

## Pattern of Burn Injuries and Outcome in Children

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### ABSTRACT

**Objective:** To identify the cause and factors associated with mortality in burn injuries among the children.

**Study design:** A hospital based cross sectional study

**Patients & Method:** A total of 94 children admitted during September 2009 to March 2010 at a tertiary care hospital were included. The variables investigated include age, gender, type of burn, percentage of body surface area burnt, hospital stay and clinical outcome.

**Results:** Out of 94 children 48 (51.06%) were male and 46 (48.93%) were female. Mean age was  $8.97 \pm 4.64$  years. Children above 6 years were more affected and flame or fire was the leading cause of burn injuries, whereas scald burns affected children less than 6 years of age. Over all mortality was 22.8% and more deaths were noticed in children above 6 year. Mean TBSA was  $24.91 \pm 24.15$  and mean hospital stay was  $6.95 \pm 6.81$  days. 90% mortality was observed in children with TBSA > 60%. A significant association was found between TBSA and mortality (p-value <0.000). There was also a significant association between age of the child and causative agent (p - value <0.000).

**Conclusion:** Females with flame burn injuries were more affected in age group above 6 years, while children at pre-school age were affected by scalds. It indicates that burn injuries mainly occur in domestic setup and are therefore preventable. More vulnerable group includes children with TBSA between 30 and 60% and requires more intensive treatment to reduce the mortality.

**Key words:** Burns, children, scalds, mortality, total body surface area (TBSA).

*How to cite this article:* Tirmizi SZ, Mirza FH, Mangi P, Yaseen S, Waseem S. Pattern of Burn Injuries and Outcome in Children. J Dow Uni Health Sci 2013; 7(1): 41-45.

### INTRODUCTION

Burn injuries are common worldwide representing stressful situation particularly in young age group because they have to lead a future productive and active life. Published research indicates that the burn injuries are still a major cause of morbidity and mortality in countries of South East Asia including Pakistan. Among the pediatric patients, burn has emerged as the 3<sup>rd</sup> most frequent cause of mortality after road traffic accidents and drowning.<sup>1</sup> Almost 2 – 6 % of all childhood injuries

are related to the burn in developed countries.<sup>2</sup> One quarter of the burn casualties attending pediatric emergency department belongs to the age group of children less than 5 years.<sup>3</sup> The age and total body surface area are considered to be the two major factors related to the outcome and therefore this is of particular importance among the children who sustain burn related injuries frequently. Burn injuries in a child can produce shock if more than 10 % of the body surface area is involved unless the patient receives adequate replacement of fluid. Children have thin skin compared to adults and sustain burn injuries deeply even at lower temperature. Mostly burn injuries among the children in our culture occur in domestic set up accidentally which are preventable. Recently a study in Karachi has revealed that the burn is the second most common cause of injuries in children less than 15 years of age.<sup>4</sup> A part from morbidity and mortality burns often leave the victims with lifelong physical and psychological trauma. It produces permanent disfigurement and disability if not properly cared. Children are considered as gifts of God in our culture and parents have future hopes and expectations from them. Development of disfigurement and disability as a result of burn related

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injuries cause difficulty in social adjustment. Burn injuries in children, therefore, may sometime result in posttraumatic stress disorder.<sup>5,6</sup> A study from Bangladesh has shown a greater risk of burn injuries among children in houses without a separate kitchen, a kitchen without door or where kerosene lamp was used for lighting purposes.<sup>7</sup> It has been noticed that young children i.e. 4 years and under suffer from scald burn while older children have more exposure to the flame burn.<sup>8,9</sup> Perception of children regarding the danger is less and therefore they can not escape the life threatening situation of burn.

These catastrophe situations of burn injuries particularly in young children are not uncommon presentation in emergency department of a tertiary care hospital or to a private clinic of a medical practitioner. It demands a thorough and deep understanding of factors associated with burn injuries in children which are usually domestic in nature and mostly preventable. This study is therefore conducted with the aim to identify the pattern of burn injuries and risk factors and finally to assess the outcome.

## MATERIAL AND METHODS

A hospital based cross sectional study was conducted on 94 cases admitted to a burn unit of a tertiary care hospital over a period of six months from September 2009 to March 2010. Study variables investigated in these burn cases include age, gender, type of burn, percentage of total body surface area burnt (TBSA), hospital stay and resulting outcome. We divided the studied population into three main groups: Infants/toddlers included children below 3 years: early childhood included children between 3 to 6 year and late childhood i.e. children above 6 years and below 15 years.

Source of data was case records obtained from burn unit of tertiary care hospital. Percentage of burn was determined by using Lund and Browder chart. The study included all children of either gender with burn injuries who got admission in the hospital. Children over fifteen year were excluded from the study. Children who were managed as outdoor patients and had minor burns were excluded. Informed consent was taken from the parent/ guardian.

Data was entered in a Microsoft Excel spreadsheet and analyzed using SPSS version 13. Chi-square test was used to calculate the p value for comparison of two groups.

## RESULTS

A total of 94 children were admitted in hospital due to burn related injuries during the period from September 2009 to March 2010. Among them 48 (51.06%) were

male and 46 (48.93%) were female. The mean age was  $8.97 \pm 4.65$  years. Two third of the total population belonged to children above 6 years. Males were commonly affected in age group below 6 years while females out numbered male in age group above 6 years. (Table 1).

Table 1: Age & Gender Distribution of Burn Patients (N=94)

Age	Male	Female	Total Patients (% Age)
< 3 Years	10	6	16 (17 %)
3-6 Years	10	6	16 (17 %)
>6 Years	28	34	62 (65.9%)
Total	48	46	94 (100 %)

Flame was the most common cause of burn injuries (41.48%), followed by scald (30.85%), chemical (13.82%), electric (10.63%) and flash burn (3.19%) respectively. Children less than 6 years suffered mainly from scald while flame was the leading cause of burn in children more than 6 years. (Table 2)

Table 2: Types of Burn (N=94)

Age Group	Fire Burn	Scald	Chemical	Electric	Flash	Total
< 3 Years	3	11	1	1	0	16
3 - 6 Years	2	8	3	2	1	16
> 6 Years	34	10	9	7	2	62
Total	39	29	13	10	3	94

Over all mortality was 22.89% after excluding the LAMA cases as their outcome was not known. Highest mortality was noted in children more than six year and least in age group between 3 - 6 years. (Table 3)

Table 3: Age & Outcome Relationship (N=94)

AGE	D/C	EXPIRED	LAMA*	TOTAL
< 3 YEARS	12	2	2	16
3-6 YEARS	13	2	1	16
>6 YEARS	39	15	8	62
TOTL	64	19	11	94

Mean TBSA was  $24.91 \pm 24.15$  and mean hospital stay was  $6.95 \pm 6.81$  days. 44.68 % of the total population suffered less than 15% TBSA burn while 29.78% had 15 -30% TBSA burn. Only few children were found to have TBSA more than 30%. Children with less than 15% TBSA were successively cured with daily dressing, antibiotic treatment and fluid replacement therapy. Fatality increased with the

increasing TBSA. It was 40%, 71.4% and 90 % with TBSA 31 – 45 %, 46 – 60 % and > 60% respectively. After excluding LAMA cases, out of 22 patients above 30% TBSA 16 children died making mortality rate of 72.72 %. (Table 4)

Table 4: Age and Total Burn Surface Area (TBSA)

Age	<15%	15-30%	31-45%	46-60%	61-75%	>75%	Total
	Tbsa	Tbsa	Tbsa	Tbsa	Tbsa	Tbsa	
<3 Years	5	7	2	0	0	2	16
3-6 Years	8	5	1	1	1	0	16
> 6 Years	29	16	3	7	3	4	62
Total	42	28	6	8	4	6	94
Mortality	0	3	2	5	4	5	19

A significant association was found between percentage of burn and outcome or mortality when the two groups of children i.e. below and more than 6 years of age were compared with TBSA equal to or less than 30% or more than 30% (P – Value <0.000). We also found a significant association between age of burned children and causative agent (P – Value < 0.000). Children less than 6 years were mainly affected by scald while flame or fire burn was the main causative agent in children more than 6 years. There was no significant association of gender with mortality (P – Value < 0.499) and hospital stay (P – Value < 0.443).

Table 5: Association of Percentage of Burn with Outcome (N=83)\*

%Age of Burn	D/C	Expired	Total	P – Value
< 30 % Tbsa	58	3	61	0.000
> 30 % Tbsa	6	16	22	

\*LAMA cases excluded

Table 6: Association of Agent (Flame & Scalds) with Age (N=68)\*

Agent	= 6 Year	> 6 Year	Total	P – Value
Scald	19	9	28	0.000
Fire Burn	5	35	40	

\*Chemical, electrical and flash burn not included

## DISCUSSION

Generally poor and aesthetic outcome of burn victims even after the treatment in a burn unit makes the prevention of childhood burn important. In this study more male were involved under the age of six year while females were predominantly involved after six year. Slightly more involvement of boys has been

Table 7: Association of Gender with Mortality (N=83)\* & Hospital Stay (N=94)

Gender	Survivor	Expired	Total	P – Value
Male	35	9	44	0.499
Female	29	10	39	
*11 LAMA cases excluded				
	Hospital Stay = 7 Days	Hospital Stay >7 Days	Total	P – Value
Female	31	15	46	0.4438
Male	33	15	48	

observed in our study while comparing overall age. Our study is consistent with other studies. Reports from other studies indicated that male children are at more risk of burn injuries because of their exploring and careless nature.<sup>10,11</sup> A similar results has also been shown in a study from USA, which indicated more involvement of boys and children less than 6 years of age.<sup>12</sup>

Most studies focused that burn related injuries are more prevalent in children less than 6 years of age.<sup>13</sup> While our study has shown that most of burn related injuries involved female children above 6 year. This difference could be due to our family trends and set up where females are involved in cooking and domestic work from childhood while males are given due care. Thermal burns as a result of flame or fire were found to be more common in our study. Similar result has been found in study from USA which showed that 59.5% burn related injuries resulted from flame.<sup>12</sup> Another study from Nigeria has reported flame burn as the leading cause of pediatric burns.<sup>14</sup> In USA this finding could be attributed to exposure of adolescents and young adults to inflammable materials at school, recreational sport facilities and other public property. In our country and Nigeria, it may be the result of open kitchen, use of kerosene lamp and stoves in economically poor population. Our study has shown that female constituted the major population of burn related injuries in children more than 6 years of age. In poor and illiterate peoples of Pakistan, who make significant proportion of our population, girls are not being sent to school, involved in domestic work and thereby exposed to burn at younger age. Scald represented the second most common cause (30.85%) of burn related injuries in our study but it formed the leading cause of burn injuries in children younger than 6 years. This is in accordance with the study done in most of the developed countries.<sup>8,15</sup> 25.5% of scald burns after the flame burns has been reported in a study conducted in USA.<sup>12</sup> This is closer to our study which shows 30.85% of scald cases. Contrasting result

has been shown in a study from Pakistan in which scald burns was reported to be 70.3%.<sup>11</sup> This may be due to difference in the criteria of sample selection. Our study showed 13.82% chemical burn which is higher than the studies done in other countries. US study has shown 8.8% chemical burn<sup>12</sup> while systemic review from China has reported 0–7% chemical burn.<sup>16</sup> A high rate of chemical burn in our study could be due to lack of storage of chemicals in proper and locked cabinets as is usually seen in our culture. Another factor contributing to high chemical burns is handling of chemicals by the children either at home or outside during their work in socioeconomically poor population of our country as it is shown in our study that elder children are mostly affected by chemicals. Electric burns constituted 10.63 % of all burn patients in this study which is closer to another study done in Pakistan which showed 8.8 % of electric burn.<sup>11</sup> Nigerian study has shown only one case of electric burn which is contrary to our study.<sup>14</sup> While the systemic review from China has reported 0–10% electrical burns.<sup>16</sup>

Unfortunately 19 out of 83 (11 LAMA cases) children died making the overall mortality rate of 22.89%. This is reasonably high as compared to another study done in Pakistan which has reported 9.09% mortality rate for the hospitalized children.<sup>11</sup> One of the Iranian study has reported 16% mortality rate which is a little bit closer to our study.<sup>17</sup> High mortality in our study could be due to unhygienic conditions of public sector hospital leading to multiple infections as well as delay in seeking medical advice due to economical problems of poor community.

Mean TBSA was 24.91% in our study which is closer to another study of Pakistan<sup>11</sup> in which 27.07% mean TBSA was reported for hospitalized children. Systemic review by Nasih Othman<sup>18</sup> from UK has reported 14–30% mean TBSA in children of East Mediterranean countries which is in agreement of our study. Mean hospital stay was found to be  $6.95 \pm 6.81$  which is low as compared to other studies.<sup>11,19</sup> This may be due to large number of children with burn of TBSA less than 30%, who were discharged within a period of week after receiving the emergency management. Our study has clearly indicated low mortality in children with TBSA < 30%, as two third of children with burn of TBSA = 30% were admitted in the hospital, out of which only 3 children died. This is in accordance with other study done in USA.<sup>20</sup> In our study more deaths were reported in children above 6 year with burn of TBSA more than 30% when compared with children group less than 6 year of age. It is important to note that no death occurred in children with burn of TBSA less than 15% in either age group although 10% TBSA is considered fatal in children. This is in accordance

with the study done in Mumbai, India.<sup>21</sup> It reflects that burn size is an important predictor of mortality of a burn injuries.

In our study we have found that only one child out of 10 with TBSA more than 60 % survived, making mortality 90%. It indicated that burn of TBSA = 60% was critical and survival was hardly possible. It has also been reported in a study from Iran.<sup>22</sup> It is providing us a vulnerable group of children with burns of TBSA between 30 – 60% requiring intensive care and support to reduce the mortality. A study from India has also shown the same findings and concluded that this group requires special care and support to make the mortality low.<sup>23</sup> A significant correlation in age, TBSA and mortality has been found in our study as reported in another study.<sup>24</sup> A significant relation is also noticed between age of burned children and causative agent.

## CONCLUSION

This study has provided an overview of hospitalized burned patients less than 15 years of age. Female were majorly affected in children group more than 6 years and flame or fire was the main causative agent while male were mainly affected in children less than 6 years and scald burn was the main causative agent. Burn of TBSA = 60% was found critical with 90% mortality while burn victims less than 30% TBSA had good prognosis. This study has provided us the more vulnerable group with TBSA between 30 and 60% which needs more attention of care and preventive strategies to reduce mortality.

## LIMITATIONS

Study population is restricted to admitted patients in burn unit of tertiary care hospital which may not be the true representative of the actual population. Outdoor patients treated in emergency were excluded which may cause the difference in findings in relation to other study. Secondly it is a retrospective study which has limitation of accuracy and completeness and hence the findings are likely to be underestimates of the actual rates of burn injuries attended by doctors.

**Suggestions:** This study helps us to develop an educational program and preventive measures for the mother to avoid the fatal outcome. This may also alert our health professional to intensify their efforts to improve the management of these patients.

**Author Contribution:** All authors contributed in the design of the study, data analysis and preparation of manuscript. Dr. Syed Zubair Ahmed Tirmizi and Capt. Dr. Farhat Hussain Mirza prepared Performa for data collection, analyzed and interpreted the data. Dr. Syed



Zubair Ahmed Tirmizi did extensive literature search, reviewed the manuscript, and retrieved the relevant references as well. He finally developed and wrote the main manuscript of the article. Sana Yaseen, Paras Mangi, Sahirah Waseem collected the data and participated in data analysis and writing initial draft of the article. All authors saw and approved the final version of the article.

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