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FREQUENCY AND PREDICTORS OF READMISSION OF SEPSIS PATIENTS AT TERTIARY CARE HOSPITAL KARACHI

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Abstract

Introduction: Sepsis presents a significant healthcare challenge globally, marked by high morbidity and mortality rates. However, a less-explored aspect is patient readmission after initial discharge. Survivors of sepsis may face complications, requiring further hospitalization. Analyzing patient demographics, clinical factors, comorbidities, and healthcare interventions, this research aims to inform local healthcare practices, contribute to sepsis management strategies, and enhance patient outcomes while reducing healthcare costs.

Objective: To determine the frequency and predictors of readmission of sepsis patients at tertiary care hospital Karachi.

Material & Methods: This particular cross-sectional investigation, carried out within the framework of the study at Ziauddin Hospital, Karachi, from January to December 2020, included 200 patients via consecutive sampling. Inclusion criteria encompassed patients aged 18-80, readmitted within 30 days after initial sepsis hospitalization, with specific medical conditions and positive cultures. Blood samples collected were used to evaluate readmission predictors, including comorbidities (DM, COPD, CHF, CLD, CKD, malignancy, HIV). Data was analyzed using SPSS version 26.

Results: The mean ± SD of age was 59.64 ±16.60 years. Gender distribution showed 55% male and 45% female participants. Patients with diabetes had a lower readmission rate (31.7%) than those without diabetes (47.9%), indicating statistical significance, with a p-value of 0.034. However, the presence of chronic obstructive pulmonary disease (COPD) didn't significantly affect readmission rates ($p = 0.444$). Additionally, chronic heart failure ($p = 0.195$), along with chronic liver disease, chronic kidney disease, malignancy, and HIV, did not significantly impact readmission rates ($p = 0.131$, $p = 0.327$, $p = 0.082$, and $p = 0.484$, respectively). Furthermore, no statistically significant differences were observed in readmission rates related to ICU admission ($p = 0.945$) or hypertension ($p = 0.279$).

Conclusion: The findings of the current study revealed a lower readmission rate among patients with diabetes as a significant finding. Conversely, factors like COPD, chronic heart failure, and various comorbidities did not significantly influence readmissions, and ICU admission and hypertension showed no significant impact. Further research is essential for broader applicability and to enhance patient care.

Keywords: Comorbidity, Predictors, Readmission, Sepsis

INTRODUCTION

Sepsis has consistently ranked as a prominent contributor to human mortality on a global scale, a somber observation that extends throughout the annals of human history.[1] Sepsis represents a critical medical condition that emerges when the body's reaction to an infection result in harm to its tissues and organs. The third international consensus on sepsis definition has recently refined sepsis as a life-threatening organ dysfunction resulting from an imbalanced host response to infection.[2]

According to Global Burden of Disease Report, 2020; there were about 48.9 million incident cases sepsis worldwide [6]. The report also showed 11.0 million deaths related to sepsis, which represents 19.7% of all global mortalities and had the greatest impact in Asian countries [3]. Sepsis is among the top causes of admission after treatment in emergency departments (EDs), as well as readmission with higher mortality and economic costs worldwide, paralleled by a continuously increasing incidence. 4,5 In addition, it is essential to realize that the effects of sepsis do not end when hospitalization ends. Individuals who have survived sepsis may confront a spectrum of complications, including cognitive deficits, psychological challenges, and an elevated susceptibility to sepsis recurrence, which may necessitate readmission to the hospital. These sequelae, in turn, elevate the risk of mortality and contribute to a diminished quality of life for sepsis survivors.[6,7]

Readmissions in a septic patient after discharge is common and approximately 21% within 30 days of discharge.[8] Subsequent to hospital discharge, fatalities have exhibited associations with an individual's health status before the onset of illness and various elements within the hospital setting. However, there remains uncertainty regarding the modifiability of these factors and the extent to which hospital care interventions can influence the trajectory of post-discharge outcomes.[9,10]

Different studies reported the increasing prevalence of hospital readmission in sepsis patients. A recent Pakistani study by Arshad A, et al. on readmissions in sepsis patients reported that 58% were treated with sepsis and discharged from the hospital whereas mortality in sepsis was 42%. Out of 58% of patients who survived with sepsis, 31% were readmitted within three months. Out of these 67% were readmitted due to infections and 33% due to non-infections[11]. A study reported the rate and risk factors for re-hospitalization in sepsis survivors and reported the 21.4% re-hospitalization rate after 30 days of discharge from hospital, whereas infection was the most reported cause of readmission.[8] Another study by Singh A, et al. was conducted on unplanned readmissions of sepsis patients within 30-days and reported a 19.19% re-hospitalization rate after 30 days of discharge from the hospital. Out of which 52.2% were readmitted due to infection and 47.8% due to non-infections.[12] Readmission to the emergency department (ED) with sepsis is a prevalent occurrence and is notably associated with unfavourable clinical outcomes, prolonged durations of stay in both the ED and the hospital, as well as heightened treatment expenditures. These factors collectively impose a substantial additional burden on both the affected patients and the broader healthcare system. Consequently, understanding and addressing the factors that contribute to sepsis readmissions are crucial for improving patient care and healthcare resource allocation.

MATERIAL AND METHODS

This prospective cross-sectional study was conducted at the Department of Emergency Medicine, Ziauddin Hospital, Karachi, from January 2020 to December 2020. A total sample of 200 patients were included in the study through non-probability consecutive sampling. The sample size was calculated using the World Health Organization (W.H.O) sample size calculator, with a re-hospitalization frequency of (31.0)[11] in sepsis patients, and a confidence level (C.L) of 95%.

The inclusion criteria for patients were age 18 to 80 years and readmission within 30 days of hospital discharge after the initial hospitalization with sepsis, both genders. These readmissions required 2 or more of the following concurrent medical conditions, along with a positive blood or urine culture: temperature >38°C (or <36.0°C), heart rate >90 beats per minute, respiratory rate [35], PaCO2<32 mm Hg, and abnormal WBC count identified as WBC>12 k/μL (>15% band forms) if out side normal laboratory values (<4×10³ μ/L). The patients discharged within 24 hours from the hospital, pregnant and trauma cases were also excluded.

We also explored several comorbidities including diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), chronic liver disease (CLD), chronic kidney disease (CKD), malignancy and human immunodeficiency virus (HIV) that could be predictors of readmission in sepsis patients. We measured the following vital signs for each patient using standard medical equipment (pulse oximeter, sphygmomanometer and digital thermometer): heart rate [beats per minute --bpm], respiratory rate [breaths/min--br/mn-], blood pressure; systolic BP mmHg: diastolic BP mm Hg; Temperature was also assessed. Arterial blood gas (ABG) testing was performed to measure the level of partial pressure of carbon dioxide (PaCO2). A volume of blood was withdrawn in sterile containers from each patient included along with indicative investigations to determine WBC counts, immature forms and hemoculture for confirmation of sepsis. The dataset was managed and analyzed by SPSS version 26. Descriptive statistics (mean, standard deviations) and frequency with percentage were calculated. Further, the data were checked for statistical significance using a 95% confidence test.

RESULTS

The sample of 200 participants aged on average at 59.64 years (SD=16.60; with a small range acceptable to the value obtained by the 95% confidence interval as (57.32---61.95). The mean weight was 69.80 kg (SD = 9.84) and a 95% CI of 68.43----71.17kg. The average BMI was 25.21 kg/m² (SD = 4.21) and the 95% CI ranged from (24.62----26.80) kg/m². There were 45.0% females and 55.0% men in terms of gender distribution. Based on their residence status, 67.0% of the participants were from urban regions and 33.0% were from rural areas (Table 1).

A comprehensive explanation of vital signs and clinical parameters can be found in Table II provides a comprehensive analysis of vital signs and clinical parameters. These metrics determined the patients' physiological condition and, predominantly, could potentially be used as readmission predictors. Thus, the mean heart rate was 81.85 with a standard deviation of 14.81, with a 95% confidence interval ranging from 79.78 to 83.92 beats per minute, indicating the cardiac average. The same applies to the blood pressure, with the rate having equal averages and standard deviations of 114.03 mmHg and 17.54, respectively, and a 95% CI of 111.58 to 116.47 mmHg. In terms of the respiratory rate, the monitor revealed this average at 19.76 with a standard deviation of 5.26 and the confidence interval from 19.02 to 20.49 breaths per minute. Appropriate reveals are also found in body temperature at 37.24°C on average, with a standard deviation of 0.83 and a 95% confidence interval from 37.12 to 37.36°C. White blood count was also controlled in this presentation with an average of 7.32 x 10^9 per liter, with a standard deviation of 2.12 and a confidence interval of 7.02 to 7.62 x 10^9/L. The last monitored indicator was the partial pressure of carbon dioxide (PaCO2) in arterial blood at 41.25 mmHg, with a standard deviation of 2.70 and a 95% confidence interval of 40.87 to 41.62 mmHg.

According to Table III, the mean age of the readmitted group was 60.85 years and that of the non-readmitted was 59.11 years. However, there was no significant difference in age populations as seen in the statistical test, p = 0.499. Males accounted for 53.3%, and females accounted for 46.7% of the readmission group. In the non-readmitted group, males were 55.7%, while females were 44.3%. There was no statistical difference between the readmission rates with respect to gender as p = 0.756.

Patients with diabetes had a readmission rate of 31.7% compared to 47.9% for the non-diabetes counterpart, p = 0.034. The presence of COPD was 23.3% readmission and 28.6% non-readmitted,

with no significant difference, p = 0.444. Chronic heart failure was 25% and 34.3% readmission and non-readmitted, respectively, with no statistical difference, p = 0.195.
Chronic liver disease was found in 8.3% and 16.4%, chronic kidney disease was in 11.7% in the readmitted group and 17.1% in the non-readmitted group, malignancy stood at 15.0% and 7.1%, and HIV was 10.0% and 13.6% for readmitted and non-readmitted, respectively, with no significant difference as p = 0.131, p = 0.327, p = 0.082, and p = 0.484. The ICU admission rate was 28.3% for readmitted patients and 27.9% for non-readmitted patients, with no significant difference, p = 0.945. Hypertension was 46.7% readmitted and 55.0% non-readmitted, respectively, p = 0.279.

DISCUSSION

In the realm of modern healthcare, the assessment of hospital readmissions stands as a critical measure of quality care and cost-effectiveness. Sepsis, a severe and life-threatening infection, has increasingly become a focal point of attention in the ongoing effort to reduce readmission rates.[13]. Understanding the frequency and predictors of readmission among sepsis patients is pivotal for optimizing patient outcomes and healthcare resource allocation. Our study, conducted at a tertiary care hospital in Karachi, presents a significant contribution to this evolving discourse.
The demographic characteristics of our patient cohort are summarized. Our study cohort had an average age of approximately 59.64 years and was sex-stratified (55% male, 45% female), demonstrating that our participants were a diverse group representing individuals with sepsis representative of septic patients in the U.S. Urban participants accounted for 67%, with the remaining third being rural residents. These demographic data provide useful context for interpreting our conclusions with respect to the broader healthcare system.
Results of our study include general assessment parameters like pulse, blood pressure, and respiratory rate as well as a complete laboratory panel with C-reactive protein levels (CRP), temperature measurement at the scene, body white blood cell count (WBC), and red cell/LOS indices scientifically allowed delation pCO2. This exhaustive inspection allows for a detailed understanding of the physiological state of septic subjects. They are important clinically as determinants of stability or instability, and they may serve as early-warning indicators to adverse outcomes.
To examine the strength and the importance of our results, we performed a comparison with established literature. Our results show that age or sex does not have a relevant impact on readmission rates, supporting previous findings such as investigations by Arshad A et al. and Fatima S et al., where these variables had been equally revealed as insignificant predictors for readmissions in sepsis patients. On the other hand, our study showed that diabetes was a strong predictor for lower readmission rates compared to patients without diabetes, with significantly decreased hospital readmissions (31.7% vs 47.9%). This corresponds with the results from Arshad A et al., who found that diabetes was a significant factor for decreased readmission rates. This supports the idea that optimal diabetes management of patients with sepsis might start during hospitalization and is predictive of the risk of readmission following discharge.

Conclusion: The findings of the current study revealed a lower readmission rate among patients with diabetes as a significant finding. Conversely, factors like COPD, chronic heart failure, and various comorbidities did not significantly influence readmissions, and ICU admission and hypertension showed no significant impact. Further research is essential for broader applicability and to enhance patient care.

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Table I: Demographic Characteristics of Study Participants (n=200)		
Variables	**Mean±SD**	**95% C. I**
Age in years	59.64 ± 16.60	57.32----61.95
Weight in kg	69.80 ± 9.84	68.43----71.17
BMI in kg/m^2	25.21 ± 4.21	24.62----25.80
Gender		
Male	110 (55.0)	
Female	90 (45.0)	
Residential Status		
Urban	134 (67.0)	
Rural	66 (33.0)	

Table II: Vital Signs and Clinical Parameters (n=200)			
Variables		**Mean±SD**	**95% C. I**
Heart Rate (beats/min)		81.85 ± 14.81	79.78----83.92
Blood Pressure (mmHg)	Systolic	132.20 ± 14.37	130.19----134.20

	Diastolic	94.38 ± 5.98	93.54----95.21
Respiratory Rate (beats/min)		19.76 ± 5.26	19.02----20.49
Temperature (°C)		37.24 ± 0.83	37.12----37.36
White Blood Count (10^9/L)		7.32 ± 2.12	7.02----7.62
$PaCO_2$ (mmHg)		41.25 ± 2.70	40.87----41.62

Table III: Characteristics of Patients with Predictors of Sepsis Readmission (n=200)

Variables		**Readmitted (n=60)**	**Not Readmitted (n=140)**	**P-Value**
Age in years, Mean ± SD		60.85 ± 16.19	59.11 ± 16.80	0.499
Gender	Male, *n* (%)	32 (53.3)	78 (55.7)	0.756
	Female, *n* (%)	28 (46.7)	62 (44.3)	
Diabetes, *n* (%)		19 (31.7)	67 (47.9)	0.034
COPD, *n* (%)		14 (23.3)	40 (28.6)	0.444
Chronic Heart Failure, *n* (%)		15 (25.0)	48 (34.3)	0.195
Chronic Liver Disease, *n* (%)		5 (8.3)	23 (16.4)	0.131
Chronic Kidney Disease, *n* (%)		7 (11.7)	24 (17.1)	0.327
Malignancy, *n* (%)		9 (15.0)	10 (7.1)	0.082
HIV, *n* (%)		6 (10.0)	19 (13.6)	0.484
ICU Admission, *n* (%)		17 (28.3)	39 (27.9)	0.945
Hypertension, *n* (%)		28 (46.7)	77 (55.0)	0.279