

Original Article

A Descriptive Analysis of the Clinical and Laboratory Characteristics of Sepsis Patients admitted to the Emergency Department of a Tertiary Hospital in Nigeria.

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ABSTRACT

Introduction: There is limited data on sepsis and sepsis outcomes in Nigeria. We described the clinical and laboratory characteristics of patients admitted with sepsis in a Nigerian tertiary hospital.

Methods: This was a prospective cohort study of patients aged ≥ 18 years, admitted to the accident and emergency department (A&E) of Lagos University Teaching Hospital (LUTH), Idi-Araba, with physician-diagnosed sepsis between November 2021 and April 2022. Presenting clinical and laboratory findings of patients that met the Systemic Inflammatory Response (SIRS) and/or the quick Sequential Organ Failure Assessment (qSOFA) criteria were documented. The primary outcome was all-cause in-hospital mortality. A bivariate analysis was conducted to determine factors associated with mortality. P-value < 0.05 was considered statistically significant.

Results: Out of 119 patients with physician-diagnosed sepsis, 80 (67.2%) met the SIRS and/or qSOFA criteria, and were therefore recruited. The mean age was 49.0 ± 17.1 years, with a slight male preponderance of 41/80 (52.2%). The median systolic and diastolic BP were 129.9 (range 87–270) mmHg and 81.6 (range 44–170) mmHg respectively, with eight people (10.0 %) presenting with septic shock. The respiratory system was the most commonly identified focus of infection (15%), and ceftriaxone the most commonly administered antibiotic (52.5%). The median duration from admission to administration of first dose of antibiotics was 2 (0.5 – 24) hours, with only 23 (28.7%) patients receiving their first dose of antibiotics within the first hour of admission. Twenty-eight patients (35%) died. Mortality was not significantly associated with any demographic, clinical or laboratory variable.

Conclusions: Patients presenting with sepsis were relatively young, with high incidence of sepsis shock and delay in first-dose of antibiotics. Mortality from sepsis was high but none of the variables assessed predicted mortality. Our findings are relevant to clinicians involved in sepsis management and support the need for larger sepsis studies in Nigeria.

Key words: sepsis, septic shock, mortality, antibiotics, Nigeria.

INTRODUCTION

Sepsis, which is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection, is associated with high morbidity and mortality^{1,2}. Globally, in-hospital mortality from sepsis is about 25%–30%, which rises to 40%–50% in patients with comorbidities and in low-and middle-income countries (LMIC)^{2,3}. In 2017, about 11 million people died as a result of an estimated 49 million cases of sepsis⁴.

This figure is likely an underestimate because data on incidence and outcomes of sepsis are often poorly captured in LMIC where access to care is sub-optimal⁵.

The clinical and laboratory features at presentation are useful in the initial evaluation of patients with sepsis⁶, both for the early recognition sepsis, recognition of organ failures, and prompt decision-making for resuscitation of patients with suspected sepsis, including early referral of severely ill patients to intensive care units (ICU)⁷.

Clinical scoring algorithms such as the systemic inflammatory response syndrome (SIRS) and the quick sequential organ failure assessment (qSOFA) have found widespread use in LMIC due to their ease of use at the point of patient interaction, such as the emergency room⁸.

In contrast to most high-income countries, data on the characteristics of patients admitted with sepsis is limited in most LMIC, as many of the health facilities do not collect standardized data on patients admitted with sepsis and hospital admission forms do not usually contain sepsis-specific evaluation and outcome measures⁹.

The availability of detailed, standardized data on patients admitted with sepsis to hospitals in LMIC would aid epidemiological research and facilitate appropriate allocation of scarce health-care resources for sepsis management, ensuring that all patients admitted with sepsis receive appropriate care. The goal of this study was to describe the baseline clinical and laboratory characteristics, antibiotic management, mortality and its determinants among patients with sepsis at the Lagos University Teaching Hospital in South-West Nigeria.

METHODOLOGY

Study design and study setting

This was a prospective cohort study. It was part of a cohort study to determine the relationship between early diagnostic assessment of sepsis in the emergency department and mortality. All consenting adult patients aged 18 years or more admitted to the medical accident and emergency department (A&E) of Lagos University Teaching Hospital (LUTH), Idi-Araba, with physician-diagnosed sepsis between November 2021 and April 2022 were eligible for the study. Only those who met the SIRS and/or the qSOFA criteria (as defined below) were included for further analyses. Participants were monitored until they were discharged from the hospital or died.

Study size

The flow chart of patients' selection is shown in Figure 1 below. During the period of recruitment (November 2021 – April 2022), 728 patients were admitted into medical A&E, LUTH Idi-Araba. Out of 119 patients who were admitted with a diagnosis of sepsis by the attending physician, only 80 met the SIRS and/or qSOFA criteria for sepsis, and so were recruited.

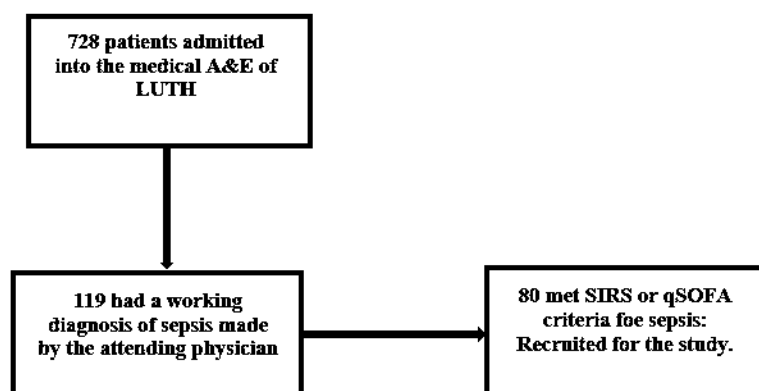


Fig. 1: Flow chart of participant recruitment

Study procedure

In this study, sepsis was defined using the systemic inflammatory response syndrome (SIRS) or the quick sequential organ failure assessment (qSOFA) scores. We defined sepsis as the suspicion of infection in the presence of two systemic inflammatory response syndrome signs: tachycardia (heart rate >90 beats/min), tachypnea (respiratory rate >20 breaths/min), fever or hypothermia (temperature >38 or <36 °C), and leukocytosis, leukopenia, or bandemia (white blood cells >1,200/mm³, <4,000/mm³ or bandemia ≥10%) (SIRS criteria),⁹ OR a qSOFA score of ≥ 2, where 1 point was assigned for each of the following three criteria: (1) respiratory rate ≥ 22 cycles/min, (2) altered mental status, or (3) systolic blood pressure (SBP) 100 mm Hg (Sepsis-3 criteria)².

Study variables

Clinical evaluation: the demographic information of each patient, including their age, gender (male or female), and marital status (single, married, separated, divorced, widowed), was obtained. The presenting characteristics of the patients that were indicative of an infection were recorded, including the presence of fever or hypothermia and symptoms attributable to the source of infection. The presenting characteristics was utilized to define clinical suspicion of an infection.

All patients' clinical examination results were also recorded, including the temperature, respiratory rate, pulse rate, blood pressure, and Glasgow Coma Score (GCS). The average of two readings of the patients' vital signs (temperature, respiratory rate, heart rate and blood pressure [BP]) performed within thirty minutes of presentation, were used to classify the patients into those with/ without sepsis. The time until the first dose of an antibiotic was recorded. All patients were monitored until discharge or death.

Laboratory assessment: The results of initial investigations were documented, including total white cell count, platelet counts, as well as serum urea, creatinine, and bicarbonate were documented. These assessments were done as part of the first-line standard of care for patients admitted to the emergency department for sepsis management.

Outcome measures and case definitions: The primary outcome was all-cause mortality defined as death in a patient with sepsis irrespective of the cause. Septic shock was defined as systolic BP < 90 mmHg and/or diastolic BP < 60 mmHg in patients with SIRS/qSOFA-defined sepsis.

Statistical Methods

Data were cleaned and analyzed using the IBM SPSS Statistics for Macintosh, Version 28 (Armonk, NY: IBM Corp). The participants' gender, occupation, marital status, GCS, site of infection, the antibiotics they received, as well as their outcome were presented as frequencies and percentages. Normally distributed variables such as age, temperature and the serum bicarbonate were presented as the mean (standard deviation, SD), while non-parametric data (such as respiratory rate, blood pressure, blood counts as well as the serum urea and creatinine) were presented as median with range. A bivariate analysis was conducted to identify potential demographic, clinical and laboratory determinants of mortality. Alpha level was set at 0.05 as the threshold for statistical significance.

RESULTS

Demographic characteristic of sepsis patients

One hundred and nineteen patients were admitted with physician-diagnosed sepsis of which 80 (67.2%) met the SIRS and/or qSOFA criteria. The demographic characteristics of the patients are presented in Table 1. The mean age of patients admitted to the A&E with sepsis was 49.0 ± 17.1 years, with a slight male preponderance of 41/80 (52.2%).

Table 1: Socio-demographic data of patients admitted to the A&E with sepsis

Variable (n = 80)	
Age, years	
Mean $\pm$ SD	49.0 $\pm$ 17.1
Sex	
	Frequency (percentage)
Male	41 (51.2)
Female	39 (48.8)
Marital Status	
Single	16 (20.0)
Married	58 (72.5)
Separated/Divorced	1 (1.3)
Widowed	5 (6.3)
Occupation	
Business	14 (17.5)
Student	3 (3.8)
Teacher	1 (1.3)
Civil Servant	7 (8.8)
Artisan	2 (2.5)
Retired	8 (10.0)
Security	1 (1.3)
Clergy	1 (1.3)
Unemployed	43 (53.8)
Business	14 (17.5)

Characteristics of admitted patients

Table 2 shows the clinical and laboratory characteristics of the individuals that were enrolled. The median systolic blood pressure (SBP) was 129.9 mmHg (range 87–270 mmHg) and the diastolic blood pressure (DBP) was 81.6 mmHg (range 44–170mmHg), with eight people (10%) presenting with septic shock. As illustrated in Table 2, the respiratory system was the most commonly identified site/focus of infection (15%). The focus of infection was unidentifiable in 32 (40%) of the patients.

Table 2: Clinical and laboratory characteristics of sepsis patients in LUTH

Clinical characteristics	Frequency (percentage)
Temperature (°C)	
Fever	57 (71.3)
Normothermia	15 (18.8)
Sub-normal	8 (10.0)
Respiratory rate (cpm)	
Tachypnoea	74 (92.5)
Normal RR	6 (7.5)
Pulse rate (bpm)	
Tachycardia	48 (60.0)
Normal PR	32 (40.0)
Systolic blood pressure (mmHg)	
< 90mmHg	4 (5.0)
≥ 90 mmHg	76 (95.0)
Diastolic blood pressure (mmHg)	
< 60 mmHg	7 (8.8)
≥ 60 mmHg	73 (91.2)
Septic shock	
Yes	8 (10.0)
No	72 (90.0)
GCS	
15	49 (63.3)
8-14	20 (25.0)
< 8	11 (13.8)
Laboratory characteristics	
White blood cell count (x 10⁹/L)	
Leucocytosis	54 (67.5)
Normal WBC	23 (28.7)
Leucopenia	3 (3.8)
Platelet count (x 10⁹/L)	
> 450 X 10 ⁹	21 (26.3)
150 - 450 X 10 ⁹	41 (51.2)
< 150 X 10 ⁹	18 (22.5)
Urea (mmol/L)	
Normal	34 (42.5)
Elevated	46 (57.5)
Creatinine (μmol/L)	
Normal	48 (60.0)
Elevated	32 (40.0)
Bicarbonate	
Normal	42 (52.5)
Below 20 mmol/L	38 (47.5)
Site of Infection	
Respiratory	14 (17.5)
GIT*	11 (13.8)
Urinary	6 (7.5)
CNS*	6 (7.5)
MSS*	5 (6.3)
Skin	3 (3.8)
Dental	2 (2.5)
Eye	1 (1.3)
Unknown	32 (40.0)

*GIT Gastrointestinal system CNS Central nervous system MSS Musculoskeletal system

Choice of antibiotic among patients.

Ceftriaxone was the most commonly administered antibiotics, as indicated in Figure 2, followed by amoxycillin-clavulanate. First dose of antibiotics was administered within a median (range) duration of 2 (0.5 – 24) hours and only 23 (28.7%) of the recruited patients receiving their first dose of antibiotics within the first hour of admission.

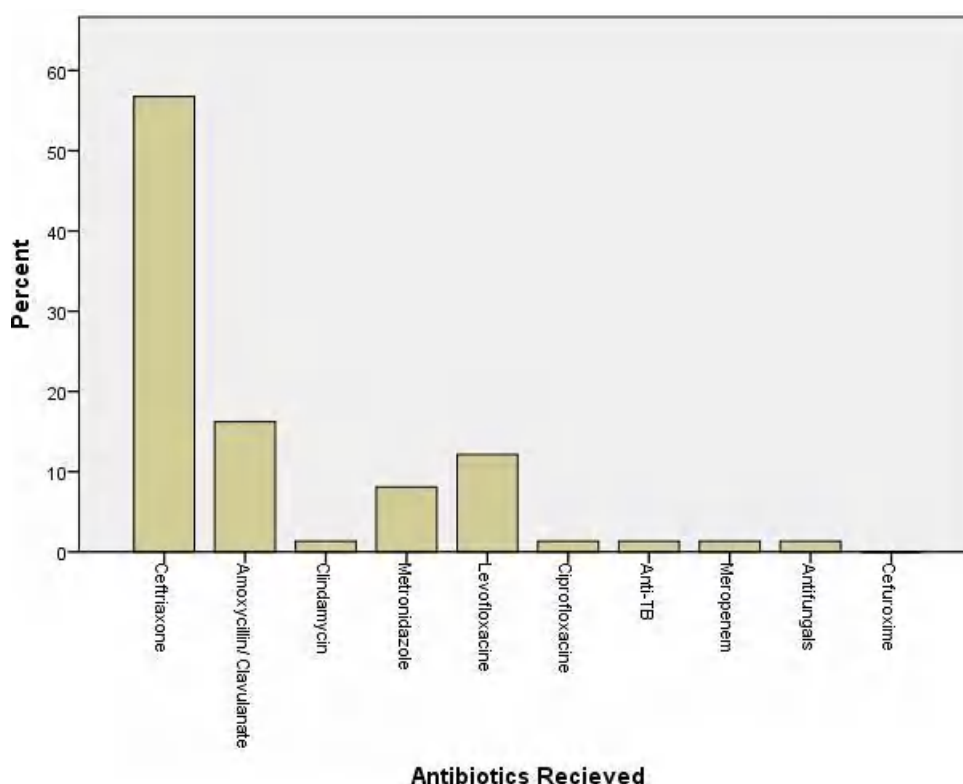


Fig. 2: The pattern of antibiotic prescriptions among patients admitted with sepsis in LUTH, Lagos.

Outcome of the patients.

Twenty-eight (35%) of the 80 patients admitted with sepsis died. On bivariate analysis, none of the demographic, clinical or laboratory variables was predictive of outcome/mortality.

Discussion

This observational study of 119 patients admitted for sepsis showed that only sixty-seven percent (80 /119) of the patients admitted to the emergency department of the Lagos University Teaching Hospital with a clinical suspicion of sepsis met SIRS or qSOFA clinical criteria for sepsis. Additionally, about 10 percent of patients had septic shock. The respiratory system was the most common site of infection, and ceftriaxone was the most prescribed antibiotic. The mortality rate among the cohort was 35%.

The relatively young mean age of the patients admitted with sepsis in this cohort reflects the prevalence of sepsis in our setting, making it expedient to identify the drivers for sepsis within the community, including malnutrition, undiagnosed human immunodeficiency virus (HIV) infection, as well as from complications of tuberculosis.

Malnutrition has been increasingly observed among adults in Nigeria, which may be a reflection of the current high unemployment rate in Nigeria, a fact that is evident even among the patients recruited for this study¹⁰.

About 10% of patients in this cohort presented with clinical features of shock. If serum lactate was measured at presentation, this value would likely be higher. Serum lactate measurements during the initial resuscitation of patients with sepsis and septic shock have been demonstrated to improve the prognosis of patients with sepsis¹¹. Patients in the early stages of septic shock have been shown to present with elevated serum lactate but normal blood pressure^{11,12}. This is especially true for patients who may have hypertensive prior to the development of sepsis. In addition, 33.6% of sepsis patients in our cohort presented with a diminished level of consciousness. This indicates the severity of organ dysfunction at presentation, but also further highlights the need for physicians to assess patients adequately when they present to hospital, so that even impairment in level of consciousness can be detected early.

The respiratory system represented the highest proportion of identified infection sites across all age groups.

This may be an indication of the environmental pollution problem in Lagos State. Respiratory symptoms and lung function abnormalities are widespread among otherwise healthy persons aged 16-35 years, with 52.6 percent having at least one symptom, and obstructive and restrictive respiratory abnormalities reported in 8.4 percent and 25.4 percent of respondents, respectively¹³. This underscores the need to increase vaccination efforts against vaccine - preventable diseases such as pneumococcal infections and haemophilus influenzae type b.

The availability of laboratory support in the management of sepsis is essential for the successful management of sepsis patients. Guidelines for sepsis recommend that samples for serum lactate and blood cultures be collected and sent to laboratories within one hour of sepsis diagnosis^{1,11}. In addition, blood samples for procalcitonin, complete blood counts, and serum biochemistry are essential not only for guiding antibiotic therapy, but also for the prompt detection of organ dysfunction, which is fundamental to the concept of sepsis management¹¹. The sequential organ failure assessment (SOFA) score is derived from laboratory parameters such as platelets, bilirubin, and creatinine¹. In most Nigerian emergency settings, laboratory support is lacking or delayed, which is likely to worsen the prognosis for patients presenting with sepsis/septic shock¹⁴.

There was a significant delay before the first dose of prescribed antibiotics could be administered. This is a regular occurrence for patients at the majority of public hospitals in Nigeria, as the payment process is cumbersome, and delivery of purchased antibiotics organized solely by patient families. In addition, hospital pharmacies frequently run out of the prescription medications, requiring family members to obtain them from pharmacies outside the hospital¹⁵. This scenario not only delays patient care, but also increases the likelihood that patients would receive substandard antibiotics. It has been shown that delaying the initiation of antibiotics worsens the prognosis of sepsis patients who are hospitalized¹⁶. The dearth of preferred antibiotics may also influence physician prescribing patterns, as evidenced by the frequent usage of third-generation cephalosporins in this cohort. Furthermore, the majority of hospitals in Nigeria lack institutional guidelines for prescribing antibiotics empirically, allowing for individual preferences of the individual physician¹⁷. The risk that such activity poses to patient outcomes and the development of antibiotic resistance is well-documented.

The high mortality rate among sepsis patients seen in this study is comparable to that observed in the majority of low-income countries². There was no statistically significant correlation between mortality and patient characteristics in this study. This was partially explained by the lack of lactate available to physicians to guide first resuscitative therapy for the patients.

This study was an observational cohort study, which essentially documented the state of the current practice in our hospital, and as such further laboratory parameters (serum lactate, serum procalcitonin, and blood culture results) of the admitted patients were not tested as part of the study. Additionally, the study only recruited patients who were admitted via the medical accident and emergency room, thereby excluding surgical, obstetrics and gynecology patients.

Conclusion

In this study, the patients were observed to be relatively young. Additionally, septic shock was detected in about a tenth of admitted patients, based on blood pressure readings. There was significant delay in instituting antibiotic therapy at presentation. There was however no significant association between the admitting characteristics and mortality in this study. The availability of laboratory support in the management of sepsis is essential for the successful management of sepsis patients. Further laboratory parameters for the diagnosis of sepsis such as serum lactate should be made more readily available at the Accident and Emergency.

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