

Audit of Admissions and Outcome of Patients with Burns in the Intensive Care Unit of a Tertiary Hospital in Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author UUU designed the study, wrote the protocol and wrote the first draft of the manuscript. Author SEI re-designed the study, modified the protocol, performed the statistical analysis, managed the literature searches and wrote the final draft of the manuscript. Author BMK managed the analyses of the study. Author BMK was involved in data collection and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Oil exploration activities in the Niger Delta region may increase the risk of burns, and may occasionally require admission into the Intensive Unit. The pattern of admission of patients with Burns into the Intensive Care Unit in the hospital does not appear to follow any stipulated guidelines.

Aim: To evaluate the pattern of burns admission in the Intensive Care Unit and to determine if the admissions influenced the outcome.

Materials and Method: A retrospective study of admissions in the Intensive Care Unit (ICU) was carried out between January 2007 and December 2015. Data on age, sex, type of burns, indication for admission into the ICU, length of stay in the ICU and outcome at the point of discharge of the patients from the ICU was collected. The data was managed using Microsoft Excel version 2013 and analysed using SPSS for windows version 20. Descriptive and analytical statistics based on the observations were generated and presented as considered appropriate.

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Results: The total ICU admissions were 1258 out of which 127 (10.09%) were patients with burns, with the male to female ratios of 1:1. The average age was 25.3years. The Burn injuries resulted from explosions of Petroleum product in 55 cases (43.3%). One patient (1.56%) was admitted for hot liquid burns. Majority of the patients were admitted into the ICU because of the severity of injuries, inhalational burns (n= 48; 37.8%) and social reasons (n = 23 (18.1%). The length of stay in the ICU ranged between 1 day and 45 days. Ninety-seven of the admitted patients (76.37%) died in the ICU.

Conclusion: Admissions into the ICU in the Hospital did not follow any identified pattern or followed any stipulated guideline. Mortality for burns patients admitted in ICU was relatively high when related to the total burn surface area. ICU admission of some of the patients did not improve outcome instead increased pressure on the limited available personnel and material.

Keywords: Audit; pattern and outcome; burns admissions; intensive care; Port Harcourt; Nigeria.

1. INTRODUCTION

Burns is a primary contributor to morbidity and mortality worldwide [1] with the low-income group being more commonly affected [2-3]. Burns can occur at home, in a work environment or even at recreation centres. Burns sometimes assume a disaster proportion, resulting in available health facilities being overwhelmed. The most prevalent type of burns is flame, [4-9] and males are usually more affected than females [3]. The Niger Delta region of Nigeria is particularly at risk of injuries from flame because of exploratory oil activities, accidents involving trucks transporting petroleum products on bad roads, illegal oil bunkering, and adulteration of domestic fuel with highly inflammable products.

Injury sustained from burns varies from mild to severe, and some of the patients could be ill enough to require ventilatory support, close monitoring and continuous infusion of vasoactive agents in the Intensive Care Unit (ICU). Nantes et al. as members of the Task Force for the Society of Critical Medicine and The American Society of Surgical Critical Care on the Guidelines for ICU Admission, Discharge and Triage suggest that, under ideal conditions, patients should be admitted or discharged strictly on their potential to benefit from ICU care [10]. The National Institutes of Health (NIH) Consensus Conference recommended that patients should be admitted into the ICU if they can benefit from the admission with decreased risk of death as well as those patients with reversible medical conditions who have a "reasonable" prospect of substantial recovery [11]. Sprung et al. had suggested that admitting those patients who are "Too well to benefit" often has the possibility of being detrimental by providing overly aggressive care, procedure complications, increased chance of developing

multi-resistant infections. The same goes for admitting those who are too ill to survive [12].

Focusing on the severity of the condition without consideration of its reversibility often results in admissions that do not change or improve the outcome. Intensive Care Unit admissions should be reserved for those patients with reversible medical conditions who have a reasonable prospect of substantial recovery because of the requirement of expensive resources which are scarce in developing countries. The admission pattern in the developed nations with well-established healthcare systems may not be the same with those in the developing nations such as Nigeria.

This study looked at the admission pattern, and outcome of patients admitted with burns in a nine-bed ICU of a Tertiary Centre in Port Harcourt.

2. METHODS

A retrospective study of admissions in the ICU of the University of Port Harcourt Teaching Hospital from January 2007 to December 2015 was carried out. Data was collated on age, sex, type and cause of burns, Indication for admission into the ICU, length of stay in the ICU outcome of treatment as well as the criteria for admission of burn patients into the ICU. Data was managed using Microsoft Excel version 2013 (Redmond, Washington, USA) and analysed using IBM SPSS for Windows version 20.0(IBM Corp Amok NY USA). Descriptive and analytical statistics were generated and presented as necessary. Categorical variables are presented as proportions and percentages in frequency tabulations and figures whereas continuous variables are presented with means and median as considered appropriate. Observed differences

were tested for statistical significance with Chi-Square (X^2) test for categorical variables while Students t-test was used to compare observed differences in Means. A P-value less than 0.05 is considered statistically significant.

3. RESULTS

The total ICU admissions during the period under review were 1258, and 127 (10.09%) of these were because of burns.

3.1 Criteria for Admission into the ICU

- **The severity of the injury**
 - Based on the age of the patients:
 - Younger than five years with burns higher than 15% TBSA
 - Older than 65 years with burns higher than 30% TBSA
 - Between 5 and 18 years with burns higher than 30% TBSA
 - Between 18 and 65 years with burns higher than 50% TBSA
- **Burns with Inhalational Injury:**
 - Features of significant inhalational burns
- **Burns with associated chronic medical conditions including**
 - Diabetes Mellitus
 - Chronic hypertension
 - Cardiac conditions
 - Burns higher than 20% TBSA and significant associated injuries.
- **Social Considerations:** Patients related to top ranking hospital staff
 - High Net-worth Individual (HNI) in the society for comfort
 - Patient or relation's insistence on ICU care.

There were 64 males and 63 females (1.01:1). The youngest patient was three months, and the oldest 71 years, with the mean age of 25.3 ± 14.0 years (Table 1).

Table 1. Age distribution of the patients

Age (years)	Frequency (Nos)	Percentage (%)
> 10	23	18.1
>5	13	10.2
6 - 10	10	7.9
11 – 20	28	22.0
21 – 30	43	33.9
31 – 40	17	13.4
41 – 50	9	7.1
> 50	7	5.5
Total	127	100

Fifty-seven (89.06%) of the 64 cases in which the type of burns was documented were flame burns. Kerosene explosion constituted 31 (48.43%) of the cases, petrol explosion; 16 (25%), Gas explosion; 8 (12.5%), electrical burns; 4 (6.25%) and Gunpowder explosion; 2 (3.1%). Other types included chemical burns; 2 (3.1%) and hot liquid burns; 1 (1.56%) (Table2).

The male to female ratio of burns resulting from kerosene explosion was 1:2 while male to female ratio in burns from petrol explosion was 2:1. The patients sustained burns ranging from (10-100) % of the Total Body surface area (TBSA) determined using Wallace Rule of Nines 13. Eighty-three patients (70.33%) sustained burns above 50% TBSA while in 35 patients (29.66%) the TBSA was 50% and below. The TBSA affected was not documented in 9 of the cases (Table 3).

Table 2. Causes of burn cases admitted in the ICU

Cause of burns	Frequency			%
	Male	Female	Total	
Kerosene Explosion	10	21	31	24.3
Petrol Explosion	11	5	16	12.6
Gas explosion	6	2	8	6.3
Electrical Burns	0	4	4	3.2
Gun Powder Explosion	2	0	2	1.6
Chemical Burns	1	1	2	1.6
Hot liquid	1	0	1	0.8
Undocumented	33	30	63	49.6
TOTAL	64	63	127	100

$X^2 = 20.03; p = 0.0004$

Table 3. Total body surface area affected by burns

TBSA %	Frequency	Percentage
1 – 10	3	2.54
11 – 20	4	3.38
21 – 30	7	5.93
31 – 40	11	9.32
41 – 50	10	8.47
51 – 60	13	11.01
61 – 70	16	13.55
71 – 80	20	16.98
81 – 90	18	15.25
91 – 100	16	13.55
Total	118	100

$\chi^2 = 62.42; P = 0.00001$

The TBSA was not indicated in 9 (7.08%) of the 127 patients

Forty-eight (37.79%) of the 127 patients had associated inhalational injury.

The indication for admission into the ICU included Severity of Burns measured by TBSA greater than 60% (n= 70; 55.1%). Associated Inhalational Burns n = 48 (37.8%), Extremes of age of Patient n= 1 (0.8%), Social consideration (n = 23; 18.1%). None of the 14 (11.86%) patients with burns less than 30% TBSA had associated inhalational component whereas 34 (28.81%) of the patients with burns greater than 70% of TBSA had associated inhalational injury.

None of the patients admitted into the ICU for respiratory support received required mechanical ventilation. Essential treatments in the ICU were advanced monitoring of vital signs using monitors supplemental oxygen delivery and wound care.

Twenty-seven (21.25%) patients survived admission in the ICU and were transferred to Burns unit, and 2 (1.57%) were discharged home after an average of 10 days, while one patient (0.78%) was discharged against medical advice (DAMA) after 32 days (Fig. 1).

There were 97 (76.37%) deaths, of which 24 (24.74%) occurred within the first 24 hours. The number of deaths increased to 37 (38.14%) after 48 hours and 61 (62.88%) after 72 hours (Fig. 2).

The length of stay (LOS) of survivors in the ICU before discharge was 9.94 days ± (2.30) while the average (LOS) for those that died was 5.61 days ± (1.50). T-test=9.68, P = 0.0001 (Confidence Interval {CI} = 3.45 - 5.22).

The lowest case fatality was recorded amongst persons older than 50 years, (57.2%, n = 4/7) followed by persons younger than 10years (69.6%, n = 16/23). The highest case fatality recorded amongst persons between the ages of (21 – 50) years (80.9%, n = 55/68)

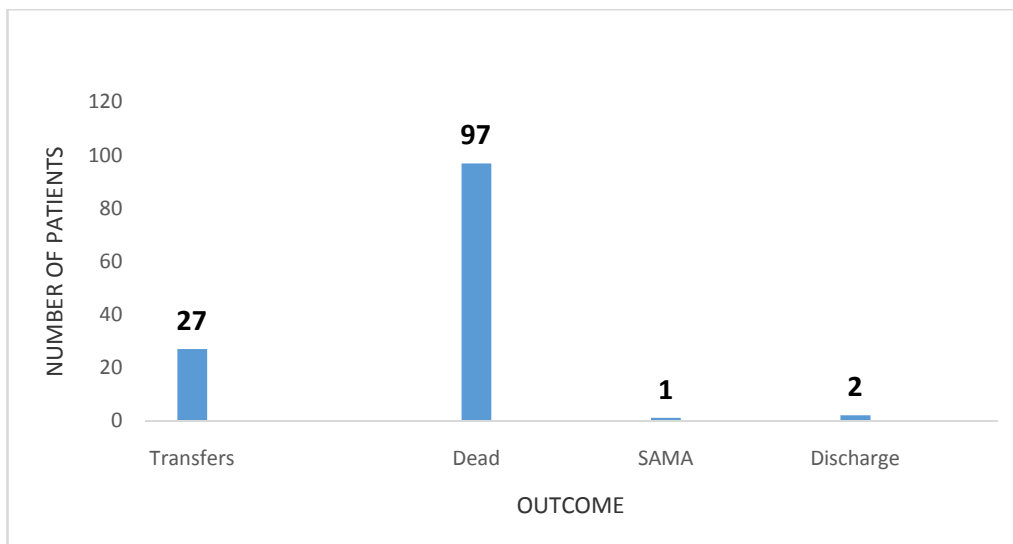


Fig. 1. Outcome of patients with burns in the ICU

$\chi^2 = 115.48; p = 0.001$

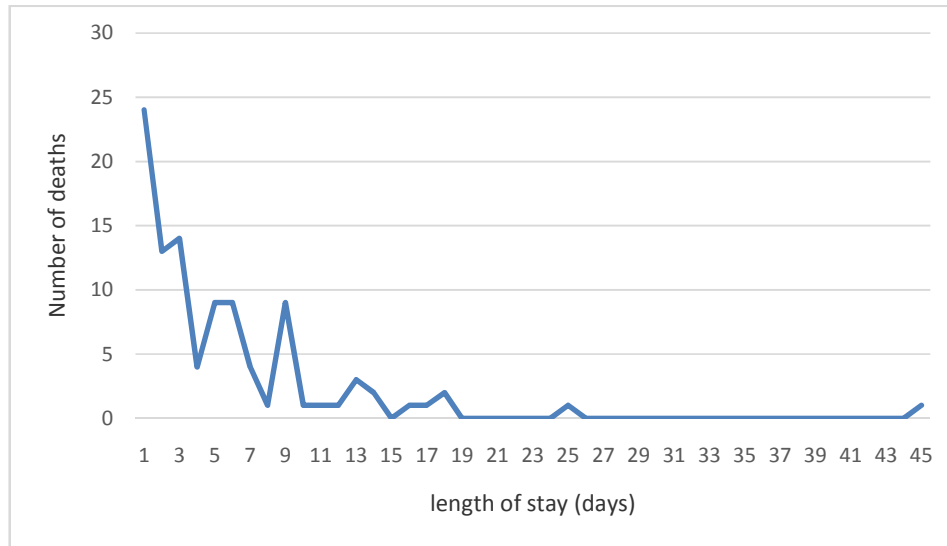


Fig. 2. Number of deaths to the length of stay in the ICU

Table 4. Age-related mortality of the patients in the ICU

Age (years)	(Nos)	(%)	Mortality	% Case fatality
< 10	23	18.1	16	69.6
< 5	13	10.2	10	76.9
6 - 10	10	7.9	6	60.0
11 – 20	28	22.0	22	78.6
21 – 30	43	33.9	37	86.1
31 – 40	17	13.4	11	64.7
41 – 50	9	7.1	7	77.8
> 50	7	5.5	4	57.2
Total	127	100	97	76.4

$\chi^2 = 30; P < 0.001$

3.2 Cause of Death

The probable cause of death observed amongst the admitted patients included complications of fluid and electrolyte derangement n = 58 (59.8%), respiratory failure from inhalational burns n =28 (28.9%). The other causes of death include septic shock and multiple organ failure n = 11(11.3%) and complications of associated injuries especially for the patients that had other trauma such as road crashes n = 5 (5.2%). These complications were either single contributor to death or acted in synergy in the cause of death of the admitted patients.

4. DISCUSSION

Burns is a severe health hazard worldwide because of its associated morbidity and mortality [13]. Flame is the most prevalent type of burns in the region [7-9] and males are often more

affected than females [7]. In another study, a female preponderance was reported [14].

Kerosene explosion was the most prevalent cause of burns (n=31), and the females (n=21) were affected more than males (n=10) in a ratio of 2:1 (P value=0.005). In the domestic settings, the incidence of burns is more among females [13–18]. This prevalence pattern is probably because of their traditional role of home keeping in the Nigerian environment which exposes them to more explosion hazards from adulterated kerosene as was documented in 48.43% of the cases (Table 1). This pattern had been recorded in earlier studies in the region [19,20].

A complete reversal in the incidence was observed with petrol explosion which was the second commonest cause of burns admissions (n=16; 25%). Petrol explosions usually occur in this environment following road traffic crashes

involving tankers laden with petrol and illegal refining and bunkering of petroleum products. Males typically dominate these activities and therefore explain the observed higher incidence of burns from petrol explosion in males (P-value = 0.034). Storage of petrol at unsafe locations is a common practice when there is scarcity, with its attendant risk of explosion and fire. This practice is a common occurrence during periods of petrol scarcity which is now frequent in Nigeria [19,20]. Gas explosion ranked as the third cause of flame burns with the male to female ratio of 3:1. Other causes of burns included electrocution (n=4; 6.25%), gunpowder explosion (n=2; 3.10%), Chemical (n=2; 3.12%) and hot liquid (n=1; 1.56%). The incidence of burns is highest between 18 years and 35 years [1], and this has serious economic implications because it is this age range that provides the necessary work-force that drives development.

Patients with burns require admission in the intensive care unit (ICU) if there is an indication for respiratory support, close monitoring and infusion of vasoactive agents. Admission of patients who are clinically stable or too ill and unlikely to survive only increases demand on human and material resources [21-23]. It is therefore imperative that only patients with severe but reversible conditions be considered for admission into the ICU. Transfer from ICU to the Burn ward should be considered when the physiological status of the patient has been stabilized [24]. Admission, treatment and discharge home directly from the ICU as was seen in two of the cases are not in line with this standard practice (Fig. 1). Fourteen (11.86%) of the cases with less than 30% burns and without inhalational component were admitted, mainly because of social considerations. This group of patients could have been adequately managed in the Burns Unit.

A critical indication for admission in the ICU is inhalational burns because of the risk of glottic oedema which can result in acute airway obstruction, and also carbon monoxide poisoning. Only 48 (37.79%) patients sustained inhalational burns, and their admission in the ICU was deemed appropriate. Forty-three (33.85%) patients with over 80% burns may have been too ill to benefit from care in the ICU considering published results from the region. In the United States of America with better facilities for management of burns, the burn size associated with a 50% case fatality (LA50) is approximately 70% TBSA [25]. In a developing environment like

Nigeria, 100% mortality is recorded for burns involving 60% TBSA and above in the same locality [23], 100% mortality for burns with 80% TBSA and above in another study [27], and this underscores the need for the provision of better facilities and training of personnel. The 24 (24.47%) deaths in the first 24 hours (Fig. 2) is an indication that the injuries were either too severe, and admission of such cases with expected poor prognosis in the ICU only increases demand on the scarce human and materials resources, and affects the level of care and the psychology of those with a better chance of survival adversely. Such result may be a reflection of defective pre-hospital and early hospital care with the inadequate resuscitation of such injuries.

Nates et al. in the Society of Critical Care Medicine's guidelines for ICU admission, Discharge and Triage recommends that conditions in which treatment outcome will be futile are not appropriate for ICU admission [10]. Extensive interventions for such cases such as admissions into the ICU are not encouraged as the outcome of such cases are usually fatal. In the ICU where this study was undertaken, the criteria for admission into the ICU for patients with burns do not appear to follow any particular guideline or protocol as recommended by Nantes et al. [10], NIH Consensus Recommendation [11] or suggestions by Sprung et al. [12] as patients who may not benefit from or require ICU care were admitted into the ICU for various reasons. Admission of some patients into the ICU on social grounds introduced significant inefficiency in a system that was already burdened with inadequate resources especially when even patients that required advanced care such as mechanical ventilation could not be ventilated because of non-availability functional ventilators in the ICU.

A good number of the patients admitted into the ICU could have benefitted with improved care in the regular burn wards with improved monitoring and supplemental oxygen delivery which was the essential treatment most of the patients received in the ICU. Local protocol based on sound research, and clinical judgement is therefore required to determine the severity of burns that may benefit from admission and care in the ICU since the levels of care available and the outcome for burns differ between institutions and regions.

The average length of stay (LOS) in the ICU was 9.94 ± 2.30 days for those that survived as opposed to the 5.61 ± 1.50 days for those that died, $t = 9.68$ $P = 0.0001$. This mortality pattern is a reflection that persons admitted into the ICU with severe burns were either too sick to survive the injury or not severely injured to necessitate admission into the ICU thus stretching the available resources (human resources and materials) for burn patients who require and would benefit from hospitalization and care in the ICU. The observed pattern may also reflect the quality of resuscitation the patients received in the ICU especially when the fatality is related to the severity of the burns. The fact that one of the admitted patients signed against medical advice after 32 days of admission indicates that the patient did not require hospitalization in the ICU for that length of time. The patient felt well enough to leave the hospital. The high number of patients with undocumented TBSA, $n=63$ (49.6%) was somewhat worrisome and indicated poor documentation and administrative processes in the ICU. These observations formed part of the reasons that informed the decision to audit the admission pattern into the ICU and the influence of such admission on the outcome of Burn Patients. Regular review of patients should, therefore, be undertaken to identify those patients who may no longer need hospitalization in ICU. As soon as the patient is stable clinically, the patient is expected to be transferred to Burns Unit [28-29].

The pattern of death with most of the deaths occurring in the first week of admission confirms that a good number of the patients must have had inadequate resuscitation with fluid and electrolyte derangement from over or under resuscitation. Again, some of the patients had extensive burns that required advanced medical care and monitoring to survive the injury. The observed cause of death was on sound clinical judgment occasionally supported by laboratory finding as most of the relations of the dead readily accept post-mortem examination due to social and cultural reasons and ignorance.

Going by the guidelines of the SCM, there is the need to develop clear ICU and institutional non-beneficial treatment policies through consensus of all the parties involved (physicians, nurses, administrators, lawyers, ethicists, and family representatives) [10]. There is, therefore, the need for guidelines on admission and discharge of patients with burns injuries into the ICU in the centre as is done in other advanced burn

centres. The admission criteria should select patients who are likely to benefit from ICU care [21-26]. Such standards should identify conditions, in which ICU admission will be of no more significant benefit than admission in the general ward [27], especially burnt patients at the extremes of either very low risk of or very likelihood of death [23]. Such patients are described as "too well" and "too sick to benefit" [30]. Better funding, human resources development and provision of necessary equipment can have a positive impact on the general outcome of patients with burns and should be considered by the policymakers since the poor may be related to the availability of quality resources.

5. CONCLUSION

Admission of patients with burns into the ICU did not follow any established guidelines and did not appear to have influenced the outcome. The mortality rate for burn patients admitted to the intensive care unit in the study centre seems relatively high to the TBSA. Some admissions of burns patient into the ICU was somewhat unnecessary as such could be considered as a drain on available lean resources.

6. RECOMMENDATIONS

Since admission into the ICU did not improve the outcome of Burns patients, appropriate triage and adherence to established guidelines on admissions and discharges into the ICU should be encouraged. Such practise will reduce the number of inappropriate admissions which only increased demand on the personnel, and material resources, and decreased the quality of care to those that have some chance of survival. Institutional protocols and guidelines are required based on sound clinical judgement and research on criteria for admission and discharge of patients with burns into the ICU for efficient management of available resources. Better funding and training of personnel will improve the quality of care, with a better outcome in the ICU.

7. LIMITATIONS

Data on causes of the burns cases admitted in our ICU was incomplete due to poor record keeping, which may have affected the quality of the data.

There are no established guidelines on criteria for admission of patients with burns in the region.

Using standards set in developed countries may not be readily applicable in the locality because of economic, social and cultural variations.

CONSENT

It is not applicable.

ETHICS APPROVAL

Study was approved by the Management and the Ethical Review Committee of University of Port Harcourt Teaching Hospital.

AVAILABILITY OF DATA AND MATERIAL

The data that support the findings of this study are available from the Authors but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the authority of Ethical Committee of University of Port Harcourt Teaching Hospital Port Harcourt.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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