

A RETROSPECTIVE STUDY OF BURN PATIENTS IN HOSPITAL SULTANAH NUR ZAHIRAH, MALAYSIA (2015-2020)

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Abstract

Introduction: A retrospective review of all burn patients admitted to the Burn Unit between 2015 -2020. To determine the demographics, causes, total body surface area (TBSA), length of hospital stay and their relationship with TBSA, percentage of patients requiring surgery, mortality and its causes, and the relationship of inhalational injury to mortality of burn patients in Terengganu over six years.

Materials and methods: A descriptive study. Data were collected through the Hospital Information System (HIS). Data were analysed using IBM SPSS Statistics V21.0.

Results: A total of 805 patients were admitted to the Burn Unit between 2015 -2020, with an average of 134 individuals annually. Minor burns accounted for 591 cases, moderate burns for 131 cases and 83 patients suffered major burns. Children were the most affected, accounting for 63% of all BI cases. The mean age for paediatric patients was 3.78, while for adults, the mean age was 36.7. The male-to-female ratio, irrespective of age group, was 1.67. The most typical BI causes were scalds. The average length of stay was 15 days, during which a 1.6% mortality rate was recorded. Inhalational injury was strongly linked to death. According to Fisher's exact test, TBSA in BI and length of stay were significantly correlated ($P < 0.001$). Surgery was needed in 29% of children and 46.5% of adults.

Conclusions: The significant incidence of burn injury in this study suggests that raising awareness and increasing education by the authorities is a critical prevention initiative.

Keywords: Burn, Epidemiology, Mortality, Inhalational Injury, Malaysia

Introduction

Burn injury (BI) is a seriously debilitating condition affecting physical and mental health, which has a financial impact on the health sector. In developed countries, BI accounts for more than 50,000 admissions with a mortality rate of 5-6% (1). In 2008, the World Health Organization (WHO) reported that fire-related burns accounted for over 300,000 deaths per year (2). The Burn Unit of Hospital Sultanah Nur Zahirah (HSNZ) was established in 2004 with eight beds and one operation theatre and was equipped with devices and equipment similar to those in the Intensive Care Unit (ICU) for the purpose of close monitoring and managing of burn patients. Until newer facilities were built in neighbouring states, it was the only tertiary referral centre on Malaysia's East Coast with a well-equipped Burn Unit and expertise in Plastic, Burn, and Reconstructive Surgery (PRS). A PRS team was established in Kuantan, Pahang in 2016 and in

Raja Perempuan Zainab II, Kelantan earlier than 2008, but both hospitals are dependent on the ICU and general ward for inpatient management, and neither hospital has a well-equipped Burn Unit. However, in Kubang Kerian, Kelantan the Burn Unit in Hospital University Sains Malaysia (HUSM) was established on 1st May 2000 and commenced full operations on 9th September 2004. Since then, the HUSM Burn Unit has been handling burn cases and surgeries in Kelantan.

Local epidemiological data regarding burn injuries in Malaysia is scanty as the country does not have a national registry, and few papers have been published on this matter. Chan et al. (3) looked at single institution burn patterns and admissions over two years and reported on only a small number of patients. Another local study by Tan et al. (4) concluded that predictors for mortality in burn patients were a total body surface area (TBSA) of more than

20%, early Systemic Inflammatory Response Syndrome (SIRS), mechanical ventilation, and inhalation injury.

This study aimed to:

- a. Determine the demography of patients admitted to the HSNZ burn unit
- b. Identify the aetiology of burns according to age and gender
- c. Report the percentages of major and minor burns among patients admitted to the HSNZ burn unit
- d. Correlate the TBSA of burn injury with the length of hospital stay
- e. Identify mortality risks and causes of mortality
- f. Determine an association between mortality and inhalation burn injury

Materials and methods

Setting

Malaysia is a Southeast Asian country with a population estimated at 32.0 million (5). HSNZ is the only tertiary hospital in the state of Terengganu treating burn cases for the entire state, catering to a population of 1.26 million (5). The Burn Unit was established in 2004 with eight beds and one operation theatre. Each bed in the Burn Unit is equipped with machines, equipment, and ventilators so that the Burn Unit can function as an ICU as well. In a situation where there is no available bed in the Burn Unit, a burn patient requiring intensive care or mechanical ventilation would be admitted to the ICU. Burn admission criteria at the unit are based on the “**Terengganu State Burn Manual**” adapted from the Australian and New Zealand Burn and Association (6). Patients who do not meet the admission criteria are treated as outpatients at the Burn clinic.

Study population

All BI admissions to HSNZ Burns Unit or Intensive Care from 2015 to 2020 were included in the study. The study excluded incomplete data. Recurrent admissions for surgical intervention or management of burn sequelae were also excluded.

Ethics approval and consent to participant

The study was approved by the Malaysian Medical Research & Ethics Committee: NMRR ID-22-00070-XXI (IIR).

Data collection

Retrospective data collection was done using the Hospital Information System (HIS) from January 2015 to December 2020. The sociodemographic parameters studied encompassed age, gender, and race. Data were categorized into adult and paediatric (patients who were younger than 12 years old) age groups.

Scald, friction, flash, flame, contact, chemical, thermal, and electrical burns were categorized according to their aetiology and the possibility of inhalational harm. The depths of the burn wounds were accessed clinically during admission and categorized into:

1. First-degree burns, clinically presenting as erythematous skin with intact pain sensation
2. Second-degree burns, divided into superficial partial-thickness or deep partial-thickness burns depending on the depth of the dermis affected. Superficial partial thickness degree burns had immediate blanching, while deep partial thickness burns appeared white with delayed or non-blanching on pressure.
3. Third-degree burns, affecting the entire skin thickness; clinically, they were white and caused little or no pain since the nerve endings were damaged.

Patients were divided into three groups depending on age and BI severity, and the TBSA of burn wounds was computed using the Lund and Browder chart (Table 1).

Table 1: Classification of burn severity

	Minor Burn	Moderate Burn	Major Burn
Adult	< 10% TBSA	10.1- 20 % TBSA	>20% TBSA
Paediatric	< 5% TBSA	5.1 – 10% TBSA	>10% TBSA

TBSA: Total Body Surface Area

The admission criteria were based on the local protocol “**Terengganu State Burn Manual**” adapted from the Australian and New Zealand Burn and Association (6). Criteria for admission were:

1. Burn greater than 10% TBSA
2. Burn of special areas (face, hands, feet, genitalia, perineum, major joints)
3. Full thickness burns greater than 5% TBSA
4. Electrical burn
5. Chemical burn
6. Burn with an associated inhalation injury
7. Circumferential burn of the limbs or chest
8. Burn at the extremes of age – children and elderly
9. Burn injury in patients with pre-existing medical conditions, which could complicate management, prolong recovery, or affect mortality
10. Any burn patient with associated trauma

The length of stay was calculated from the date of admission to the date of discharge. Inhalational injury was determined based on history, physical examination, and investigations such as arterial blood gasses and chest X-rays. Data were also gathered on the number of patients who had undergone surgical and nonsurgical interventions.

Data analysis

Data were analysed using IBM SPSS Statistics V21.0 0 for descriptive analysis, and Fisher’s exact test analysis was used to study the correlation between TBSA and duration of stay. The chi-square test was used to study the correlation between inhalation injury with mortality.

Results

807 patients were admitted to the HSNZ Burn Unit over six years (2015-2020), with two missing data points excluded from this study.

Sociodemographic features

The study population was divided into adult and paediatric groups based on age. During the study period, 60.2% of the patients were paediatric, while adults made up the remaining 39.8%. The mean age for the paediatric group was 3.78, and for the adult group, the mean age was 36.7. Males were 1.67 times more susceptible to BI than females. The sociodemographic data of the study population are provided in Table 2 and Table 3.

Table 2: Social demographics and variables for adult patients

Adult Variable	Frequency n = 320	Percentage	Mean Age
Gender			
Female	106	33.1	3.67
Male	214	66.9	
TBSA			
Minor	224	70.0	
Moderate	52	16.2	
Major	44	13.8	
Length of stay			
<15 days	233	87.0	
16-30 days	68	11.3	
31-60 days	13	1.4	
>60 days	6	1.9	
Operation			
Yes	149	46.5	
No	171	53.5	

Table 3: Social demographics and variables for paediatric patients

Variable	Frequency n = 485	Percentage	Mean Age
Gender			
Female	195	40.2	3.78
Male	290	59.8	
TBSA			
Minor	367	75.7	
Moderate	79	16.3	
Major	39	8.9	
Length of stay			
<15 days	422	87.0	
16-30 days	55	11.3	
31-60 days	7	1.4	
>60 days	1	0.3	
Operation			
Yes	141	29.1	
No	344	70.9	

Between 2015-2020, the number of BI admitted per month ranged from 6 – 19 cases/month, with an overall average of 134 cases per year, summarized in Figure 1.

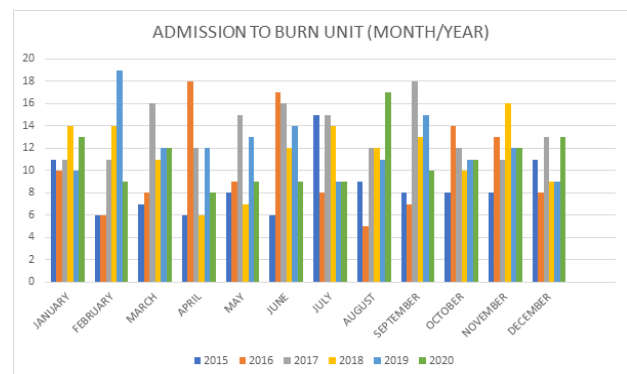


Figure 1: Admission to burn unit according to month and year

Aetiology of burn based on age group

Scald was the most common cause of BI in both age groups, affecting 69.8% of children and 25.6% of adults. Figure 2 and Figure 3 show a comparison of different burn aetiologies for the two age groups.

Total body surface area and length of stay

Minor burns were the most common type of burn for both age groups. Paediatric minor BI cases (367/485) accounted for 75.7% of cases, moderate (79/485) 16.3%, and major (39/485) 8.0%. For adults, minor TBSA 224/320 accounted for 70% of cases, moderate (52/320) 16.2%, and major

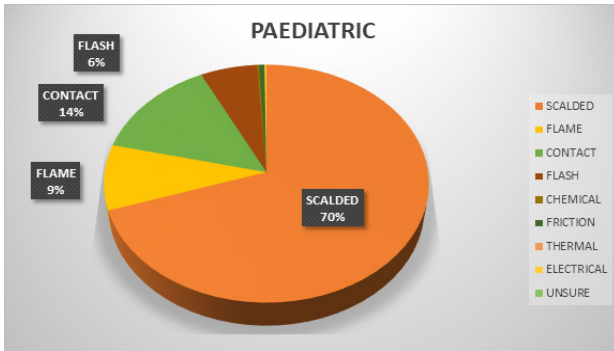


Figure 2: aetiology of burn for paediatric patients

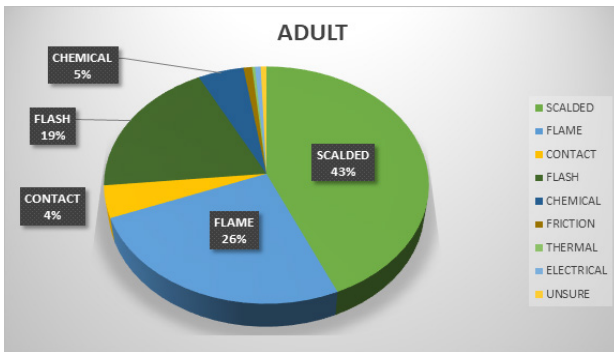


Figure 3: Aetiology of burn for adult patients

(44/320) 13.8%. Most of the cases admitted to the burn unit (73.42%) were minor burns, followed by moderate burns (16.27%) and major burns (10.31%). Table 2 and Table 3 show a comparison between gender and TBSA.

Most BI cases were admitted for 15 days (81.3 % of all cases), with 15.3% admitted for 15-30 days. 2.5% of patients stayed for 31-60 days, with seven cases (0.9%) staying for more than 60 days). Figure 4 summarizes the data.

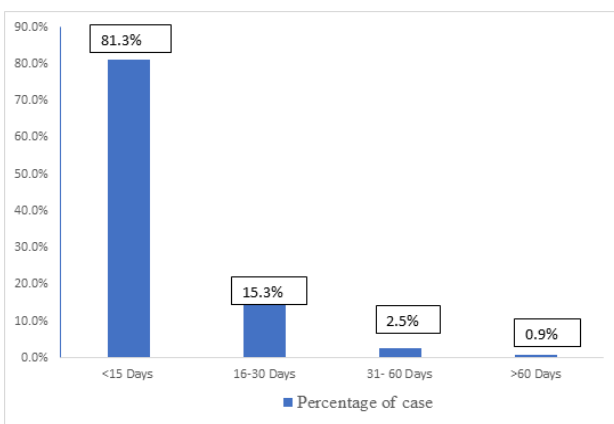


Figure 4: Length of hospital stay

A Fisher’s exact test indicated that the TBSA in BI correlated with the duration of hospital stay. Therefore, there was a significant association between TBSA and duration of hospital stay ($P < 0.001$).

Treatment

The treatment of a burn patient included both medical and surgical treatment. Of the paediatric group, 29% required surgical intervention, while 46.5% of adults required surgical intervention. Escharotomy, tangential excision, and split skin graft or local flap were the surgical treatments for BI. Table 2 and Table 3 show the total number and percentages of cases operated on by age group.

Mortality, cause, and relation with inhalational injury

During the six-year study period, 13 patients died from BI, resulting in a 1.6% mortality rate. There was one case of a paediatric patient with severe burns, and the other 12 cases were from the adult group. Major burns were the most common cause of death 69.2% (9/13 cases), while the other causes were 2 cases of major burns complicated with septicaemic shock secondary to bacterial infection (15.4%) and 1 (7.7%) case with septicaemic shock secondary to hospital-acquired pneumonia and 1 (7.7%) case with cause of death listed as severe airway obstruction.

Inhalation injury was reported in 2.4% of the patients in this study, which was 20 cases out of 805. Five of the 20 (25%) patients with inhalational injury died. A Chi-square test for independence indicated that inhalational injury was significantly associated with mortality rate ($P < 0.001$).

Discussion

The data only represent cases admitted to a single tertiary centre; BI data from district hospitals were not collected, so the data do not represent the burden of the entire state. Terengganu has four district hospitals without specialists and one with an in-house surgeon serving a population of 1.14 million people. The burn unit was usually fully occupied based on the number of admissions per month.

Most BI involved children, accounting for 63% of total admissions. According to Ho and Ying, 51.7% of cases in Hong Kong were paediatric burns, with 42.7% involving toddlers (age 2 years) (8). Most childhood burns were reported to occur in the home (4). Children also enjoyed playing with fire, which also contributed to burn injury (7). Domestic burns accounted for 71.1% of injuries, followed by industrial burns 16.5% (5).

Males, both adult and paediatric were more prone to BI, which could be attributed to males being involved in activities with a greater risk of burn injury in their daily lives, especially outdoor activities such as burning trash, playing with fire as well as workplace injury. However,

there was a notable inconsistency in the reporting of the gender distribution of burns. While most studies in children reported a significantly higher number of burns among males, this bias towards males was not seen across all age groups (7).

Terengganu's population in 2017 was 1.21 million, 1.23 million in 2018, 1.24 million in 2019, and 1.26 million in 2020, according to Malaysia's Department of Statistics official portal, with approximately 1.10 million Malays (5). Since most Terengganu residents are Malay, the majority of cases were also Malay.

The most common BI for both paediatric and adult cases was scalding, with contact and flame injury coming in second and third, respectively. The most common cause of scald burns was hot oil from cooking or a splash of hot water. Nowadays, many homes have water filters that children can access, this may have also contributed to the scald type of BI. The study by Ho and Ying showed that scald burn injury accounted for 90.4% of cases and thermal burns 8.2% (8).

Total body surface area was one of the factors influencing burn outcome; the other factors were the depth of burn and location. Of the 70% of cases that had minor BI, TBSA was less than 10% in children and 15% in adults. The percentage of cases of major burn in the adult group was 13%, while in the paediatric group it was 8%. This can be reflected in the length of stay; in the adult group the percentage for length of stay more than 15 days was 27.2% while for the paediatric group it was 13%. Statistically in this study, there was a weak correlation between TBSA and length of stay. Since most BI were minor burns, the admission period for most cases was less than 15 days; 65.5% of patients admitted to the burn unit had a length of stay of 15 days. A paper published by Sierra Zúñiga et al. regarding factors associated with length of stay for minor and moderate burns in Popayan, Colombia, reported that the average hospital stay was 20.4 days and the median stay was 14 days (10). The TBSA and length of stay had a weak but statistically significant correlation.

46.5 percent of adult cases required surgery, compared to 29.1% of paediatric cases. The need for surgery was determined by the TBSA as well as the depth of the burn (3). The proportion of moderate and major burns in adults was 30%, while in paediatric cases, it was 24%. In future studies, complete data on the depth and TBSA of burn wounds will be used to determine whether there is a significant difference between the two groups when undergoing surgery. The mortality rate for this study was only 1.6%, which was 13 cases out of the 805 admitted cases, with the majority of the mortality cases being due to major burns. The mortality rate reported by Chan et al in a review of burn injuries in West Malaysia over two years was 6.3% (3). Studies from other countries revealed a lower mortality rate; Sierra Zúñiga et al. (10) reported a 1.4% mortality rate in Colombia, and Cronin et al. 1.8% in Ireland (11). Muguti et al. (12) and Ho and Ying (8)

reported the mortality rate to be 2% and 2.3% respectively in Zimbabwe and Hong Kong.

Throughout the period of our study, 20 cases of inhalation were recorded, with 5 of the patients affected by inhalation injury succumbing to death. A study published by Tan et al. regarding the predictors of mortality showed that inhalation was one of the contributing factors for mortality (4). Children are more likely to sustain scald burns in a domestic accident at home, whereas adults are more likely to sustain flame burns in a workplace fire that may result in inhalation injuries (13). More cases are needed to study the relationship between inhalation and mortality in our setting to determine the significance.

Conclusion

This study examined burn patients admitted to the Burn Unit of HSNZ between 2015 and 2020 in terms of prevalence and sociodemographics. Because of the high prevalence of burn patients, we had already fully utilized the burn unit to optimize treatment. Scald burns were the most common aetiology in both age groups, hence better awareness and education can be spread through social media to prevent such injuries. Because most of the cases admitted were minor burns, the average length of stay was less than 15 days per patient. Inhalation is one of the contributing factors to burn mortality in addition to a large TBSA. To obtain a better correlation in relating inhalation with mortality, a cohort study with a larger sample of patients with inhalation injury would need to be conducted. The Burn Unit is critical for optimizing care and preventing cross-infection on the sterile burn wound. Given the prevalence of BI, the number of beds available for patients can be increased to accommodate these cases.

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Conflict of interest

There are no conflicts of interest affecting this work or paper.

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