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Original Research Article

INTENSIVE CARE UNIT PATIENTS' MORTALITY INDICATORS AND ASSOCIATED PARAMETERS

PERVAIZ R[1*], BUKHARI SZ[2], ISSA LH3, AHMED H[1], SAGHEER T[1], QURBAN A[1], RASHEED R[1], ADEEL[4], ARISH[4]

[1]*Department of Internal & Critical Care Medicine, Bahria International Hospital, Lahore, Pakistan*
[2]*Department of Critical Care Medicine, Services Institute of Medical Sciences, Lahore, Pakistan*
[3]*Department of Critical Care Medicine, Mediclinic City Hospital, Dubai, UAE*
[4]*Department of Critical Care Nursing, Bahria International Hospital, Lahore, Pakistan*
**Corresponding author's email address:* drrizwanpervaiz@gmail.com

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ABSTRACT

Background: *Several risk factors have been associated with the intensive care unit (ICU) mortality. Identifying these factors can help predict and reduce ICU mortality rates.* ***Objective:*** *To determine the mortality rate, identify contributing factors, and conduct a survival analysis in ICU patients.* ***Study Design:*** *A retrospective cohort study.* ***Setting:*** *Bahria International Hospital Lahore, & Services Institute of Medical Sciences, Lahore. Duration of Study: January 1, 2021, to December 5, 2022.* ***Methods:*** *A retrospective study was conducted in the medical & surgical ICUs. Data on delirium prevalence, socioeconomic status, and clinical conditions were collected retrospectively. The information included patient admission details, ICU diagnoses, hospital stays, presence of pressure ulcers, signs of dehydration, fluid balance, urine output, skin conditions, diabetes status, temperature, oro-gastric feeding, and ventilatory support. Patients were divided into two groups based on their hospitalisation outcomes: Group A for patients who died and Group B for those who were discharged/shifted from the ICU.* ***Results:*** *A total of 185 patients met the inclusion criteria. The study found that 18.9% of hospitalisations resulted in death. Patients in the death group were older (54 ± 16 years vs. 46 ± 19 years, p = 0.02) and were more likely to be transferred from hospital units after a sepsis diagnosis (57.1% vs. 20.1%, p = 0.01). Delirium was observed in 54.2% of individuals in the death group compared to 47.3% in the discharge group (p = 0.14). The Charlson score was higher in the death group (2.4 ± 2.78 vs. 1.71 ± 2.41, p = 0.04). Multifactorial analysis using the Cox regression model revealed that patients admitted via the emergency room (HR 0.39, p = 0.007) and those with an abnormal glycemic index (HR 1.71, p = 0.041) had higher odds of dying in the ICU.* ***Conclusion:*** *Older age, medical diagnosis of sepsis, and admission from other hospital units were associated with increased ICU mortality. Additionally, water and electrolyte imbalances, variations in glycemic index with tube feeding, mechanical ventilation, and higher Charlson scores were correlated with increased mortality.*

Keywords: Age Factors, Charlson Comorbidity Index, Delirium, Glycemic Index, Intensive Care Units, Mechanical Ventilation, Mortality, Sepsis

INTRODUCTION

The intensive care unit (ICU) treats patients with potentially fatal illnesses. The effective use of human and technological resources determines treatment outcomes and ICU death rates (1). ICU mortality has been linked to several factors, including the length of hospital stay (2), the clinical status of the patient, immobility, sedation, neurological disorders (3), intubation, mechanical ventilation (4), utilisation of vasopressor medications (5), glycemic index (6), socio-demographic traits (7), and delirium (8).

Extended ICU stays appear to double the risk of mortality. Nevertheless, 47% of ICU patients pass away within 48 hours of being admitted (7). According to multi-country research, most ICU patients are admitted from emergency rooms and require hemodialysis, blood pressure medication, and mechanical ventilation (9).

In Pakistan, ICU patients often present with neurological, cardiovascular, and septic conditions or trauma. ICU mortality rates in Pakistani public hospitals can range from 23-28% (10). This high mortality reflects the need for thorough patient assessment to provide optimal care. Employing appropriate assessment tools is crucial to maintaining high standards of ICU care. For example, the Charlson Comorbidity Index (CCI) is instrumental in evaluating comorbidities and calculating mortality risk, thus aiding in formulating safe healthcare plans by identifying potential risk indicators (11).

In this study, we aim to evaluate the survival rate of ICU patients at Bahria International Hospital in Lahore and Services Institute of Medical Sciences, Lahore, identify the frequency of death, and aeeeeee the associated risk factors. Our findings seek to contribute to the body of knowledge needed to improve ICU care and patient outcomes.

METHODOLOGY

This retrospective cohort study was conducted in the medical and surgical Intensive Care Units (ICUs) of Bahria International Hospital and Services Institute of Medical Sciences in Lahore. The study protocol was approved by the hospital's ethical board. The study encompassed ICU admissions between January 1, 2021, and December 5, 2022. The study included a total of one hundred eighty-five patients who were 18 years or older, regardless of their anesthesia status, with a Richmond Agitation-Sedation Scale (RASS) score of at least three. Patients in critical condition with a Glasgow Coma Scale (GCS) score of ≤8 or those with fatal brain injuries were excluded.

Retrospective data collection was conducted from patient medical records, with data gathering times varying based on the study team's availability. Collected data included clinical status, socio-demographic characteristics, and the presence of delirium. Admission details documented comprised ICU admission diagnosis, type of hospital stay, presence of pressure ulcers, clinical signs of dehydration, fluid balance, urine output, skin conditions, diabetic status, temperature, oro-gastric feeding, and ventilatory support.

Consciousness levels were assessed using the Glasgow Coma Scale (GCS) and the Richmond Agitation-Sedation Scale (RASS). The GCS

evaluates eye, verbal, and motor responses to measure the level of consciousness, with scores ranging from 3 (deep unconsciousness) to 15 (fully awake). The RASS assesses agitation and sedation, ranging from -5 (unarousable) to +4 (combative). The Charlson Comorbidity Index (CCI) was utilized to assess comorbid conditions impacting mortality risk. The CCI assigns scores to 17 comorbid conditions, with higher scores indicating a greater mortality risk. Delirium episodes were identified using the Confusion Assessment Method for the ICU (CAM-ICU), a tool that diagnoses delirium based on the presence of acute onset, inattention, disorganised thinking, and altered level of consciousness.

Patients were monitored daily until their death or ICU discharge. Based on hospitalisation outcomes, patients were categorised into two groups: Group A and Group B espectively.

Continuous variables were represented as means and standard deviations, while categorical variables were depicted as frequencies. Log-binomial regression was utilized to calculate and adjust incidence proportions. Fisher's exact test and Pearson's chi-square test were used to evaluate the significance of variables, with a p-value of less than 0.05 considered statistically significant.

The study was conducted in accordance with ethical standards and approved by the Bahria International Hospital ethical board, ensuring the confidentiality and integrity of patient data.

RESULTS

This study involved patients admitted to the medical and surgical intensive care units of the hospitals. A total of 287 potential participants underwent screening during the study period. Ultimately, 185 patients who met our inclusion criteria were included in the study Among the cohort, 18.9% of hospitalizations culminated in mortality. Notably, individuals in the deceased cohort exhibited a higher mean age (54 ± 16 years) in contrast to the recovered group (46 ± 19 years), a distinction found to be statistically significant (p = 0.02). A substantial proportion of patients in the deceased cohort had been transferred from other hospital units with post-sepsis diagnosis (57.1% vs. 20.1%, p = 0.01). Although not statistically significant, delirium was evident in 54.2% of individuals in the deceased group versus 47.3% in the discharged group (p = 0.14). Furthermore, the Charlson comorbidity index score was markedly higher in the deceased group (2.4 ± 2.78) compared to the discharged group (1.71 ± 2.41, p = 0.04) (Table 1).

Years of age, dehydration as well feeding through tubes, and anticonvulsant medication use are associated with an increased risk of death, according to the modified logistic regression model (Table 2).

Patients admitted via the emergency room (HR 0.39, p = 0.007) and those with a deranged glycemic index (HR 1.71, p = 0.041) had higher odds of dying in the intensive care unit (ICU), according to the multifactorial analysis conducted using the Cox regression model (Table 3).

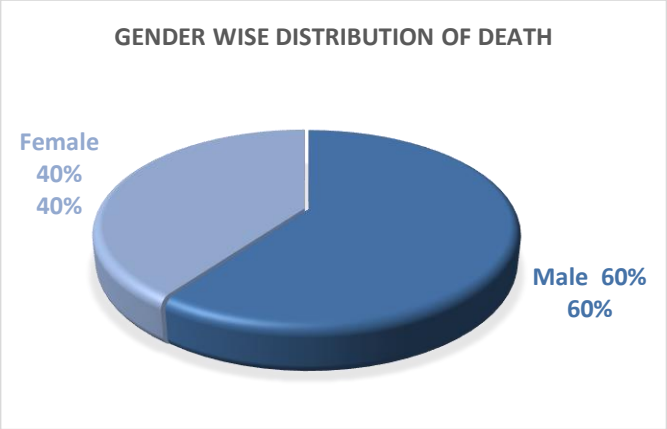

Figure 1: Types of Malignancies admitted in the ICU

Table 1: Variables linked to hospital deaths

Variable	Group A N=35 N,%	Group BN=150 N,%	P value
Years of age	54 ± 16 y	46 ± 19	0.02
Delirium			
Yes	19(54.2)	71(47.3)	0.14
No	16(45.7)	79(52.6)	
Gender			
Male	21(60)	96(64)	0.64
Female	14(40)	54(36)	
Clinical category			
Sepsis	20(57.1)	31(20.1)	0.001
water and electrolyte disorders	13(37.1)	29(19.3)	0.034
Blood sugar levels	14(40)	29(19.3)	0.21
Immobility	6(17.1)	39(26)	0.73
Physical immobility	26(74.2)	91(60.6)	0.65
Tube feeding,	30(85.7)	103(68.6)	0.04
Mechanical ventilation,	19(54.2)	48(32)	0.03
Wound injury	13(37.1)	34(22.6)	0.079
Charlson score total with Adjustment, mean (SD)	2.4 ± 2.78	1.71 ± 2.41	0.04

Table 2: Death probability ratios.

	Death		
	Prevalence ratio (PR) (CI 95%)	**Adjusted prevalence ratio (PRa) (CI 95%)**	**P value**
Age	1.03 (1.02–1.04)	1.03 (1.02–1.04)	0.008
Delirium	1.51 (1.02–2.29)	-	-
Dehydration	2.21 (1.12–4.81)	2.61 (1.67–4.11)	0.001
Water & electrolytic disorder	1.71 (1.11–2.71)	-	-

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Changes in sugar levels (glycemic index)	1.91 (1.21–2.91)	-	-
Hypothermia	1.79 (0.89–3.51)	-	-
Physical immobility	1.48 (1.01–2.41)	-	-
Tube feeding	2.11 (1.21–3.90)	1.92 (1.12–3.48)	0.035
Wound injury	1.61 (1.01–2.41)		
Anticonvulsant drugs use	0.71 (0.41–1.18)	0.62 (0.31–1.01)	0.044
Insulin use	1.59 (1.11–2.61)	-	-
Charlson score	1.11 (1.13–1.24)	-	-

Table 3: Cox model for clinical factors and mortality risk.

Variable	**Death**	
	HR (CI 95%)	P value
Delirium	1.21 (0.69–1.89)	0.541
Origin		
Inpatient unit	1	
Emergency room	0.39 (0.22–0.74)	0.007
water & electrolytic disorder	1.59 (0.95–2.81)	0.069
Changes in glycemic index	1.71 (1.12–2.79)	0.041
Hypoxemia	2.49 (1.01–6.31)	0.052
Anticonvulsive use	0.51 (0.29–1.09)	0.072

DISCUSSION

The study uncovered a concerning ICU mortality rate of 18.9%, prompting a critical examination of factors contributing to such outcomes. Our investigation identified several key factors associated with mortality, including age, insulin utilization, higher Charlson scores, sepsis, water & electrolyte disorders, glycemic index (blood sugar levels) alterations, enteral tube feeding, and mechanical ventilation.

The burgeoning burden on healthcare systems is compounded by the early onset of non-communicable diseases intertwined with comorbidities, exacerbating strain on tertiary care facilities with a surge in hospital admissions (12) (13). This phenomenon particularly impacts individuals in critical condition, leading to increased mortality rates (13) (14).

Our adjusted model underscored the significant relationship between mortality and advanced age, consistent with findings in other studies involving ICU patients (15) (16). Additionally, male patients exhibited a higher mortality rate, echoing trends observed in prior research (17). Notably, a substantial proportion of deceased patients were diagnosed with sepsis (57.1%), indicating a significantly elevated risk compared to broader investigations (17).

The intricate clinical state of critically ill patients, exemplified by higher Charlson scores and intensive treatment regimens, may predispose them to sepsis, ultimately contributing to mortality (18) (19). Moreover, factors such as anticonvulsant medication usage, dehydration, and enteral feeding were identified as contributors to mortality. Despite being a preferred method of care for critically ill patients, enteral feeding poses challenges in nutritional assessment due to fluid retention, dehydration, and weight loss (20).

Mechanical ventilation emerged as a significant predictor of mortality, potentially due to associated complications such as infection and ventilator-associated pneumonia (VAP), and ventilator-associated lung injury (VILI) (21) (22). Critically ill patients frequently experience glycemic index fluctuations, exacerbated due to corticosteroid use and feeding methods, which significantly impact the outcomes (23) (24). Precise glycemic index tracking is imperative for ICU patients to mitigate the risks associated with hyperglycemia and hypoglycemia (25).

While delirium did not statistically correlate with mortality in our investigation, its significance in ICU outcomes has been emphasized in previous studies (27). The multifaceted nature of ICU mortality necessitates identifying modifiable variables, such as sedation timing, prompt mobilization, and early ventilator weaning, to enhance patient outcomes.

However, our study has limitations. Being confined to only two hospitals may introduce participation bias and limit the generalizability of findings. Additionally, the relatively small sample size warrants further investigation in larger cohorts to explore additional scenarios and illnesses influencing ICU mortality. Addressing these limitations will contribute to a more comprehensive understanding of ICU mortality determinants and inform targeted interventions to improve patient outcomes.

CONCLUSION

In conclusion, our study identifies several modifiable factors associated with increased mortality in the intensive care unit (ICU), including the medical diagnosis of sepsis, patient age, and admission from hospital units. Additionally, imbalances in fluids and electrolytes, variations in glycemic index due to tube feeding, mechanical ventilation, and higher Charlson scores were correlated with mortality outcomes. Specifically, age, dehydration, use of a feeding tube, and use of anticonvulsant medications were found to elevate the incidence of death in our adjusted analysis.

DECLARATIONS

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declared absence of conflict of interest.

AUTHOR CONTRIBUTION

RIZWAN PERVAIZ
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
SABA ZARTASH BUKHARI
Study Design, Review of Literature.
LAILA HASSAN ISSA
Conception of Study, Final approval of manuscript.
HASSAN AHMED
Data entry and Data analysis, drafting article.
TOOBA SAGHEER
Manuscript drafting.
ANEEQA QURBAN
Study Design, Review of Literature.
RUMAISA RASHEED
Coordination of collaborative efforts.
ADEEL
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
ARISH
Coordination of collaborative efforts.

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