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**ORIGINAL ARTICLE**

# Characteristics and Outcomes of Community Acquired Versus Hospital Acquired Sepsis at A Tertiary Care Hospital, Karachi

RABEEA SHAH[1], NASEEM SALAHUDDIN[2], SHAMEEM BEHRAM KHAN[3], RABIAH MASROOR[4], KIRAN ABBAS[5]
[1]*Fellow Infectious Diseases, Department of Infectious diseases, The Indus Hospital and Health Network*
[2]*Head of Department, Consultant, Department of Infectious Diseases, The Indus Hospital and Health Network*
[3]*Consultant, Critical Care Unit, Indus Hospital and Health Network*
[4]*SMO, Nephrology, The Indus Hospital and Health Network*
[5]*Masters Candidate, Health Policy and Management, Aga Khan University, Karachi*
*Corresponding author: Kiran Abbas, Email: kiran.abbas@scholar.aku.edu, Cell: 03350345963*

## ABSTRACT

**Objective:** The study compared the demographics, clinical characteristics and site of infection leading to community acquired and hospital acquired sepsis. Secondly, the study further compared the distribution of the isolated organisms and complications caused by community and hospital acquired sepsis.

**Methods:** A prospective cohort study was undertaken at the intensive care unit, high dependency unit, and critical care unit at the Indus Hospital, Karachi, Pakistan between 14-April-2021 to 15th-April-2022. All the individuals diagnosed with sepsis, admitted through the Emergency Department or transferred from a ward were included in the study. Age < 15 years or who were shifted from another hospital were removed from the study. The data on demographics, vital signs, SOFA score, site of infection, laboratory parameters, radiological investigations, culture results, and complications, if any, were filled on a pre-designed Performa.

**Results:** Age of the participants was 42.1 ± 17.4 years with a predominance towards female gender. Urinary tract was the most common site from which the organisms were isolated with a frequency of 35 (28.9%). Table 3 revealed that gender was significantly associated with gender (p=0.008). It was found that the majority of the community acquired sepsis were reported in males while the majority of the hospital acquired sepsis was reported in females. Furthermore, marital status (p=0.019) and site of infection were significantly correlated with the hospital acquired sepsis. It was further found that mean creatinine was significantly lower in community acquired sepsis than those with hospital acquired sepsis [(7.83 ± 4.85) vs (15.4 ± 10.4); p<0.001].

**Conclusion:** The study revealed both hospital acquired and community acquired sepsis are life threatening conditions that may add significant burden on the healthcare facility while at the same time placing significant financial burden upon the patients.

**Keywords:** Sepsis; Community-acquired infections; Nosocomial; Mortality

## INTRODUCTION

Sepsis, formerly known as septicemia, is defined as a potentially fatal condition caused by an extreme reaction of the immune system to an infection.[1] Sepsis being a syndromic response to infection is a leading cause of death around the world and is a significant public health issue. It is characterized as a serious issue in public health that results from a dysregulated host response to infection and organ failure. Pathogenesis of sepsis depends on multiple factors. Just like any other infection, sepsis initiates a pro-inflammatory response, which contributes by enhancing and stimulating the inflammatory response. Whereas the anti-inflammatory response dampens the inflammatory response, ultimately causing the control of infection.[1-2]

The host's body condition, including co-morbidities and immunosuppression, and the pathogen's growth rate are the characteristics of a patient's reaction to sepsis. The endothelium is a thin layer of cells that lines blood vessels. During sepsis or septic shock, there is a breakdown of the endothelial barrier, which leads to intravascular coagulation, fibrinolysis, microvascular thrombi, and ineffective oxygen delivery to tissues resulting in major medical problems like hypotension and organ failure.[2]

Despite the recent advances in medical management over the past few decades, sepsis remains the primary cause of death worldwide, with an unacceptably high mortality rate.[3] It not only leads to increased mortality but is an important cause of morbidity as well, especially in patients admitted to intensive care units, those who have multiple co-morbidities and who are immunocompromised (HIV, organ transplant, solid organ and hematological malignancies complicated by neutropenia) and is usually associated with multiple organ failure as final outcome. [3,4]

Insights from high-income countries suggest that 31 million sepsis cases are reported around the world with about 6 million deaths annually.[5] A recent study published in July 2020 states that in the United States, 1.7 million adult cases are diagnosed with sepsis which is associated with 270,000 deaths annually.[6] Sepsis is emerging as a global disease in low and middle-income countries. Developing countries have the highest ratio of deaths, around 90% from pneumonia, meningitis, or other infections, and most of the deaths of neonates and infants having sepsis occur in Asia and sub-Saharan Africa.[5] According to a clinical trial conducted in four intensive therapy units in India, out of all the admissions, 16.45% of patients were having severe sepsis, moreover, ICU mortality was 12.08%, and that of severe sepsis was 59.26%.[5]

Patients with sepsis are categorized into clinically distinct subgroups according to the environment in which the condition first developed.

a) patients admitted with community-acquired (CA) sepsis.

b) patients who are diagnosed with hospital-acquired ( HA) sepsis during a hospital stay.

It might be inappropriate to consider both of these entities as a whole group because they may differ greatly in terms of etiology, risk factors, underlying infections, patient symptoms, onset, and prognosis of the disease. [8] A study done in the United states reported community-acquired sepsis to be 62.8%, whereas hospital-acquired sepsis was found to be 11.3% of cases. Compared to CA-SS, HA-SS was linked to greater mortality and resource consumption.[9] According to a study conducted in Saudi Arabia and published in the journal of infection and public health(2015), 60% of this patient population had hospital-acquired infections that led to severe sepsis and septic shock, while 40% had a community-acquired infection. Community-acquired sepsis and septic shock had lower mortality rates at 23% and 28% respectively, whereas hospital-acquired sepsis developed inside or outside the ICU had a 53% mortality rate.[10]

Sepsis being one of the most common reasons for hospital admissions imposes a significant financial impact on any hospital. In terms of hospital utilization septic patients represent a disproportionately high burden. The cost of treating sepsis in US hospitals is the highest of any type of admission. For instance, in 2013 sepsis represented more than $24 billion in hospital expenditure, addressing 13% of all hospital stays. [11] In a study that was carried out in the intensive care unit(ICU) of a tertiary care hospital in Tamil Nadu, India. It was discovered that 76 patients

had HAI and that infections that occurred in ICU were associated with significantly higher costs than infections that did not.[12]

Although numerous studies describe the epidemiology, risk factors, outcomes, and hospital costs of patients with sepsis and septic shock in various nations around the world, data on bacterial sepsis, particularly in adults, are unfortunately lacking in developing nations.[3] In addition, unfortunately, there has been no study conducted in the past few years, comparing the characteristics and incidence of community acquired sepsis to that of hospital acquired sepsis in Pakistan.[3]

The study compared the demographics, clinical characteristics and site of infection leading to community acquired and hospital acquired sepsis. Secondly, the study further compared the distribution of the isolated organisms and complications caused by community and hospital acquired sepsis.

## MATERIALS AND METHODS

A prospective cohort study was undertaken at the intensive care unit, high dependency unit, and critical care unit at the Indus Hospital, Karachi, Pakistan between 14-April-2021 to 15th-April-2022. After ethical approval was obtained from the institutional review board (IRB), the study was initiated. All the adult patients of Medicine and Allied & Surgery and Allied admitted in any urgent Facility at TIH i.e.: HDU/ ICU/ CCU /who are 15 years or older and are fulfilling the criteria of sepsis, patients who were admitted through the Emergency Department or transferred from a ward were included in the study. Age < 15 years or who were transferred from another hospital were excluded from the hospital.

All eligible patients were enrolled in the study through TIH Inpatient Department. Verbal consent was obtained from patients or if they were not able to consent then from their next of kin. The data on demographics, vital signs, SOFA score, site of infection, laboratory parameters, radiological investigations, culture results, and complications, if any, were filled on a pre- designed Performa. The excess cost was calculated for patients acquiring HAIs, in collaboration with the finance department, for the extra investigations and treatment. Excess costs included the investigations and treatment done for those patients who would have been otherwise discharged but had a prolonged length of stay due to a hospital acquired infection.

All data was entered into SPSS software and analyzed. All continuous variables were presented as mean and standard deviation and dichotomous or categorical variables were presented as frequency and proportions. The groups were further stratified according to the sociodemographic, clinical, and biochemical parameters. Chi square and independent student t-tests were applied to find out the correlation between independent and dependent variables. A p-value of < 0.05 was considered as a cut off for statistical significance.

## RESULTS

Age of the participants was 42.1 ± 17.4 years with a predominance towards female gender. Almost 70% of the population had comorbidity. Mean Systolic BP was 126.1 ± 23.8 mm Hg while the diastolic blood pressure was 74.2 ± 15.7 mm Hg. 108 (89.3%) individuals presented at the emergency department. Most common complication was acute kidney injury with a frequency of 49 (40.5%).

Table 1: Sociodemographic and clinical parameters of the study population

| Parameters | N (%) |
|---|---|
| Male | 57 (47.1%) |
| Female | 64 (52.9%) |
| Marital Status | |
| Married | 99 (81.8%) |
| Unmarried | 19 (15.7%) |
| Divorced | 3 (2.5%) |
| Education Status | |
| Graduate | 14 (11.6%) |
| Intermediate | 25 (20.7%) |
| Matric | 31 (25.6%) |
| None | 20 (16.5%) |
| Postgraduate | 11 (9.1%) |
| Secondary | 14 (11.6%) |
| Undergraduate | 5 (4.1%) |
| Ethnicity | |
| Sindhi | 17 (14%) |
| Punjabi | 3 (2.5%) |
| Pashto | 11 (9.1%) |
| Urdu speaking | 86 (71.1%) |
| Muhajir | 5 (4.1%) |
| Comorbidities | |
| None | 36 (29.8%) |
| Diabetes Mellitus Type II | 31 (25.6%) |
| HIV | 2 (1.7%) |
| CKD | 17 (14%) |
| Malignancy | 1 (0.8%) |
| HTN | 18 (14.9%) |
| CVA | 1 (0.8%) |
| CVD | 7 (5.8%) |
| Others | 9 (7.4%) |
| Age in years | 42.1 ± 17.4 |
| Years of education | 10.1 ± 5.4 |
| Mean Systolic BP | 126.1 ± 23.8 |
| Mean Diastolic BP | 74.2 ± 15.7 |
| Mean Arterial pressure (MAP) mmhg | 92.2 ± 27.5 |
| Pulse rate beats per minute | 109.2 ± 15.6 |
| Respiratory rate breaths / min | 24.1 ± 5.1 |
| Temperature in degree celsius | 39.2 ± 8.2 |
| Oxygen saturation | 95.2 ± 5.6 |
| GCS | 14.6 ± 1.7 |
| SOFA Score | 3 ± 2.4 |
| Admission source into the urgency unit | |
| Emergency | 108 (89.3%) |
| Outpatient department | 13 (10.7%) |
| Complications | |
| None | 19 (15.7%) |
| AKI | 49 (40.5%) |
| Liver dysfunction | 6 (5%) |
| Cardiac dysfunction | 6 (5%) |
| ARDS | 6 (5%) |
| MODS | 7 (5.8%) |
| Empyema | 9 (7.4%) |
| Others | 19 (15.7%) |
| Patient outcome | |
| 1.Discharged | 99 (81.8%) |
| 2.Referred | 4 (3.3%) |
| 3.Expired | 18 (14.9%) |

The mortality rate in our study was reported to be 14.9%. Primary diagnosis is illustrated in Table 2. It was found that community acquired pneumonia was found in 14 (11.6%) cases, complicated pyelonephritis in 25 (20.7%), followed by infective endocarditis, septic arthritis, osteomyelitis, surgical site infection, skin and soft tissue infection.

Urinary tract was the most common site from which the organisms were isolated with a frequency of 35 (28.9%).

Table 2: Primary diagnosis at the presentation and site of infection among the study population

| Primary diagnosis at the time of Admission | N (%) |
|---|---|
| Community Acquired Pneumonia | 14 (11.6%) |
| Complicated Pyelonephritis | 25 (20.7%) |
| Uncomplicated Pyelonephritis | 4 (3.3%) |
| Infective endocarditis | 5 (4.1%) |
| Septic arthritis | 2 (1.7%) |
| Osteomyelitis | 5 (4.1%) |
| Surgical site infection | 5 (4.1%) |
| Skin and soft tissue infection | 14 (11.6%) |
| Intra Abdominal sepsis | 2 (1.7%) |
| Meningitis fungal | 4 (3.3%) |
| Enteric fever | 2 (1.7%) |
| Dengue fever | 5 (4.1%) |
| Complicated malaria | 2 (1.7%) |
| Other | 33 (27.3%) |
| Site of infection | |
| Respiratory infection | 21 (17.4%) |
| Abdominal infection | 15 (12.4%) |
| CLABSI | 2 (1.7%) |
| Peripheral line associated BSI | 5 (4.1%) |

| | |
|---|---|
| Surgical site infection | 1 (0.8%) |
| Skin and soft tissue infection | 16 (13.2%) |
| Urinary tract infection | 34 (28.1%) |
| Bone and joint infection | 15 (12.4%) |
| Obstetrical/gynecological | 4 (3.3%) |
| CNS | 5 (4.1%) |
| Other | 3 (2.5%) |

Table 3: Comparison of Community versus Hospital Acquired Sepsis

| Parameters | Community acquired sepsis | Hospital acquired sepsis | P-value |
|---|---|---|---|
| Gender | | | 0.008 |
| Male | 45 (55.6%) | 12 (30%) | |
| Female | 36 (44.4%) | 28 (70%) | |
| Marital status | | | 0.019 |
| Married | 61 (75.3%) | 38 (95%) | |
| Unmarried | 18 (22.2%) | 1 (2.5%) | |
| Divorced | 2 (2.5%) | 1 (2.5%) | |
| Ethnicity | | | 0.066 |
| Sindhi | 15 (18.5%) | 1 (2.5%) | |
| Punjabi | 1 (1.2%) | 2 (5%) | |
| Pashto | 7 (8.6%) | 4 (10%) | |
| Urdu speaking | 58 (71.6%) | 33 (82.5%) | |
| Patient outcome | | | 0.569 |
| Discharged | 70 (86.4%) | 33 (82.5%) | |
| Expired | 11 (13.6%) | 7 (17.5%) | |
| Site of infection | | | 0.026 |
| Respiratory | 16 (19.8%) | 5 (12.5%) | |
| Abdominal | 10 (12.3%) | 5 (12.5%) | |
| CLABSI | 0 (0%) | 2 (5%) | |
| Peripheral line associated BSI | 0 (0%) | 5 (12.5%) | |
| Surgical Site Infection | 0 (0%) | 1 (2.5%) | |
| Skin and Soft tissue Infection | 13 (16%) | 3 (7.5%) | |
| UTI | 25 (30.9%) | 9 (22.5%) | |
| Bone and joint infections | 9 (11.1%) | 6 (15%) | |
| Obstetrical/ Gynecological | 2 (2.5%) | 2 (5%) | |
| CNS | 4 (4.9%) | 1 (2.5%) | |
| Other | 2 (2.5%) | 1 (2.5%) | |

Table 4: Biochemical parameters comparison of Community versus Hospital Acquired Sepsis (Continuous variables)

| Parameters | Community acquired sepsis | Hospital acquired sepsis | |
|---|---|---|---|
| Age in years | 41.47 ± 18.4 | 41.5 ± 14.79 | 0.994 |
| Years of education | 10.69 ± 5.04 | 8.96 ± 5.47 | 0.183 |
| GCS | 14.56 ± 1.8 | 14.67 ± 1.09 | 0.784 |
| SOFA Score | 2.71 ± 2.31 | 3.4 ± 2.3 | 0.275 |
| Complete Blood Count | 9.6 ± 5.37 | 18.76 ± 9.48 | <0.001 |
| C-reactive protein | 1.69 ± 1.57 | 2.64 ± 2.58 | 0.065 |
| Erythrocyte sedimentation rate | 0.5 ± 0.89 | 0.8 ± 1.23 | 0.252 |
| Creatinine | 7.83 ± 4.85 | 15.4 ± 10.4 | <0.001 |
| Procalcitonin | 0.5 ± 0.74 | 1.04 ± 1.55 | 0.059 |
| Prothrombin time/ INR | 1.74 ± 1.8 | 4.04 ± 4.7 | 0.006 |
| APTT | 1.17 ± 1.29 | 2.56 ± 3.83 | 0.034 |
| Serum lactate levels | 0.71 ± 0.71 | 0.68 ± 0.99 | 0.869 |
| Blood gasses | 3.62 ± 3.87 | 6.72 ± 8.96 | 0.054 |

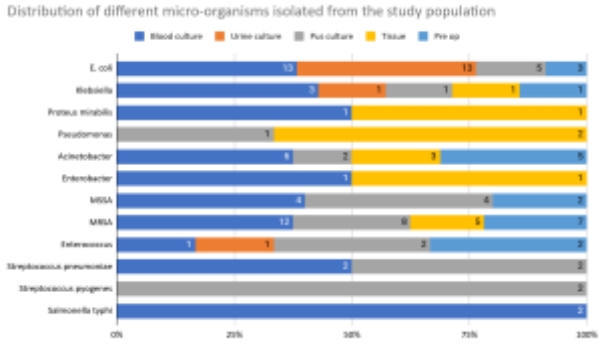


Figure 1: Distribution of different organisms isolated from the study population

Table 3 revealed that gender was significantly associated with gender (p=0.008). It was found that the majority of the community acquired sepsis were reported in males while the majority of the hospital acquired sepsis was reported in females. Furthermore, marital status (p=0.019) and site of infection were significantly correlated with the hospital acquired sepsis.

It was further found that mean creatinine was significantly lower in community acquired sepsis than those with hospital acquired sepsis [(7.83 ± 4.85) vs (15.4 ± 10.4); p<0.001].

## DISCUSSION

Sepsis acquired via community is a fatal systemic response that develops in an infected individual who hasn't been exposed to medical risks within 72 hours of hospital admission. In contrast, care facility sepsis describes instances confirmed 48 hours after being admitted to the hospital. The research aimed to examine the features and consequences of sepsis acquired from hospitals and communities in patients hospitalized at a tertiary treatment center in Karachi, Pakistan.

A historic cohort analysis was conducted in which all patients diagnosed with sepsis at a medical center in southern Brazil between January 2010 to December 2015 were included. As per the research, sepsis was diagnosed in 90.5 (85 to 105) cases per year and out of these, 58% (319) cases were determined to have healthcare-facility sepsis.

If we compare the outcomes of those patients who acquired sepsis via community, this group suffered from longer stays in ICUs ((5 days versus 8.5 days; p 0.001), longer hospital stays (8 days versus 23 days; p 0.001), more organ related health issues, had more serious disorders and increased in-hospital death rates (30.7% versus 15.6%; p 0.001). In fact, despite adjusting for APACHE II scores, age respiratory and hemodynamic instability, sepsis acquired from hospitals was still linked to higher fatality (OR 1.96; 95%CI 1.15 - 3.32, p = 0.013) [15].

In the present study, acute kidney injury was developed in 49 (40.5%) individuals. A much higher percentage was reported in another study revealing that out of the 432 patients 335 (79.4%) developed community acquired acute kidney injury. Compared to acute renal damage acquired from the hospital, the researchers concluded that patients with community-acquired acute renal damage had relatively lower mortality rates, short hospital stays, fewer complications and chronic diseases and volume deficiency as the cause. [16].

In our study, Klebsiella was isolated from 12 patients. Lately, 377 individuals with K. pneumoniae bacteremia were investigated by Kang CI et al (186 acquired from the hospital and 191 from the community). Nosocomial bacteremia patients were more likely to have neoplastic illnesses (solid tumor and hematologic malignancy, 56%) than individuals who acquired bacteremia from the community, who were more likely to have diabetes mellitus (20%) and chronic liver problems (35%). Patients with infections acquired from the community tended to develop bacterial liver abscesses most of the time. The 30-day fatality rate was 24% total (91/377), with nosocomial bacteremia having a fatality rate that was considerably greater than bacteremia acquired from the community (32% vs 16%, p0.001). Among all nosocomial and community-acquired cases, 33% and 4% were ESC (extended-spectrum cephalosporin tolerant, and 21% and 4% were CIP (ciprofloxacin (tolerant), respectively. In nosocomial infections, the CIP and ESC prior uses were discovered to be a separate health concern for CIP and ESC tolerance, respectively.

Patients with a diagnosis of nosocomial sepsis had a significant in-hospital death rate, but there was no difference between the two research groups. The burden of hospital acquired sepsis among admitted patients can be reduced via vigilant monitoring and rigid adherence to hospital regulations. It is necessary to do more prospective research on the topic to further substantiate the results.

## CONCLUSION

The study revealed both hospital acquired and community acquired sepsis are life threatening conditions that may add significant burden on the healthcare facility while at the same time placing significant financial burden upon the patients.

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