Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 6, 2024

Type of Article: Original Research Article

CLINICAL PROFILE AND OUTCOMES OF SEPSIS IN GERIATRIC PATIENTS IN A TERTIARY CARE HOSPITAL: OBSERVATIONAL STUDY

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ABSTRACT

Sepsis is defined as a life-threatening organ dysfunction due to a dysregulated inflammatory host response to infection. Among the vulnerable population, Geriatric patients stand out as a high-risk group due to age-related physiological changes, immunosenescence, and a higher prevalence of comorbidities displaying higher mortality rates. We wanted to explore the various etiologies, clinical profiles, and outcome of sepsis in geriatric patients in a tertiary hospital. We conducted a cross-sectional observational study, where geriatric patients aged 65 years and above, admitted in the Departments of General Medicine (Wards and ICUs) in King George hospital, Visakhapatnam, diagnosed with sepsis were followed up from admission until their discharge or until the end of their hospital stay. The clinical profile of the patients and their outcome was assessed. The study population consisted predominant male (69.3%)and belonged to the age group 65-70years (73.9%). The study revealed an in-hospital mortality rate of 31.8% among geriatric patients admitted with sepsis, with diabetes mellitus being the most prevalent comorbid condition. Common presenting symptoms included fever (17.6%), shortness of breath (17%), and limb swelling (10.8%), with skin and soft tissue infections being the most frequent infection site (37%), followed by urosepsis (35.2%) and respiratory tract infections (14.8%). Klebsiella was the most common organism isolated from cultures, followed by Staphylococcus aureus. Patients who succumbed to sepsis had a higher mean age, shorter duration from symptom onset to hospitalization, higher respiratory rates, elevated white blood cell counts, lower Glasgow Coma Scale (GCS) scores, and higher Sequential Organ Failure Assessment (SOFA) score.

Keywords : Geriatrics, Sepsis , SOFA score

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 6, 2024

INTRODUCTION

Sepsis is defined as a life-threatening organ dysfunction due to a dysregulated inflammatory host response to infection.[1]. It is a potentially life-threatening condition triggered by the body's response to infection, leading to inflammation, organ failure, and tissue damage. Despite significant advances in medical science, sepsis continues to pose a substantial burden on healthcare systems, particularly in vulnerable patient populations. Among these, geriatric patients stand out as a high-risk group due to age-related physiological changes, immunosenescence, and a higher prevalence of comorbidities [2]. Older individuals are particularly vulnerable to developing sepsis due to pre-existing comorbidities, compromised immune function, sarcopenia, diminished physiological reserves associated with aging, malnutrition, and polypharmacy.[3] The consequences of sepsis in this population are often devastating, with increased mortality rates and prolonged hospital stays[4]. Initially defined by the International Consensus Panel in 1992, sepsis classifications have evolved. With a collaborative effort by the Society of Critical Care Medicine and the European Society of Intensive Care Medicine led to a reevaluation of established definitions of sepsis and septic shock, resulting in the formulation of the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) introducing the Sequential Organ Failure Assessment (SOFA) score as a diagnostic tool.[5] Elderly patients face increased vulnerability due to comorbidities and atypical symptoms, complicating diagnosis. Risk factors include skin breakdown, cognitive impairment, and immunosenescence. Diagnostic challenges in older adults include nonspecific symptoms and pharmacokinetic changes affecting treatment. Respiratory and genitourinary infections are common sources of sepsis, often involving multidrug-resistant organisms. Early sepsis management bundles improve survival rates, focusing on resuscitation, antibiotic administration, and supportive care. For the elderly, considerations include optimizing cardiac function, source control, and minimizing antimicrobial-related adverse effects. Supportive care interventions address challenges like ICU delirium and glucose management.[6] Prompt identification and management tailored to the unique needs of elderly patients with sepsis needs to be emphasized.

The increasing aging population worldwide highlights the urgent need to investigate the clinical profile and outcomes of sepsis in geriatric patients to enhance our understanding of this complex condition. However, while extensive research has been conducted on sepsis in various patient groups, there remains a paucity of data specifically addressing the unique characteristics of geriatric sepsis in tertiary care settings.[7]

Our study aims to fill this knowledge gap by conducting a comprehensive investigation into the clinical profile and outcomes of sepsis in geriatric patients admitted to a tertiary care hospital. By focusing on this specific population, the study seeks to shed light on the distinct clinical profile and prognostic factors that contribute to sepsis in older adults. The findings of this research have the potential to yield crucial insights into the unique challenges faced by geriatric patients with sepsis, enabling healthcare providers to develop targeted interventions and optimize clinical management strategies. Ultimately, the study's outcomes may contribute to improved patient care, enhanced outcomes, and reduced mortality rates in this vulnerable population, thereby advancing the overall quality of healthcare provided in tertiary care settings. The Primary objective of the study was to i) Determine the Clinical Profile of Sepsis in Geriatric Patients (age 65 years and above) admitted to a tertiary care hospital and ii) As the outcomes associated with sepsis in geriatric patients.

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MATERIALS AND METHODS

It was a cross-sectional observational study, where geriatric patients diagnosed with sepsis were followed up from admission until their discharge or until the end of their hospital stay. The target population for this research consisted of geriatric patients aged 65 years and above, admitted in the Department of General Medicine (Wards and ICUs) in King George hospital, Visakhapatnam with sepsis, during the study period. Simple random sampling was used. As per previous studies, geriatric patients made up a larger population (58-65%) of patients with sepsis.[2] Based on the proportion of geriatric patients with sepsis in previous studies (65%) and with 95% confidence interval and 10% (of the prevalence rate) allowable error, the minimum sample size was obtained using the formula given below, Where 'Z' was standard normal variate, 'd' was the allowable error or precision, and 'p' was the estimated proportion in the population depending on the previous studies, was calculated to be 88.

The study was initiated after obtaining approval from the Institutional Ethics Committee(IEC). Patients with age 65 years and above with a confirmed diagnosis of sepsis based on established criteria (e.g., Sepsis-3 criteria)[5] with the ability to provide informed consent or consent obtained from a legally authorized representative were included in the study. Patients with incomplete medical records or missing data, with a history of advanced directives to withhold life-sustaining treatments, who were unable to provide informed consent or complete study assessments due to any cognitive impairments or dementia were excluded. Data from patients who left the hospital against medical advice/absconded were excluded.

DATA COLLECTION AND ANALYSIS

After informed consent, geriatric patients admitted in medical wards and ICUs with sepsis fulfilling the inclusion criteria were interviewed personally by the principal investigator, with the case study proforma. The informant/attendant/guardian also obtained the historical details. Clinical examination was carried out and recorded. Requisite data regarding diagnosis and laboratory investigations were entered into the proforma from the case sheet. The patients underwent treatment as per standard hospital protocol. Patients were followed up for the outcome at the end of the hospital stay. The proforma consisted of 7 sections with several questions appearing sequentially in order of (1) Demographic data (2) Medical History (3) Clinical examination (4) Investigations (5) Final diagnosis of the patient (6) Treatment advised (7) Outcome. Standardized scales, such as the Sequential Organ Failure Assessment (SOFA) score [5], were utilized to evaluate disease severity and comorbidities. The collected data were organized into Microsoft Excel sheet and Statistical Package for Social Sciences (SPSS) software version – 26 was utilized for statistical analyses. Descriptive analyses were performed including frequencies (N), percentages (%), Mean, Standard deviation (SD). Suitable statistical tests, such as the independent t test and relevant statistical analysis was done to find the association between the variables. The level of significance was adopted at p-value < 0.05 for all statistical analyses.

RESULTS

Demographic variables (Table 1) of the study population revealed 69.3% to be male patients (n=61) and 30.7% (n=27) as female patients. The mean age of the study population was 68.33 ± 3.918 years with a minimum age of 65years and the oldest patient being 83 years. All the patients had a non-vegetarian diet. Almost half of the study participants were habituated to alcohol (48.9%)and smoking (53.4%). The outcome distribution among the cases indicated that 28 patients succumbed to death while 60 patients were discharged from the hospital reflecting a mortality rate of 31.8%.

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Table 1. Demographic variables of the study population.

Variable	Frequency	Percentage
Gender		
Male	61	69.3%
Female	27	30.7%
Age group		
65-70years	65	73.9%
71-75 years	17	19.3%
76-80 years	5	5.7%
>80	1	1.1%
Dietary habit		
Non vegetarian	88	100%
Habits		
Smoking	47	53.4%
Alcoholism	43	48.9%
Comorbidities		
Diabetes mellitus	40	45.5%
Hypertension	36	40.9%
Heart disease	5	5.7%
Outcome		
Survived	60	68.2%
Expired	28	31.8%

The clinical characteristics of the participants are summarized in table 2. In our study, the common presenting symptoms among the geriatric patients with sepsis was fever (17.6%, n=31), followed by shortness of breath (17%,n=30) and swelling of the limb (10.8%, n=19). Urinary symptoms (such as burning micturition, increased frequency of urine) and cough accounted for 9.1%(n=16) and 9.7%(n=17), respectively, of the presenting symptoms among the patients in the study population. Yellowish discoloration of the eyes and convulsions were the least common presenting symptoms (1.1%, n=2) in the present study. About 45.5% (n= 40) patients had a previous history of Diabetes Mellitus whereas 40.9% (n=36) of the patients had past history of hypertension. Only 5.7% (n=5) of the patients had a previous history of heart disease. Out of the 88 patients, physical examination 25 (28.4%) presented with pallor, 15 (17.04%) with edema, and 18 (20.45%) were febrile at the time of presentation. Additionally, 4 (4.54%) displayed icterus, while 2 (2.27%) presented with lymphadenopathy. A subset of 4 (4.54%) patients was found to be hypotensive at the time of their initial examination.

Table 2 Clinical characteristics of the study population

Presenting Clinical feature	Frequency	Percentage
Fever	31	17.6%
Shortness of breathlessness	30	17.0%
Swelling of limb	19	10.8%
Cough	17	9.7%
Urinary symptoms	16	9.1%
Vomiting	12	6.8%
Altered sensorium	11	6.3%
Abdominal pain	9	5.1%
Necrotic patch over limb	8	4.5%
Foot injury	7	4.0%

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Loose stools	4	2.3%
Chest pain	3	1.7%
Yellowish discoloration of eyes	2	1.1%
Convulsions	2	1.1%
GCS score ≤8	7	8.0%
SOFA score		
≤5	34	38.6
6-10	50	56.8
≥11	4	4.5

SOFA – sequential organ failure assessment. GCS – Glasgow coma scale

The descriptive statistics of the clinical and laboratory parameters of the study population are noted in Table 3. Of the 88 cases under examination, 82 (93.18%) showed an elevation in leucocyte counts, and 51 (57.95%) manifested a decline in hemoglobin percentage. Notably, 81 cases (92.04%) demonstrated elevated serum creatinine levels, while 69 cases (78.40%) exhibited an increase in blood urea levels. Moreover, 20 cases (22.72%) displayed hyponatremia, and 4 cases (4.54%) had hypernatremia. Within the cohort of 88 cases, 10 (11.36%) had hypokalemia, and 11 (12.5%) exhibited hyperkalemia.

The GCS score of the study population ranged from 4 to 15 with a mean of 12 (12.3±2.7). The mean arterial pressure in the present population was 89.48 (±17.97) mm of Hg. The mean White blood cell (WBC) count was 19,201.7 ± 9152.8 cells/cu mm and the platelet count was 2.1917 (±1.34)lakh/cu mm. About 50% of the patients had thrombocytopenia (platelet count <1.5lakhs/cumm) in the study population. The mean values of the renal function tests were serum creatinine 3.19±2.53 mg/dl, blood urea 94.192±60 mg/dl. Mean serum sodium level in the study population was 138.1 mg/dl(±9.7). The mean serum bilirubin level was1.59 (±1.7)mg/dl among the study population. Among the study population, the SOFA score calculated revealed a mean score of 6.22(±1.9). The distribution of scores in the cases showed that 38.63% had scores ranging from 2 to 5, 56.81% fell within the 6 to 10 range, and 4.54% scored 11 or higher.(Table 2) This breakdown offers insights into the severity levels observed in the studied cases, with the majority falling within the moderate to higher score categories.

Table 3. The descriptive statistics of the Clinical and laboratory parameters of the study population

Quantitative Variable (n=88)	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Clinical				
Age	65	83	68.33	3.918
Onset of symptoms to hospital admission	1	90	5.78	9.832
Mean arterial pressure	50	133	89.48	17.974
Pulse rate	51	110	84.24	10.799
Respiratory rate	13	24	16.91	1.945
GCS	4	15	12.35	2.721
Laboratory parameters				
Hemoglobin(gm/dl)	3.7	13.6	9.384	2.0350
WBC Count (/cu.mm)	7000	50120	19201.70	9152.893
Platelet count(lakh/cumm)	.50	5.54	2.1917	1.33811
Percentage of lymphocytes	1	48	11.47	7.848
Serum Creatinine(mg/dl)	1.2	12.2	3.194	2.5399
Blood urea (mg/dl)	13.0	312.0	94.192	60.0849

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Serum Na+ (mEq/L)	116.0	182.0	138.168	9.7771
Serum K+ (mEq/L)	2.30	6.38	4.0967	.81934
Serum Cl- (mEq/L)	74.0	115.0	100.459	8.1215
Serum Bilirubin (mg/dl)	.2	10.8	1.590	1.7736
AST (IU/L)	9.0	902.0	75.848	141.3804
ALT(IU/L)	13.0	424.0	47.666	70.2699
RBS (mg/dl)	89	399	157.87	52.166
pH	7.174	7.526	7.35241	.058834
PaO2	55.0	196.0	84.408	28.4814
PaCO2	18.10	44.00	34.4895	5.38240
SOFA Score	3	11	6.22	1.997

AST- Aspartate transaminase , ALT -Alanine transaminase, assessment, GCS – Glasgow coma scale, PaO2 – partial pressure of alveolar oxygen, PaCO2- partial pressure of alveolar CO2, RBS – Random blood sugar, SOFA – sequential organ failure, WBC- White blood cells.

The final diagnosis of the study population leading to sepsis are given in Table 4. The most frequent diagnosis leading to sepsis in geriatric patients include Urosepsis (35.2%) followed by cellulitis (19.3%).

Table 4 :Final diagnosis leading to sepsis in the study population.

Diagnosis	**Frequency**	**Percent**
Urosepsis	31	35.2
Cellulitis	17	19.3
Community acquired pneumonia	13	14.8
Necrotizing fasciitis	10	11.4
Diabetic foot	6	6.8
Aspiration pneumonia	5	5.7
Liver abscess	3	3.4
Pancreatitis	2	2.3
Meningitis	1	1.1

The site of the sepsis was predominantly the skin and soft tissue (37.5%, n=33), followed by the urinary tract (35.2%, n= 31).(Graph 1). About 45 (51.1%) blood samples sent for culture and sensitivity of the septic patients reported positive the organism and rest of them were sterile. Out of the 45 culture positive samples, about 64.4% (n=29) were positive for gram negative organisms and the rest 35.6% (n=16)showed gram positive organisms. Klebsiella species were the most prevalent, accounting for 20.4%(n=18) of the cases in the present study followed by Staphylococcus aureus at 14.8%, (n=13). (Graph 2)

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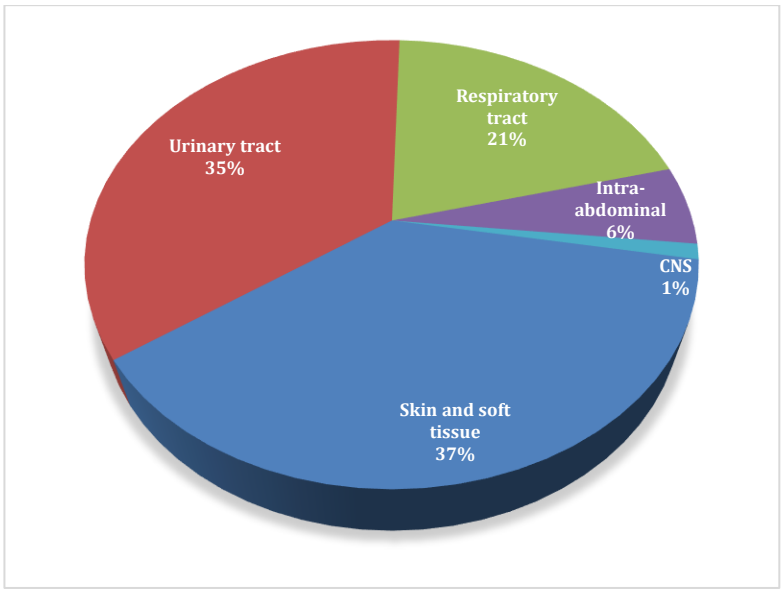
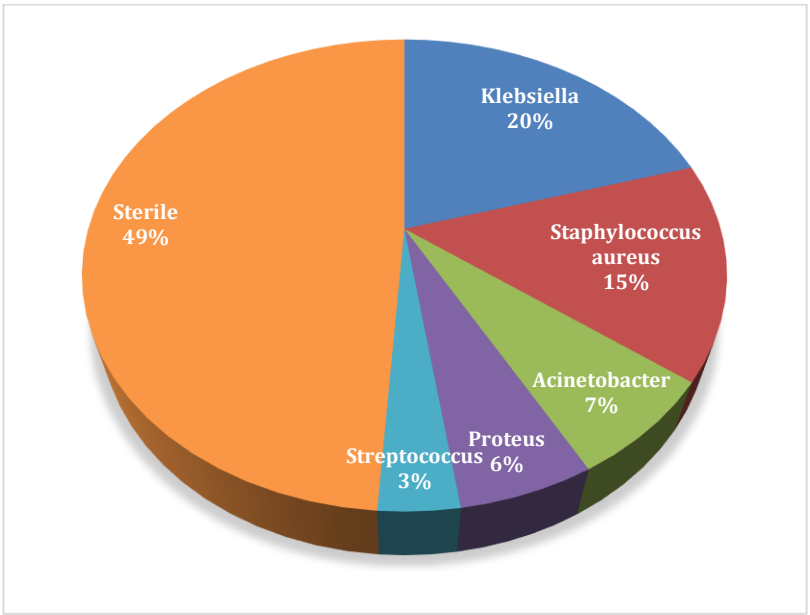


Graph 1: Frequency of site of infection leading to sepsis among the patients in the present study.



Graph 2: Frequency of organisms isolated from the blood culture samples of the patients in the present study.

Table 5 . Comparison of means of quantitative variables among the surviving and expired geriatric patients in the study population.

Variable	Survived (n=60)		Expired (n=28)		t	p
	Mean	SD	Mean	SD		
Age	67.43	2.667	70.25	5.31	-3.317	**0.001***
Onset of symptoms to	7.03	11.483	3.11	3.531	1.766	**0.040***

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hospital admission						
Pulse rate	83.75	10.129	85.29	12.244	-0.619	0.269
Respiratory rate	16.42	1.369	17.96	2.531	-3.724	**0.000***
Hb	9.477	1.7706	9.186	2.5365	-.622	0.268
Percentage of lymphocytes	11.5	8.526	11.39	6.291	0.059	0.476
Total leukocyte count	17794.83	6540.651	22216.43	12752.923	-2.154	**0.017***
Serum Creatinine	3.082	2.3827	3.436	2.8796	-0.607	0.273
Blood urea	89.732	57.4489	103.75	65.4366	-1.020	0.155
Serum bilirubin	1.547	1.83	1.682	1.6749	-0.332	0.370
AST	46.76	33.6037	138.179	236.7073	-2.947	**0.002***
ALT	33.773	20.524	77.436	116.8008	-2.821	**0.003***
RBS	155.71	55.799	162.5	43.984	-0.546	0.293
GCS	13.87	1.033	9.11	2.347	13.257	**0.000***
MAP	90.72	17.422	86.82	19.158	0.946	0.173
SOFA Score	5.37	1.507	8.04	1.688	-7.447	**0.000***

*p<0.05 -Statistically significant AST- Aspartate transaminase , ALT -Alanine transaminase, assessment, GCS – Glasgow coma scale, MAP- mean arterial pressure PaO2 – partial pressure of alveolar oxygen, PaCO2- partial pressure of alveolar CO2, RBS – Random blood sugar, SOFA – sequential organ failure, WBC- White blood cells.

Table 5 presents the results of an independent t-test comparing the means of quantitative variables between patients who survived and those who did not. The analysis showed a statistically significant difference between the mean age (p=0.001) and mean duration from symptom onset to hospitalization(p=0.040) among patients who expired and those who survived. A higher mean age and a shorter mean duration of onset of symptoms to hospitalization were associated with mortality. Additionally, patients who succumbed to sepsis had a higher mean respiratory rate at admission compared to those who were discharged and the difference between the survivor and expired group was Statistically significant (p=0.000). Statistically significant differences were also observed in mean White blood cell counts and liver function tests such as Alanine transaminase (AST) and Aspartate transaminase (ALT). Higher counts (p=0.017*) as well as elevated mean ALT (p=0.003) and AST levels (p=0.002) were found in patients who expired. Furthermore, those who expired had a lower mean GCS score and a higher mean SOFA score, both of which were statistically significant (p=0.000)

DISCUSSION

The present study was undertaken at Andhra Medical College, King George Hospital, Visakhapatnam. The study included a total of 88 patients belonging to the geriatric age group (> 65 years of age) with features of sepsis. In our study population, most patients (73.9%) were in the age group 65-70 years with only one patient with age more than 80 years (1.1%). In the study done by Anand AK et al, the maximum number of patients (68%) were in the age group of 60-69 years, whereas 8% of them were in the age group of >80 years.[8] In a separate investigation conducted by B.M. Greenberg et al. in 2005, a higher prevalence of bacteremia

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was observed in the 65-74 age group, with 128 cases, compared to the ≥75 age group, which had 110 cases.[9] The smaller representation of individuals aged ≥80 years in our present study may reflect the lower life expectancy of the developing world. The mean age of the patient in the present study was 68.3 ± 3.9 years, similar to the study done by Anand AK et al[8] (67.52 ± 6.65 years). Out of the 88 cases studied, 69.3% were men while rest 30.7% were women. The gender distribution of the study population showed a male to female ratio of 2.25. The lower proportion of female patients despite a higher life expectancy may reflect the disparities in health seeking behavior and socioeconomic factors. Among all the patients in the present study about 53.40% of the patients abused tobacco while 48.9% were habituated to alcohol.

The most prevalent comorbid condition in the current study was Diabetes mellitus present in 45.5% of the study population, followed by Hypertension (40.9%)and heart disease (5.7%). In a similar study done by Anand AK et al, Diabetes was noted to be the most prevalent comorbid condition (28%), followed by BPH (17.75%) and hypertension (16%)[8]. Like our present study, B.M. Greenberg et al. also observed that diabetes was prevalent in 31% of elderly patients with bacteremia. However, cardiovascular diseases were found in 37% of the patients, indicating a notable association with these conditions[9]. Marshall et al similarly observed that diabetes was detected in 34.5% of hospitalizations associated with sepsis [10]. Many prevalent comorbid conditions in older adults elevate the risk of infection and subsequent sepsis, including congestive heart failure, chronic obstructive pulmonary disease (COPD), malignancies, diabetes mellitus, and chronic liver failure. [11] Long standing diabetes mellitus can result in delayed phagocytosis with decreased clearance of yeast and bacteria by neutrophils, thus enhancing risk for infections and sepsis. [12]

In the present study, the geriatric patients, who were diagnosed to have sepsis, presented to the hospital with varied symptomatology. The common presenting symptoms among the study population was fever (17.6%), followed by shortness of breath (17%) and swelling of the limb (10.8%). Cough was the chief complaint in about 9.7% of the patients while urinary symptoms such as burning micturition, increased frequency of urine, accounted for 9.1% of the presenting symptoms among the study population. Yellowish discoloration of the eyes and convulsions were the least common presenting symptoms (1.1%) in the present study. In another study on sepsis in older adults, about 50.2% of the patients had documented fever and about 58.2% presented with delirium.[13] In the geriatric population, potentially life-threatening infections may present through various behavioral changes, such as sudden confusion, perceptual disorders, psychomotor agitation, or lethargy. Physical symptoms like loss of appetite, dehydration, dizziness, falls, and incontinence can also be the sole indicators. Fever, a common sign of infection, is notably absent in 30–50% of older adults, who may show a reduced febrile response to infections such as bacteremia, pneumonia, endocarditis, and meningitis. The conventional definition of fever may not apply to older adults due to their lower baseline body temperature, which is influenced by diminished cytokine production, reduced hypothalamic receptor sensitivity, and impaired adaptation of peripheral thermoregulation.[3]

The mean GCS score of patients who succumbed to death in this study was significantly lower than that of survivors. Geriatric patients with fever and sepsis are prone to developing delirium, which often indicates a poor prognosis, as demonstrated in the current study. In the present study, a higher total leukocyte count at admission was associated with mortality. Similarly, among the vital parameters, respiratory rate of the patient at admission was higher among those who succumbed to death compared to those who survived in the present study. An increased respiratory rate is often one of the earliest clinical signs of sepsis. In older adults, a respiratory rate greater than 20 breaths per minute is frequently used as a criterion for identifying systemic inflammatory response syndrome (SIRS), which can precede sepsis.[1] The Sequential (Sepsis-related) Organ Failure Assessment (SOFA) and the quick SOFA (qSOFA)

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are newly developed tools used to predict mortality in patients suspected of having sepsis. Respiratory rate >22/min is one of the components of the qSOFA along with altered mentation and reduced Systolic blood pressure <100 mm Hg. Both the SOFA and qSOFA help in identifying patients likely to have a prolonged ICU stay or die in the hospital.[11]

The analysis of infections in the present study population of 88 cases revealed a diverse array of sites affected. The most common site of infection was skin and soft tissue with 37% of the cases followed by urosepsis (35.2%) and respiratory tract (14.8%). Like the present study, various studies on sepsis in geriatric patients showed that Lower respiratory tract and urinary tract infections (UTIs) are predominant both in community and health care associated infections [11, 16]. The most common site of infection was the urinary tract (30.5%) followed by the lungs (21.25%) and skin infection (14%) in a study done on 400 geriatric patients with sepsis.[8] In another study by B.M. Greenberg et al., the authors have noted that the most prevalent source of bacteremia was the urinary tract, (26%) followed by the lungs, which accounted for 16.38% of cases.[9] In yet another study done by Samuel SV et al in 2023, Pneumonia was the leading cause of sepsis (47.2%), followed by pyelonephritis (21.8%), findings consistent with present study that suggest older inpatients with sepsis were more likely to have Gram-negative infections, pneumonia, and multiple comorbidities.[13] Leibovici et al. (1993) similarly discovered that the urinary tract was the predominant source of bacteremia in the elderly.[15]

In the current study blood cultures were positive in almost half of the patients (48.9%). Similar findings of a 40.3% positivity rate of blood cultures in patients suspected of having septicemia were noted by Christopher et al.[16] In a study conducted by Anand AK et al., the blood culture positivity rate was 28.75%. The examination of the cases of isolated organisms uncovered a variety of bacterial species.[8] The leading pathogen was Klebsiella species, making up 20.4% of the cases, followed by Staphylococcus aureus at 14.8%. Acinetobacter species were present in 6.8% of cases, while Proteus species and Streptococcus species constituted 5.7% and 3.4%, respectively. This distribution emphasizes the diverse microbial composition contributing to the studied infections, with Klebsiella species taking precedence as the primary pathogen. In their study, Anand AK et al showed that Gram-negative organisms (51.7%) were more commonly grown than gram-positive ones (48.30%).[8] Older adults are more likely than younger adults to develop infections from gram-negative organisms. Martin and colleagues[17] reported that adults aged 65 and older are 1.31 times more likely to have a gram-negative infection compared with adults under 65. Although E. coli is the predominant cause of UTI in both younger and older adults, older adults are at increased risk for infections from other gram-negative bacteria, such as Proteus spp, Klebsiella spp, and Pseudomonas spp. Common gram-positive organisms in older adults with bloodstream infections include Staphylococcus aureus, Enterococci spp, and Streptococci spp. [11] In their study, B.M. Greenberg et al. reported that gram positive organisms were present in 58% of the blood isolates, while gram-negative organisms were present in 36% of the isolates.[9]

A statistically significant association was found between elevated mean SOFA scores and mortality due to sepsis in the current study (p value 0.000). Out of the 88 cases, 54 of them had a SOFA score of more than 6. Four patients with SOFA scores more than equal to 11, succumbed to death and 21 out of 50 cases who had their SOFA score between 6 to 10 died. The mean SOFA score at the admission in the current study was 6.22(±1.997) which predicted a mortality of 21.5%. (SOFA score 6-7).[18] The in-hospital mortality rate in the present study is slightly higher 31.8%. The difference could be due to the probable increase in the SOFA score predisposing the patient to higher mortality. Serial SOFA score measurement could have helped predict the mortality more accurately in the current study, however it was not

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 6, 2024

undertaken. In a study conducted by Sipahioglu H et al., the SOFA score was the only independent risk factor indicating mortality in geriatric patients with sepsis.[19]

Among the 88 cases in the study, 60 of them were discharged after the treatment and were advised for follow-up and 28 of them died due to the complications of sepsis indicating an in-hospital mortality rate of 31.8%. In their study , Anand AK et al found a mortality rate of 19% among the study population, which had statistically significant correlation with the stage of the sepsis.[8] In the study done by Sameul et al, a cohort of 201 older adults were studied with , majority being males. Among the study population about one third of patients were admitted to the ICU, and in hospital mortality rate was 40.2%. [13] According to the article on sepsis in elderly by Rowe TA, In patients aged ≥65, in-hospital mortality ranged from 30 to 60%, escalating to 40–80% in those aged 80 and above.[11] A systematic review of very old septic patients in the ICU reported mortality rates of 43% in the ICU, 47% in the hospital, and 68% one year after ICU admission.[20] The mortality rate among older adults with sepsis rises with age,[21] and was postulated likely due to "immunosenescence." and "inflammaging."[22] The Predictors of mortality included advanced age, female gender, underlying renal disease, general hospital admission, high quick-SOFA score, mechanical ventilation, and vasoactive support use.[13] A statistically significant higher mean age and greater SOFA score were found in the those who expired in the present study which are consistent with the previous literature. Diagnosing sepsis in this age group necessitates a lower threshold and heightened suspicion. Timely, aggressive, and well-balanced management could potentially enhance outcomes in these patients. A review on multidrug-resistant (MDR) sepsis among the elderly revealed that geriatric patients experience a higher incidence (57.5%), influenced by comorbidities, immunosuppression, age-related immune changes, and limited ICU resources. [23]

Given the high mortality rate of 31.8%, early recognition of sepsis in the geriatric population is crucial, emphasizing the importance of timely diagnosis and intervention. Healthcare professionals should be trained to swiftly identify the signs and symptoms of sepsis to improve patient outcomes. Diabetes is a significant comorbidity, suggesting that individuals with diabetes are more susceptible to severe sepsis outcomes, making careful diabetes management essential. Public health initiatives, including awareness campaigns, vaccination programs, and lifestyle interventions, are vital in preventing and managing sepsis and its complications in individuals with diabetes.

LIMITATIONS

A small sample size of the present study can restrict the applicability of the results, potentially compromising their representativeness and statistical power. As this study is hospital-based, it only includes ill patients, meaning its findings may not accurately reflect the prevalence in the wider population. Moreover, the findings may be biased toward more severe cases, complicating their extrapolation to the general community. Accurate identification of the causative agent relies on cultures taken before antibiotic administration, underscoring the importance of recognizing these limitations for precise interpretation and guiding future research endeavors.

CONCLUSION

The study revealed an in-hospital mortality rate of 31.8% among geriatric patients admitted with sepsis, with diabetes mellitus being the most prevalent comorbid condition. Common presenting symptoms included fever (17.6%), shortness of breath (17%), and limb swelling (10.8%), with skin and soft tissue infections being the most frequent infection site (37%), followed by urosepsis (35.2%) and respiratory tract infections (14.8%). Klebsiella was the most common organism isolated from cultures, followed by Staphylococcus aureus. Patients who

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 6, 2024

succumbed to sepsis had a higher mean age, shorter duration from symptom onset to hospitalization, higher respiratory rates, elevated white blood cell counts, lower GCS scores, and higher SOFA scores.

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