for fastidious organisms)

2.4. Identification of Bacterial Isolates

I. Preliminary identification was performed using:

1. Gram staining to distinguish gram-positive from gram-negative bacteria.
2. Biochemical tests, including:

- Catalase and coagulase tests for Staphylococcus spp.
- Oxidase test for Pseudomonas spp.
- Indole, urease, citrate utilization, and triple sugar iron (TSI) tests for Enterobacteriaceae.

II. Automated identification:

- Confirmatory identification of all isolates was performed using the vitek $4 system (bioMérieux, France), which delivers species-level identification and antimicrobial susceptibility profiles.
- Based on metabolic profiles and matching with the database

III. Quality Control

• The sterility of all culture media and reagents was routinely tested using control strains, namely:

- Escherichia coli
- Staphylococcus aureus

• All procedures were performed under standard microbiological safety practices to avoid contamination and ensure reproducibility.

2.4.1 Inclusion Criteria:

Patients diagnosed with systemic lupus erythematosus (SLE) according to established clinical and laboratory diagnostic criteria, regardless of sex, who exhibited clinical signs and symptoms suggestive of a bloodstream infection, and who consented to participate in the study, were included. Blood samples were collected from patients during the study period for microbiological testing [7].

2.4.2 Exclusion Criteria:

Patients who did not meet the diagnostic criteria for SLE, whose clinical records were incomplete, who were receiving antibiotic treatment before blood sample collection, and individuals who declined to participate were excluded. Contaminated blood culture samples were also excluded from the final analysis. [8]

3. RESULTS

A selective range of media for the isolation and identification of bacterial organisms was employed (Table 1 and Figure 1). MacConkey agar for gram-negative bacteria, Blood agar for gram-positive and hemolytic bacteria, CLED agar for urinary pathogens, and Chocolate agar for fastidious organisms. Interpretation (Observation) Growth in various media was interpreted as given in Tables 2–3. This combination enabled the accurate identification and initial characterization of both Gram-positive, Gram-negative, and fastidious bacterial isolates.

Table 1. The distribution of isolates of 8 blood samples yielded bacterial growth.

Bacterial species	Number of isolates (n)	Percentage (%)
Escherichia coli	3	37.5
Staphylococcus aureus	2	25.0
Klebsiella pneumoniae	1	12.5
Pseudomonas aeruginosa	1	12.5
Enterococcus faecalis	1	12.5
Total	8	100

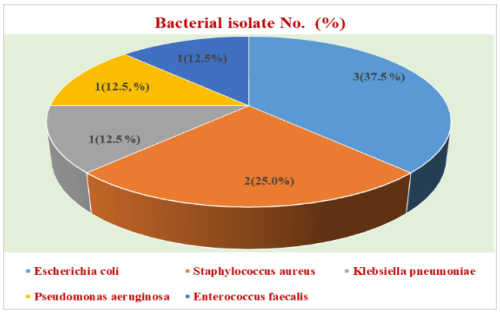

Figure 1: Distribution of bacterial isolates in blood samples of patients with SLE (Pie chart).

3.2 Identification by VITEK

All isolates from blood were further tested for identification by the vITEK $4 automated system (bioMérieux, France), which produces fast and reliable identifications with its biochemical profiles and metabolic activity. The system identified species-level preliminary identifications from traditional culture and Gram staining: *E. coli* (3 isolates), *S. aureus* (2 isolates), *K. pneumoniae* (1 isolate), *P. aeruginosa* (1 isolate), and *E. faecalis* (1 isolate). In addition, the VITEK system yielded preliminary antimicrobial susceptibility profiles for all isolates, giving an early direction for therapy (Fig 2).

(A)

bioMérieux Customer: Microbiology Chart Report Printed December 11, 2024 1:44:05 PM CST

Patient Name: Ghadeer, Hasan Patient ID: 617397
Location: Physician:
Lab ID: 617397 Isolate Number: 1

Organism Quantity:
Selected Organism : Pseudomonas aeruginosa

Source: **Collected:**

Comments:	

Identification Information	**Analysis Time:** 9.97 hours	**Status:** Final
Selected Organism	**Bionumber:**	**Pseudomonas aeruginosa** 0003051103500352
ID Analysis Messages		

Susceptibility Information	**Analysis Time:** 15.82 hours	**Status:** Final

Antimicrobial	MIC	Interpretation	Antimicrobial	MIC	Interpretation
Ticarcillin	>= 128	R	Gentamicin	>= 16	R
Ticarcillin/Clavulanic Acid	>= 128	R	Tobramycin	>= 16	R
Piperacillin	>= 128	R	Ciprofloxacin	>= 4	R
Ceftazidime	16	*R	Pefloxacin		
Cefepime	>= 64	R	Minocycline		
Aztreonam			Colistin	<= 0.5	S
Imipenem	>= 16	R	Rifampicin		
Meropenem	>= 16	R	Trimethoprim/ Sulfamethoxazole		
Amikacin	>= 64	R			

*= AES modified **= User modified

AES Findings	
Confidence:	Consistent

(B)

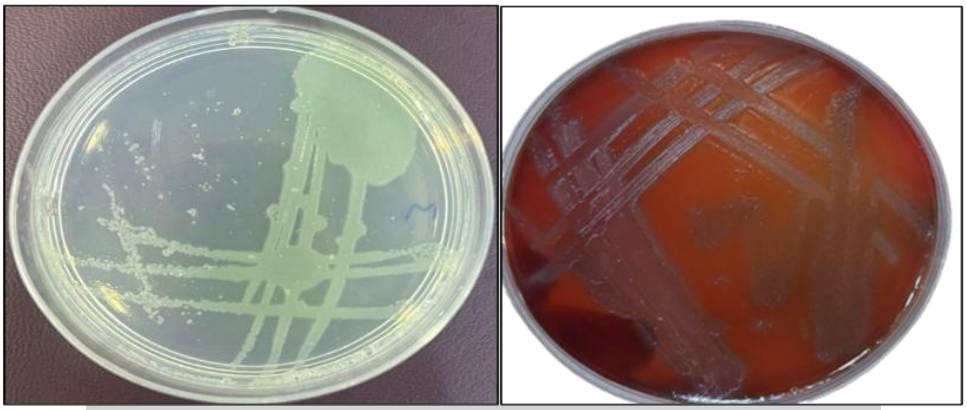

Figure 2: *P. aeruginosa* on (a) Cetrimide agar and (b) MacConkey agar at 37°C for 24 hours.

4. Discussion

Systemic lupus erythematosus (SLE) may lead to critical with a serious complication of bloodstream infection (BSI). This has been attributed primarily to immune dysregulation, complement deficiency and prolonged immunosuppressive therapy such as corticosteroids, cyclophosphamide and azathioprine. These factors impair host defense mechanisms thereby predisposing to both community-acquired and hospital-acquired pathogens [9]. In this study, we recovered 8 bacterial isolates from blood stream infections. The most isolated organism was Escherichia coli (37.5%, n = 3) followed by *Staphylococcus aureus* (25.0%, n = 2), while Klebsiella pneumoniae, Pseudomonas aeruginosa and Enterococcus faecalis were found in 12.5% (n=1).No statistically significant difference between the distribution of bacterial isolates among Gram-negative and Gram-positive organisms were found using statistical analysis with the chi-square/Fisher's exact test (p = 0.73), most likely owing to small sample size. Two well-defined problems of leadership 40 A descriptive prevalence of Gram-negative over Gram-positive bacteria (50% vs. 50%) has been found each their own but this slight shift suggests a clinically significant but balanced balance in the word. Mok et al. (2020) [9] and Daniel et al. Staphylococcus aureus is the most frequent cause of bacteremia in SLE patients; Gram-positive organisms comprised 30–40% of cases (Mosca et al.(2019) [10].

In contrast, the present study revealed a lower proportion of gram-positive isolates (31.25%) than that previously reported, with *S. aureus* accounting for only 25% of cases. Pamuk et al. Recently, there has been an increasing incidence of opportunistic gram-negative pathogens, eg, Pseudomonas aeruginosa and Enterococcus faecalis, in patients with SLE with immunosuppression [2023]. The high prevalence of E. coli (37.5%) in the present study could probably be due to urinary tract source bacteremia and neutrophil dysfunction in patients with SLE, which may impair immune clearance [11]. This predominance was clinically relevant, as its virulence with association to sepsis in immunocompromised patients is well recognized, although not statistically significant against the background of other isolates (p >0.05). gram-negative organisms (E. coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa) represented 50% of the isolates overall. Both community-acquired and hospital-acquired sources likely contribute to bloodstream infections in SLE populations, which is reflected more equitably by the presence of gram-negative and gram-positive bacteria. [12].

The isolation of Enterococcus faecalis (12.5%) is consistent with opportunistic infections seen in immunocompromised hosts, especially in patients who have been on antibiotics or had invasive procedures. The polymicrobial spectrum seen in this population stresses the need to initiate empirical broad-spectrum antimicrobial therapy until culture and susceptibility data become available. However, you still need to rapidly identify with automated systems such as vITEK $4 to ensure timely diagnosis and targeted treatment for at-risk SLE patients who are receiving immunosuppressive therapy or extended hospital stays.

5. Conclusion

A wide variety of gram-positive and gram-negative bacteria infect patients with SLE who develop bloodstream infections, including the most commonly isolated microorganism, Staphylococcus aureus. The emergence of gram-negative and opportunistic pathogens reinforces the need for a high index of suspicion, timely diagnosis, and appropriate antimicrobial therapy to reduce morbidity and improve outcomes in this vulnerable cohort.

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