Introduction

Burn injuries are among the most severe traumas that a person can experience, resulting in devastating effects on the skin, the body’s largest organ. Burn injuries are a significant public health problem worldwide, but they are more common in developing than in developed countries, mortality rate being eleven times higher in the former. Burns have a heavy economic burden, not only on health care services, but also on children and their families, resulting in repeated hospitalization and long-term rehabilitation, in addition to social, psychological and education-
al consequences in terms of loss of school days, possible future unemployment and social rejection. Because children are curious in nature, they tend to explore objects as soon as they become able to move. This exploration of surrounding objects can cause harm and increase the risk of burns. Children, including those in the school and preschool age group, make up a significant proportion of burns admissions. They account for a higher number of emergency department visits than any other age group. A global estimation of hospitalized burned children in 2004 was 505,276 cases. Aetiology of burn injuries varies accordingly. Scalds represent more than 50% of all burns, and one fourth of all cases require hospital admission.

Over the past eight years, the Gazan people have been struggling to adapt and cope with harsh siege and the impact of three consecutive wars from 2007 to 2014, in addition to deteriorating public services, economy and life standards. Details of the profile and epidemiological characteristics of hospitalized burn injuries among children are missing or unavailable. Therefore, the aim of this study is to determine mortality rate and hospital length of stay, and describe the epidemiological profile of children under 15 years of age. Such information will be useful for policy makers outlining related principles to understand the problem and set out plans for prevention measures. It is also important to compare the results with published data and contribute feedback to the target of developing prevention campaigns.

Materials and methods

The methodology of this study was retrospective review of medical records, plus assessment of admission sheets from 30 June, 2013 to 1 July, 2014 (Fig. 1). The sheet had to be filled in by the department’s doctor when the patient was admitted to the unit. It includes socio-demographic data and information on burn size, depth, location and causes. Moreover, it contains information on discharge status and interventions performed. Only acute burns of children under 15 years old, who spent at least one night in hospital, and who were directly admitted from the hospital emergency department or referred from other hospitals were included in the study (Fig. 2). Outpatients were not included.

![Fig. 1 - Admission and assessment sheet.](image-url)
The study setting was Al Alamy Burn Centre in the Al Shifa Medical Complex, the largest public hospital under the Ministry of Health (MoH) in the Gaza Strip. Al Alamy Burn Centre was established in 2007, and serves approximately 1.2 million inhabitants covering 3 out of 5 Gaza governorates. It also receives severe burn injuries from the sole burn unit in the remaining southern governorates. It has 12 beds in six rooms, three ICU beds, an operating room and a dressing and hydrotherapy room. Care is provided by plastic surgeons, expert nurses, physiotherapists and the recent addition of a psychologist. The assessment and admission sheets were reviewed for age, gender, total body surface area (TBSA), depth of burns, etiology of burns, hospital length of stay (LoS), mortality, type of burn injuries and surgical procedures performed. TBSA was estimated using the rule of nines. The children were divided into three age groups: infants/toddlers (0-2 years), early childhood (3-6 years) and late childhood (7-15 years). Infants are totally dependent and require the assistance of adults. Patients in the early childhood group are mobile and active, and at this stage children explore and try out new things. Those in the late childhood group become increasingly skilled at understanding logical and concrete information and are more aware of hazards than the previously mentioned groups, but they tend to explore and discover fire and matches.

Data were entered into Statistical Package for Social Sciences (SPSS) version 22, and different descriptive statistics were used to calculate frequencies, percentages, means and standard deviations. Numeric variables like age and LoS were reported as means and standard deviations. Also, median association between variables was examined using Chi square tests. P value ≤ 0.05 was considered statistically significant. The study was conducted according to the principles of the Helsinki Declaration and was approved by the Institutional Review Board of the Al Shifa Medical Complex.

Results

Demographic data

During the study period, a total of 204 admissions were registered. 15 of them (7.4%) were adults admitted for reconstruction purposes, 4 (1.9%) were children also admitted for reconstruction purposes, and 61 (29.8%) were over 15 years of age. The remaining 124 admissions were under 15 years; 72 (58.1%) were males and 52 (41.9%) were females, and male to female ratio was 1.6:1. The mean age was 4.02 ± 2.85 years (median: 3.00 S.E.25) ranging from one month to 15 years. The mean age for
boys was 4.03 ± 2.93 years ranging from 1 month to 15 years. The mean age for girls was 4.08 ± 2.75 years ranging from 1 to 12 years. There was no significant difference in age between girls and boys (P > 0.05). The mean age of children who were exposed to scald was lower than children exposed to fire flame or other causes of burn, although no statistical significance was observed (P = 0.451).

The vast majority of burns (89.5%) resulted from accidents, while 96% occurred at home, and 83.9% were scalds. Table I presents the characteristics of the burn cases included.

**Age and gender incidence**

Out of the 124 admissions, 45 cases (36.3%) belonged to the infant/toddler group, 58 cases (46.8%) to the early childhood group, and 20 cases (16.1%) to the late childhood group (Fig. 3).

**Place of burn injury**

Based on the study results, most burns among children (111 cases = 89.5%) were accidents and 119 cases (96%) happened at home. 83.1% of burns (103 cases) occurred indoors. Place and location of burn injuries were significantly associated with etiology of injury (F = 5.438, P = 0.005 and F = 4.987, P = 0.008 respectively).

**Causes of burns**

Scalds were by far the most common cause of burn injury. 104 injuries (83.9%) were due to scalding, 9 (7.3%) to fire flame and 11 (8.9%) to other causes, including electrical, chemical explosion or inhalation. Analysis of cause of burn with regard to age group showed that scalding was the predominant cause of injury among the 3-6 age group followed by the 0-2 group (Table II).

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**Table II - Etiology of burn injuries among age groups**

<table>
<thead>
<tr>
<th>Age group / etiology of burn</th>
<th>Scald</th>
<th>Fire flame</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2</td>
<td>39</td>
<td>3</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>3 – 6</td>
<td>49</td>
<td>3</td>
<td>6</td>
<td>58</td>
</tr>
<tr>
<td>7 – 15</td>
<td>15</td>
<td>3</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>9</td>
<td>11</td>
<td>123</td>
</tr>
</tbody>
</table>

**Table III - Extent of burns among admitted children**

<table>
<thead>
<tr>
<th>TBSA</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5%</td>
<td>28 (22.6)</td>
</tr>
<tr>
<td>6% - 10%</td>
<td>53 (42.7)</td>
</tr>
<tr>
<td>11% - 20%</td>
<td>33 (26.6)</td>
</tr>
<tr>
<td>21% - 30%</td>
<td>6 (4.8)</td>
</tr>
<tr>
<td>≥ 31%</td>
<td>4 (3.2)</td>
</tr>
</tbody>
</table>

**Table IV - Distribution of study population by depth of burn and etiology of burn injuries**

<table>
<thead>
<tr>
<th>Depth of burn</th>
<th>N (%)</th>
<th>Scald (N)</th>
<th>Fire flame (N)</th>
<th>Others (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>1 (0.8)</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Second</td>
<td>63 (50.8)</td>
<td>59</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Deep second</td>
<td>9 (7.3)</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Third</td>
<td>7 (5.6)</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Mix</td>
<td>7 (5.6)</td>
<td>33</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

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**Extent of burns**

TBSA was divided into 6 groups. 53 (42.7%) children admitted with burns were in the 5% - 10% TBSA group, 33 (26.6%) children were in the 11% - 20% TBSA group and 28 (22.6%) children were in the ≤ 5% TBSA group. The overall affected mean TBSA was 10.72 ± 8.15% (median 9.00, SE .73). There was no significant difference between the cause of burns and TBSA (P > 0.05). Table III shows the distribution of children according to their TBSA percentage.

**Depth of burn**

Most of the children (50.8%) sustained second-degree burns (Table IV). The children who sustained a combination of second- and third-degree burns (34.7%) were mainly burnt by hot water. Fire flame was responsible for 11.6% of these burns.

**Surgical interventions**

Surgical intervention depends on the extent and depth of burn injury. It includes skin graft, debridement and escharotomy/fasciotomy. The department management decided to perform early debridement for all those who required it to minimize the risk of infection and hospital length of stay. A total of 20 (16.1%) patients underwent debridement, while 12 (9.7%) patients were subjected to grafting procedures and only one patient (0.8%) underwent an escharotomy/fasciotomy operation. The burns of the remaining 91
children (73.4%) were managed with dressing only, carried out either by nurses in the dressing room or under general anesthesia in the operating theatre. It is worth saying that dressing under general anesthesia is a good approach for those who cannot tolerate pain or need aggressive dressing.

Hospital length of stay (LoS)

Hospital length of stay was normally distributed and ranged from 1 day to 54 days (Mean: 10.23 SD ± 10.60; Median: 7.00 SE. 0.95). Moderate correlation was shown between LoS and TBSA (Pearson r = 0.37, P = 0.000). There were no significant differences between length of stay, gender (t-test = 0.224, P = 0.823) and etiology of injury (F = 0.620, P = 0.540). There was no significant correlation between age and hospital stay (P = 0.396). More than half of the cases (51%) spent a week in the hospital, while 25% of them spent two weeks. Table V presents mean length of stay for each TBSA group.

Mortality

The two patients who died were males aged two and nine years. TBSA was 30% and 40% respectively. The first boy had third-degree burns and the second boy a combination of second- and third-degree burns. Documentation in these charts was either absent or did not clearly identify a reason for death and complications. Case fatality rate was 1.6% and total mortality rate was 1.0%.

Discussion

The Gaza Strip has a total of approximately 1.8 million inhabitants living over an area of 365 Km². It has only two burn treatment facilities, one in south Gaza Strip and the second in Gaza city. The latter is the only referral burn centre. It provides services to more than 1.2 million inhabitants. Thus we believe that our findings reported here can reflect regional figures related to burn injuries.

A burn is a devastating and catastrophic injury. Catastrophic in its psychological burden, economic costs, physical impairment and social consequences as well. This study provides evidence and sheds light on the picture of burns among the most vulnerable group in the Palestinian community. This paper supports the need for outreach community programs to promote prevention, and for actions to educate parents and ensure safe home environments.

The study’s findings revealed that children made up a large proportion of hospitalized burn patients (65.6%), which is consistent with reports from China, Israel and Australia. More specifically, the incidence of burn injuries was highest among children below 6 years of age, similar to findings from France, Nigeria, Nepal, Iran, South Korea and Iraq Kurdistan.

Scald resulting from hot water was the most common cause of injury. This finding is consistent with reports from high-income countries, showing no differences between developed and developing nations with regard to causes of burns and burn prevention strategies. Males were most affected (male to female ratio 1.6:1), which is similar to a study from Iran. The high incidence of scalds among toddlers and children in the early childhood group is possibly due to their high mobility, longer time spent in the home and inability to protect themselves.

There were no significant gender differences for burns among children in all age groups, which means that both boys and girls are equally exposed to the danger of burns, especially scalds. Interestingly, this is contrary to a report from Africa.

Most patients presenting with second- or a combination of second- and third-degree burns were in the toddler and early childhood age groups. The potential long exposure to the cause of the burn resulted in longer contact time with the skin. Children in the toddler and early childhood groups were possibly unable to remove their wet or drenched clothes as quickly as the older children. Because of this, burn depth can be significant.

The vast majority of burn accidents (96%) among children occurred at home. A similar finding was reported from France and the Republic of Ireland. In the home, burns most commonly occur in the kitchen due to ease of access, as cited in the literature.

Regarding burn severity, more than half of all children (65.3%) had a TBSA of 1% to 10%, which is consistent with other studies from China, Australia and India.

In this study, the total mortality rate was 1.0%. It is worth saying that this mortality rate is comparable with and even lower than reports from Brazil, Turkey and China. Moreover, mortality from Iran and India was 16% and 10.4% respectively. Furthermore, our reported case fatality rate was far better than findings from Iraq. The children’s mean length of stay in hospital was 10.23 days. This is almost double the time reported from Brazil, but slightly better than others which recorded 11.89 and 16.32 days of hospitalization respectively. This means that severity of burn and complications arising during hospitalization could determine the length of hospitalization.

Conclusion

Childhood burns are widely preventable. Success is not determined by treatment of burn injuries, but by the successful prevention of injuries. Every effort must be made to prevent burns among children. It is important to highlight the need to make the home a safe environment, and to educate parents and caregivers in recognizing potential hazards.

Table V - Distribution of the study population by TBSA and length of stay in hospital

<table>
<thead>
<tr>
<th>Length of Stay</th>
<th>≤ 5%</th>
<th>6%-10%</th>
<th>11%-20%</th>
<th>21%-30%</th>
<th>&gt;31%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>6.21</td>
<td>8.86</td>
<td>10.73</td>
<td>19.16</td>
<td>28.75</td>
</tr>
<tr>
<td>SD</td>
<td>7.58</td>
<td>9.34</td>
<td>7.11</td>
<td>11.65</td>
<td>19.51</td>
</tr>
<tr>
<td>Median</td>
<td>3.00</td>
<td>5.00</td>
<td>10.50</td>
<td>19.50</td>
<td>28.00</td>
</tr>
</tbody>
</table>

257
BIBLIOGRAPHY


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