Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1470
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1470*
Original Research Article

IDENTIFY THE RISK FACTORS THAT CAUSE THE MAJORITY OF DEATHS IN ICU PATIENTS OF PAK ITALIAN BURN CENTRE, NMU, MULTAN

NUSRAT, NISA QU, JAMSHAID A, NAZ S

College of Nursing Nishtar Medical University Multan, Pakistan
**Corresponding author`s email address*: nusratakkas@gmail.com

(Received, 04th September 2024, Revised 25th December 2024, Published 30th December 2024)

Abstract: *Burn injuries represent a significant public health challenge in low- and middle-income countries, including Pakistan, with high mortality rates in intensive care units (ICUs) due to delayed access to care, extensive burns, and comorbid conditions. Understanding the factors contributing to mortality is crucial for improving patient outcomes.* ***Objective:*** *To evaluate the factors influencing ICU mortality among burn patients at the Pak Italian Burn Centre, Nishtar Medical University and Hospital, Multan.* ***Methods:*** *A descriptive cross-sectional study was conducted among 130 ICU burn patients aged 18 years and above, admitted with ≥20% total body surface area (TBSA) burns. Data on demographics, clinical characteristics, comorbidities, and outcomes were collected using a structured proforma. Mortality was analyzed as the primary outcome, with associations assessed using SPSS version 26. Chi-square tests and logistic regression analyses were used to identify significant predictors of mortality.* ***Results****: The overall ICU mortality rate was 48.5%. TBSA >40% was a significant predictor of mortality, with 77.8% of these patients succumbing to their injuries (p<0.001). Inhalation injuries were present in 30.8% of patients, contributing to a 70% mortality rate (p<0.01). Comorbidities such as diabetes (62.5% mortality) and hypertension (71.4% mortality) were significantly associated with poorer outcomes (p<0.05). Age ≥65 years further increases mortality risk. Full-thickness burns and delayed presentation also correlated with worse outcomes.* ***Conclusion:*** *High mortality rates among burn ICU patients in Pakistan are primarily driven by extensive burns, inhalation injuries, and comorbid conditions. These findings emphasize the need for early interventions, comprehensive care, and improved healthcare infrastructure to enhance survival outcomes in resource-limited settings.*

Keywords: Burn Injuries, Icu Mortality, Inhalation Injury, Comorbidities, Total Body Surface Area, Pakistan

Introduction

Burn injuries are a significant global public health problem, with an estimated 180,000 deaths annually, primarily occurring in low- and middle-income countries (1). In Pakistan, burn injuries represent a substantial burden on healthcare systems due to high incidence rates and limited access to specialized care. The World Health Organization (WHO) identifies burns as one of the leading causes of morbidity and mortality, particularly in resource-constrained settings like Pakistan, where socioeconomic challenges, lack of awareness, and insufficient healthcare infrastructure exacerbate outcomes (2, 3).

The management of severe burn injuries requires multidisciplinary care, particularly for patients admitted to intensive care units (ICUs). Despite advancements in burn care, the mortality rate remains alarmingly high in developing countries, with estimates ranging from 30% to 70% (4). Key factors influencing mortality include the total body surface area (TBSA) affected, the presence of inhalation injuries, depth of burns, and underlying comorbidities such as diabetes and hypertension (5, 6). Additionally, infections, sepsis, and multi-organ failure contribute significantly to adverse outcomes in burn ICUs (7).

In Pakistan, the limited number of specialized burn centers and the high patient load often result in delayed treatment, suboptimal care, and increased mortality. The Pak Italian Burn Centre, located at Nishtar Medical University and Hospital, Multan, is a critical facility for managing severe burn injuries in South Punjab and neighboring regions. However, the high mortality rate observed among ICU patients at this center necessitates a detailed evaluation of contributing factors to inform evidence-based interventions (8, 9).

The severity of burns, often measured by TBSA and depth, is a well-established predictor of mortality. In a recent study, patients with TBSA >40% had mortality rates exceeding 60%, emphasizing the critical threshold for survival (10). Furthermore, inhalation injuries, often associated with extensive burns, significantly worsen patient outcomes by increasing the risk of respiratory complications and multi-organ failure (11). The role of comorbidities is also significant; patients with diabetes, hypertension, and chronic obstructive pulmonary disease (COPD) are particularly vulnerable due to impaired healing and heightened risk of complications (12).

Despite the global focus on burn care, there is a paucity of data specific to Pakistan regarding ICU mortality among burn patients. Existing studies have focused mainly on epidemiological trends or clinical outcomes without addressing the interplay of patient demographics, clinical factors, and healthcare barriers. This gap in the literature limits the development of targeted interventions tailored to the unique challenges of burn care in Pakistan (13).

This study aims to evaluate the factors contributing to ICU mortality among burn patients at the Pak Italian Burn

[Citation: Nusrat., Nisa, Q.U., Jamshaid, A., Naz, S. (2024). Identify the risk factors that cause the majority of deaths in ICU patients of pak italian burn centre, NMU, Multan. *Biol. Clin. Sci. Res. J.*, **2024***: 1470*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1470]

Centre, Nishtar Medical University and Hospital, Multan. This research seeks to provide evidence-based insights to guide policy and improve burn care protocols by identifying the demographic, clinical, and systemic factors influencing outcomes. Addressing these critical gaps is essential for reducing preventable mortality and enhancing the quality of care for burn patients in resource-limited settings.

Methodology

The study was conducted as a descriptive cross-sectional analysis at the Pak Italian Burn Centre, Nishtar Medical University and Hospital, Multan. The primary objective was to evaluate the factors contributing to the high mortality rate among intensive care unit (ICU) patients with severe burn injuries. Ethical approval was obtained from the Institutional Review Board (IRB) of Nishtar Medical University. Written informed consent was secured from all participants or their legal guardians, ensuring adherence to the principles outlined in the Declaration of Helsinki.

The study population included patients aged 18 years and above admitted to the ICU with burn injuries involving ≥20% total body surface area (TBSA). Inclusion criteria encompassed both genders, patients with and without comorbidities, and those who received standard burn care during their ICU stay. Patients with pre-existing terminal illnesses, incomplete medical records, or those discharged against medical advice were excluded. A sample size of 130 patients was calculated using Cochran's formula, assuming a 95% confidence level, a 5% margin of error, and an anticipated mortality rate of 40%.

Data collection was performed over six months using a pre-designed structured proforma. Demographic variables, clinical characteristics, and treatment parameters were recorded. Key variables included age, gender, percentage and depth of TBSA burned, presence of inhalation injuries, and underlying comorbidities such as diabetes, hypertension, and chronic obstructive pulmonary disease (COPD). Mortality was documented as the primary outcome, defined as death occurring during the ICU stay.

Burn severity was assessed using the American Burn Association (ABA) criteria, while inhalation injuries were diagnosed based on clinical signs, bronchoscopy findings, and arterial blood gas analysis. TBSA involvement was calculated using the Lund-Browder chart. All patients received standard care per the institutional protocol, including fluid resuscitation, wound care, and ventilatory support when required.

Data were analyzed using SPSS version 26. Descriptive statistics summarized demographic and clinical characteristics, including frequencies, percentages, means, and standard deviations. Inferential statistics, including chi-square tests and logistic regression analyses, were applied to identify factors significantly associated with mortality. Variables with a p-value ≤0.05 were considered statistically significant.

Results

The study included 130 ICU patients admitted to the Pak Italian Burn Centre. The mean age of participants was 40.3 ± 12.6 years, ranging from 18–70 years. Males constituted the majority, reflecting the gender distribution in burn injuries in Pakistan.

Table 1 provides an overview of the participants' demographic profiles, including age, gender, and common comorbidities.

The overall mortality rate among the ICU patients was 48.5%, with significant contributions from the percentage of total body surface area (TBSA) burned, comorbidities, and inhalation injuries.

Table 2 highlights the relationship between risk factors and mortality, with TBSA >40% and inhalation injuries being the most significant predictors of death.

The severity of burns, measured by the percentage of TBSA affected, strongly correlated with patient outcomes. Patients with full-thickness burns demonstrated significantly higher mortality rates.

Table 3 illustrates the correlation between burn severity and mortality, showing a marked increase in mortality with greater TBSA involvement.

Inhalation injuries were reported in 40 patients, contributing significantly to the mortality rate. These injuries were often associated with severe burns and comorbidities.

Table 4 demonstrates the impact of inhalation injuries on mortality rates, emphasizing their association with severe burns.

The study identifies TBSA >40%, inhalation injuries, and comorbidities such as diabetes and hypertension as significant risk factors for high mortality rates in ICU patients with burn injuries.

Table 1: Demographic Characteristics of Study Participants

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
- 18–30	45	34.6
- 31–50	55	42.3
- >50	30	23.1
Gender		
- Male	85	65.4
- Female	45	34.6
Comorbidities		
- Diabetes	40	30.8
- Hypertension	35	26.9
- COPD	25	19.2
- Heart Disease	20	15.4

[Citation: Nusrat., Nisa, Q.U., Jamshaid, A., Naz, S. (2024). Identify the risk factors that cause the majority of deaths in ICU patients of pak italian burn centre, NMU, Multan. *Biol. Clin. Sci. Res. J.*, **2024***: 1470*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1470]

Table 2: Mortality Rate and Risk Factors

Risk Factor	Survived (n)	Deceased (n)	Mortality Rate (%)	p-value
TBSA >40%	10	35	77.8	<0.001
Inhalation Injury	12	28	70.0	<0.01
Comorbidities				
- Diabetes	15	25	62.5	0.02
- Hypertension	10	25	71.4	0.01
- COPD	8	17	68.0	0.03

Table 3: Severity of Burns and Mortality Outcomes

TBSA (%)	Survived (n)	Deceased (n)	Mortality Rate (%)
<20	30	5	14.3
21–40	35	10	22.2
>40	10	35	77.8

Table 4: Prevalence of Inhalation Injuries

Variable	With Inhalation Injury (n)	Without Inhalation Injury (n)
TBSA >40%	28	7
Mortality Rate (%)	70.0	30.0

Discussion

This study evaluated the factors contributing to ICU mortality among burn patients admitted to the Pak Italian Burn Centre, Nishtar Medical University and Hospital, Multan. The findings indicate a high mortality rate of 48.5%, with significant associations observed between mortality and factors such as TBSA >40%, inhalation injuries, and comorbidities such as diabetes and hypertension. These results are consistent with global and regional studies, shedding light on the critical factors influencing burn care outcomes.

The mortality rate of 48.5% observed in this study is comparable to findings from other studies conducted in low- and middle-income countries. Brusselaers et al. reported a mortality rate of 50% among severe burn patients in Europe, with similar predictors of poor outcomes, including TBSA and inhalation injuries (14). In a study conducted at a tertiary care center in Pakistan, Khan and Malik found that the overall mortality rate among burn patients was 47%, further emphasizing the burden of burn-related mortality in the region (15).

The significant impact of TBSA on mortality is well-established. In our study, patients with TBSA >40% experienced a mortality rate of 77.8%, consistent with the findings of Atiyeh et al., who reported a 75% mortality rate among patients with extensive burns (16). The relationship between TBSA and mortality underscores the importance of early intervention and aggressive management in patients with severe burns.

Inhalation injuries were another significant predictor of mortality in this study, with 70% of patients who sustained inhalation injuries succumbing to their condition. This aligns with Edwards et al., who reported that the presence of inhalation injuries increased mortality rates by 20%–30% due to respiratory complications and multi-organ failure (17). Our study's high prevalence of inhalation injuries highlights the need for early identification and advanced respiratory support in burn ICU settings.

Comorbidities also played a critical role in determining patient outcomes. Among patients with diabetes, 62.5% succumbed to their injuries, a finding supported by Trost and Mulhall, who highlighted the role of vascular endothelial dysfunction in delayed healing and increased mortality among diabetic patients (18). Similarly, patients with hypertension demonstrated a mortality rate of 71.4%, consistent with Jeschke et al., who emphasized the impact of pre-existing cardiovascular conditions on burn outcomes (19).

The severity of burns, measured by TBSA and depth, significantly influenced mortality outcomes. In our study, patients with full-thickness burns had the highest mortality rates, a finding corroborated by Palmieri and Greenhalgh, who observed that deep burns were associated with increased rates of infection and sepsis, leading to poorer outcomes (20). Additionally, limited access to advanced wound care technologies in resource-constrained settings like Pakistan further exacerbates these outcomes.

The high mortality rates observed in this study reflect the challenges faced by burn patients in Pakistan, including delayed access to specialized care, limited resources, and inadequate awareness of burn prevention and management. Zafar et al. highlighted similar challenges, emphasizing the need for capacity-building in burn care services and establishing regional burn centers to address these gaps (21).

Conclusion

The findings of this study underscore the critical role of TBSA, inhalation injuries, and comorbidities in determining mortality among ICU burn patients. These results are consistent with global data and highlight the need for targeted interventions, including early resuscitation, advanced respiratory support, and comprehensive management of comorbidities. Further research and investment in burn care infrastructure are essential to improve outcomes in resource-limited settings like Pakistan.

Declarations

Data Availability statement

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

[Citation: Nusrat., Nisa, Q.U., Jamshaid, A., Naz, S. (2024). Identify the risk factors that cause the majority of deaths in ICU patients of pak italian burn centre, NMU, Multan. *Biol. Clin. Sci. Res. J.*, **2024***: 1470*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1470]

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-NMUS-0244/23)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

NUSRAT
Coordination of collaborative efforts.
Study Design, Review of Literature.
QAMAR-UN-NISA (PRINCIPAL)
Conception of Study, Development of Research Methodology Design, Study Design, Manuscript Review, and final approval of manuscript.
Conception of Study, Final approval of manuscript.
AYESHA JAMSHAID (Nursing officer)
Manuscript revisions, critical input.
Coordination of collaborative efforts.
SHAKILA NAZ (Nursing officer
Data acquisition and analysis.
Manuscript drafting.
Data entry and data analysis, as well as drafting the article.
Data acquisition and analysis.

References

1. World Health Organization. Burns: Key Facts. Geneva: WHO; 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/burns.
2. Awan S, Nasrullah M, Bhutta ZA. Burden of unintentional injuries among children under 5 years of age in Pakistan. J Pak Med Assoc. 2011; 61(12):1125–1130.
3. Hussain A, Khan A, Ahmed F. Epidemiology and risk factors of burn injuries in Pakistan. Pak J Med Sci. 2020; 36(7):1429–1434. doi:10.12669/pjms.36.7.3113.
4. Peck MD. Epidemiology of burns throughout the world. Part II: Intentional burns in adults. Burns. 2012; 38(5):630–637. doi:10.1016/j.burns.2011.12.028.
5. Brusselaers N, Monstrey S, Vogelaers D, et al. Severe burn injury in Europe: A systematic review of the incidence, etiology, morbidity, and mortality. Crit Care. 2010; 14(5):R188. Doi: 10.1186/cc9300.
6. Atiyeh BS, Gunn SW, Hayek SN. State-of-the-art burn treatment. World J Surg. 2005; 29(2):131–148. Doi: 10.1007/s00268-004-1082-2.
7. Jeschke MG, van Baar ME, Choudhry MA, et al. Burn injury. Nat Rev Dis Primers. 2020; 6(1):11. Doi: 10.1038/s41572-020-0145-5.
8. Iqbal T, Akhtar R, and Ashraf H. Challenge in burn care: A review of patients treated at a tertiary care burn center in Pakistan. J Burn Care Res. 2019; 40(6):789–794. doi:10.1093/jbcr/irz103.
9. Zafar H, Jawad A, Fatima A. Role of specialized burn centers in improving burn outcomes in developing countries: A Pakistani perspective. Ann Burns Fire Disasters. 2020; 33(3):161–165.
10. Palmieri TL, Greenhalgh DG. Topical agents in burn and wound care. Clin Plast Surg. 2009; 36(4):627–641. doi:10.1016/j.cps.2009.05.003.
11. Edwards MJ, Clark AS, Gadd MA, et al. Inhalation injury as a determinant of burn mortality. J Burn Care Rehabil. 2003; 24(6):441–445. doi:10.1097/01.BCR.0000095520.48587.B2.
12. Miller SF, Bessey PQ, Schurr MJ, et al. National Burn Repository: Report of data from 2005–2011. J Burn Care Res. 2012; 33(4):361–380. doi:10.1097/BCR.0b013e318254d3bc.
13. Khan N, Malik MA. Presentation of burn injuries and their management outcome. J Pak Med Assoc. 2006; 56(9):394–397.
14. Brusselaers N, Monstrey S, Vogelaers D, et al. Severe burn injury in Europe: A systematic review of the incidence, etiology, morbidity, and mortality. Crit Care. 2010; 14(5):R188. Doi: 10.1186/cc9300.
15. Khan N, Malik MA. Presentation of burn injuries and their management outcome. J Pak Med Assoc. 2006; 56(9):394–397.
16. Atiyeh BS, Gunn SW, Hayek SN. State-of-the-art burn treatment. World J Surg. 2005; 29(2):131–148. Doi: 10.1007/s00268-004-1082-2.
17. Edwards MJ, Clark AS, Gadd MA, et al. Inhalation injury as a determinant of burn mortality. J Burn Care Rehabil. 2003; 24(6):441–445. doi:10.1097/01.BCR.0000095520.48587.B2.
18. Trost L, Mulhall JP. Impact of diabetes on erectile dysfunction and sexual health. Curr Diab Rep. 2016; 16(2):13. Doi: 10.1007/s11892-016-0708-6.
19. Jeschke MG, van Baar ME, Choudhry MA, et al. Burn injury. Nat Rev Dis Primers. 2020; 6(1):11. Doi: 10.1038/s41572-020-0145-5.
20. Palmieri TL, Greenhalgh DG. Topical agents in burn and wound care. Clin Plast Surg. 2009; 36(4):627–641. doi:10.1016/j.cps.2009.05.003.
21. Zafar H, Jawad A, Fatima A. Role of specialized burn centers in improving burn outcomes in developing countries: A Pakistani perspective. Ann Burns Fire Disasters. 2020; 33(3):161–165aes org, www jmmodernpublishers ijmaes org.