

DOI: 10.36648/2576-3911.4.4.1

Description of Pediatric Burn Injuries at an Academic Hospital in Blantyre, Malawi

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Received date: October 09, 2020, Accepted date: October 23, 2020, Published date: October 30, 2020

Citation: Mzama I, Naidoo K, Mbeba M, Majamanda M, Chinkhata M, et al. (2020) Description of Pediatric Burn Injuries at an Academic Hospital in Blantyre, Malawi. Integr J of Glob Health. Vol.4 No.4:1

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Abstract

The purpose of this study was to describe characteristics of pediatric burn patients and outcomes of burn injuries at an academic hospital in Blantyre, Malawi.

Methodology: A descriptive, retrospective design was used that employed quantitative data collection and analysis methods. The study reviewed n=148 patients' files of pediatric patients with burn injuries admitted at Queen Elizabeth Central Hospital Burns unit during September 2011 to August 2012. A check list was used to extract information on demographics, time, date, place and site of burn injury, mode of admission to the hospital whether referred from other health facilities or not, complications and outcomes. Data were organized and analyzed using Microsoft Excel 2007® (Microsoft, Seattle, USA) and Statistical 9.1® (Stat soft, Tulsa, USA).

Results: Results revealed that that 51% (n=75) of the patients admitted were boys while 49% (n=73) were girls. Furthermore, male patients were significantly younger than their female counterparts (p=0.001). The median age for boys was 3 years (IQR: 2-4 years) while for girls it was 4 years (IQR: 2-6 years). Children with burn injuries admitted directly to the hospital were associated with 57% decreased odds of mortality compared to those referred from other health facilities OR 0.43 (95% CI:0.20-0.93).

Conclusion: The study concluded that being referred from other health facilities was associated with 4 times odds of deaths compared to being admitted straight from home [OR 3.79 (95% CI:1.33-10.79)], p<0.001. Mostly burn injuries affected children under the age of five years. The mortality rate was greatly influenced by poor referral systems, total burnt surface area, depth of the burn wounds, and age of the child. Improving the referral systems and undertaking community sensitization on prevention of burns, could improve survival of the children.

Keywords Burn wounds; Pediatric patients; Malawi; Referral system

Introduction

Burns are traumatic injuries to the skin and other epithelial surfaces as a result of contact with fire, chemicals, electricity, steam and hot liquids [1]. Burn injuries affect millions of children worldwide and they result in disruption to the skin's various physiologic functions mainly in two ways. The loss of the skin's infection barrier function thus placing the individual at risk for infections due to the damage to the skin's epithelium which often leads to potentially disastrous loss of fluids and electrolytes and allow locally invading organisms [1]. Patients with burn injuries are at risk of developing severe inflammatory response syndrome (SIRS) which leads to further intravascular fluid losses, thus, potentiating systemic complications such as shock and anemia [2]. Shock and anemia come about due to increased generalized permeability of the blood capillaries [2]. This occurs due to systemic inflammatory mediators and hypo proteinemia which causes oedema of the surrounding non-burnt tissues as well [2]. This leads to excessive leakage of plasma especially during the initial hours after burn injury resulting in hypovolemia, hypoproteinemia, haem-concentration acid base disturbances and electrolyte imbalance [2]. Because of this, plasma volume and cardiac output are reduced while peripheral vascular resistances increase. In the absence of prompt fluid replacement, hypovolemic shock becomes imminent [2]. Amount of fluids required to resuscitate the child can be estimated by using the total burnt surface area (TBSA) and the weight of the child [2]. Burn injuries in children remain one of the leading causes of deaths and disabilities worldwide [3]. It is estimated that 5 million children die from burn injuries every year [3]. In Malawi burn injuries are reported to be the third leading cause of deaths in children [4]. No known study has been conducted at Queen Elizabeth Central Hospital (QECH) Burns Unit to describe the characteristics of children with burn injuries and their outcomes.

However, J C Samuel conducted an observation study that looked only at the etiology, presentation and management of all the burn injuries that were being attended to at QECH. This is a descriptive, retrospective, quantitative study which is aimed at describing the characteristics of the pediatric burn injuries at an academic hospital in Blantyre, Malawi.

Literature review

As the study is focused on burn injuries in children, literature was sought to understand the concept of burns in children in terms of age, source, place of burns incident, and the outcomes. Previous studies on burn injuries in children globally, regionally, nationally and QECH were reviewed to get what other people have already researched on and the findings to identify the gap. The search engines used for literature review were Google scholar, Pubmed, Nursing Journals and Hinari and Library Nursing Books. The search words used were burn injuries and children in Malawi, causes of burn injuries in Blantyre, classification and management of burn injuries, and outcomes in burn injuries.

Burns and age

Globally, with the search engines used, there was little literature on burns and age in developed countries probably due to increased awareness on prevention. However, a retrospective study on burn injuries in children was conducted at Bergen Accident and Emergency Department of National Burns Centre Haukeland University Hospital in Norway. The results revealed that children under two years were the most vulnerable to burn injuries [5]. While a study that was conducted in Tanzania reported that 60% of burn injury patients were children under the age of seven years [6]. However, in Africa studies reveal that the majority of burn injuries were among children below five years of age.

It was estimated that between 17,000 and 30,000 children under the age of five years die every year due to burn injuries in Africa [7]. The number of injuries decreased as age increases [7]. Research studies which were conducted in various countries in Africa, such as Tanzania, Mozambique, Ghana and Malawi confirm that burn injuries are prevalent among children who are under the age of five years. It was reported in Dar-e-salaam, Tanzania that 54% of burn patients were children between one and two years of age [7]. Another study conducted at Kilimanjaro Christian Medical Centre in Tanzania found that the largest age group affected by burns was children below five years accounting for 18% [6].

The study conducted in Tanzania on morbidity and mortality in children revealed that the highest risk factor for burn injuries was young age [6]. It was further revealed that the most vulnerable age was 1-3 years. It was found that burns were the most common cause of deaths among children under the age of five years [6]. Dean den Hollander's study which was conducted at Inkosi Albert Luthuli Central Hospital in 2014 on epidemiology and referral pattern of burn patients found that 58% of the patients with burn injuries were children who were under the age of five years [8]. Similarly, a study conducted in Maputo,

Mozambique found that children under the age of five years were commonly affected by burn injuries [6]. A retrospective study which was conducted in Ghana on pediatric burns mortality and risk factors in a developing country's tertiary burns intensive care unit revealed that 73% of the children with burn injuries were children under the age of five years [3]. It was further revealed that the mean age of the patients who died of burn injuries was three years and the most vulnerable age group was 0-13 years [3].

At Kamuzu Central Hospital, Malawi, a study was conducted on the epidemiology, management, and outcomes of burn injuries. The study found that 75% of burn patients were children under the age of fifteen years [9].

The literature review reveals that burn injuries in African countries are common in children under the age of five years. This could be due to parental neglect and cooking areas that are at ground level.

Burns and common sources or places of incidents

Studies have shown that there is a variety of causes and places where burns actually occur. Most of the burn injuries occur at home. Most of the burn injuries in children that occur in low income countries usually happen within home premises with scalds taking the lead [10]. This is because most of the cooking places and equipment are accessible to children, especially in the circumstances where cooking, living and sleeping take place in one room which is common in developing countries [10]. A retrospective study conducted in Ghana found that 73% of the children with burn injuries were due to scalds and happened within home premises [3]. It was then concluded that children under the age of five years get burn injuries in the homes accounting for 50-80% of all childhood burns with scalds as common source [3,9]. It was also concluded that scalds are the type of burns that commonly occur in the home environment [11]. A study by Gevaart on energy related injuries in 16 regional hospitals of South Africa revealed that only 30% of the burns were scalds sustained within the home premises [10]. South Africa is considered as a country better economically than others in developing countries hence they registered less scalds [10].

A study by Agbenorku at Kwame Nkrumah University in Uganda on pediatric burn risk factors in 2013 indicated that scalds account for 73.8% [11]. Similarly, a study by Outwater in Tanzania concluded that most of the burns in children were scalds [6].

To be specific, 70% of the burns among children in Tanzania were related to scalds from hot water and food [6]. Furthermore, a study at Kamuzu Central Hospital in Malawi on epidemiology, management and outcome of burn care reported that 67% of the burns were due to scalds [9].

In Mozambique a study revealed that 82.8% of burns in children were due to scalds [12]. The studies cited above indicate that scalds are the common type of burns in children globally, regionally and nationally. This could be due to parental neglect.

Burns outcomes

World Health Organization (WHO) states that more burns occur in middle and low-income countries with prolonged hospitalization, disfigurement, and death [13]. Burn injuries may result in physical, psychological and economic impact on individual, family and community level. Additionally, outcomes of burn injuries may be short and long-term [13]. Physically, children as individuals may report tremendous suffering caused by disfigurement and contractures secondary to extensive scarring. Some children have to undergo amputation of limbs following circumferential burns. These negative outcomes affect them psychologically by loss of self-esteem and failure to cope with friends and studies at school among fellow children [1]. Economically burn injuries in children may also increase costs to families, communities, the nation, and entire world through health care bills and also lack of earning income ability [1].

Burns and long period of stay in hospital

One of the outcomes that children with burn injuries experience is long period of stay in the hospital. An overview of Sub Saharan pediatric burn injuries revealed that the children who were admitted into the different hospitals due to burn injuries had an average length of stay in hospital of about 23 days [14].

Another study of energy related injuries conducted in 16 regional hospitals of South Africa showed that among all the injuries experienced by children who are under the age of five years, burn injuries resulted in longer period of stay than any other injuries [7].

Similarly, a 2017 study in Malawi revealed that the average period of stay in the hospital for burnt children was 25 days [15]. The above-mentioned studies indicated that children are hospitalized for not less than 20 days. This can have an impact on a child psychologically since the hospital is not a conducive environment for the children to develop. Children can also suffer lack of attendance at school and can contract other nosocomial infections whilst in the hospital.

Nature of complications

Other outcomes of burn injuries in children include severe complications which depend on severity of the injury as regards to depth, TBSA, age and management [9]. Burn injuries in children can result in undesirable complications which may not be reversed for the rest of the child's life such as amputation [9]. Amputation of any body part brings a permanent disability. A study in Tanzania found that out of 49 children who suffered amputation of their limbs, 16% of them were as a result of burn injuries. Apart from amputation, children with burn injuries may suffer sepsis and contractures among others [7]. An epidemiological study conducted at Inkosi Albert Luthuli Central Hospital in Durban in 2010 found that 21.6% had severe complications such as severe sepsis, contractures and skin graft failure [8]. The Chi-squared test showed that age was significantly related to depth, type and severity of burns which resulted in the stated complications [8].

Other studies conducted in Tanzania found that 53.7% of burn injured children, developed sepsis while 24.4% developed contractures [6,7]. Over 95% of burn injuries occur in middle and low income countries and are among the leading causes of disability adjusted life years (DALYs) [6].

Mortality

Burn injuries in children contribute to child mortality [16]. Children remain the most vulnerable group of people with highest mortality related to burn injuries [16]. A retrospective cohort study that was conducted in Australia between 1980 and 2012 found that burn injuries are one of the leading causes of deaths among children younger than 15 years of age [16]. The study also found that burn injuries contributed about 38% of all pediatric deaths that occurred in the period of study [16]. It is estimated that a number of deaths in burn injured children in middle and low income countries is eleven times higher than in high income countries [6]. A study conducted in Norway indicated 90% of burn deaths and many incidents continue to occur in low income countries [13]. This is because prevention programs are uncommon and quality of acute care is inconsistent in these places [5].

Significance of the study

Although burn injuries contribute to the morbidity and mortality of children in Malawi at QECH, little is currently known about the causes, and outcomes. In some previous studies that were conducted about burn injuries in Malawi, the focus was on epidemiology, management and outcome. QECH is a referral hospital for district hospitals in the southern region of Malawi, as well as health centers that are within the district and is the only burn center in Malawi where burn injury patients are referred to nationwide. The results of this study give a good representation of description of burn injuries in Malawi as a whole.

In addition to this, QECH is an academic hospital that offers practical experiences for medical and nursing students from various colleges in Malawi. Therefore, it was important to conduct the study at QECH.

Methodology

The study used descriptive, retrospective design that employed quantitative data collection and analysis methods. The study reviewed N=148 patients' files of pediatrics with burn injuries admitted during the period from September 2011 to August 2012 at the Burns Unit of QECH in Malawi.

Data collection, Management and analysis

Checklist was used to extract information on demographics, causes, anatomical distribution, depth, place of incidence of the burn injury, period taken from time of incidence to time of arrival to hospital, season of the year when the incidence occurred, whether the child had been admitted straight to QECH or referred, complications that occurred, period of hospitalization and outcomes. Data was analyzed using

Microsoft Excel 2007® (Microsoft, Seattle, USA). For the purpose of descriptive analysis, data was then exported to Statistical 9.1® (Stat soft, Tulsa, USA) which was utilized for all other analysis. For descriptive purposes, medians together with inter-quartile ranges (IQR) were reported for all variables related to age, while proportions (percentages) were reported for categorical variables. Chi-squared tests and multiple regressions were done to analyses and assess associations between characteristics of the children, mortality and other factors key to describe the nature and outcomes of burns in children. All analyses considered a value of $p < 0.05$ as significant with 95% confidence intervals reported for estimates. Individual associations were determined by univariate analysis.

Results and Discussion

Results of the study showed that 51% (n=75) of the children admitted with burns over the period of the study were boys while 49% (n=73) were girls.

Furthermore, males admitted with burn injuries were significantly younger than the females [$p = 0.001$ (Figure 1)]. The median age for boys was 3 years (IQR: 2-4 years) whereas the median age for girls was 4 years (IQR: 2-6 years).

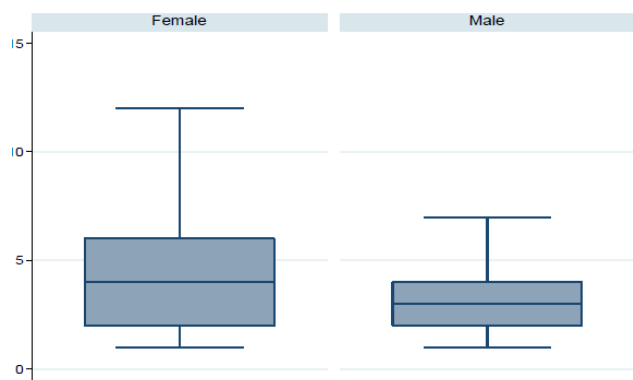


Figure 1 Relationship of burns, age and sex

Hot liquids and open fire were the only sources of burn injuries with hot liquids affecting 68% of the children. The Arms and hands were the most affected body parts with about 59% while the least was the back. The depth of the burns was 17.2% (n=25) superficial, 52.7% (n=78) superficial partial, 7.5% (n=11) deep partial and 22.6% (n=34) full thickness burns.

The incidents of burn injuries that occurred in the home premises were 96.6% (n=143), 2% (n=3) at school and 1.4% (n=2) in the surrounding gardens. There were 42.5% (n=63) incidents of burn injuries that occurred in cool dry winter season, 43.8% (n=65) in warm wet and 13.7% (n=20) in hot dry season. The outcome of the burn injuries was that the median length of hospitalization was 14 days (IQR: 7-27).

The children discharged were 75.7% (n=112) and had a median stay of 16 days (IQR: 11-29 days) in hospital. The children who died were 24.3% (n=36) and had median of hospital stay of 5 days (IQR: 3-10 days). Children who died spent significantly a smaller number of days in hospital than those that were discharged. Out of 148 children, 59 were referred from

other health centers to QECH representing 40%. Children that were admitted directly to QECH were associated with 57% decreased odds of mortality compared to those referred from other health facilities OR 0.43 (95% CI:0.20-0.93).

Burns and sex

The frequency of burn injuries between the two sexes showed a slight difference with boys having 2% higher incidents than girls (51% vs. 49%) with p value of ($P = 0.001$). Similarly, a study that was conducted in some district hospitals of Dar-es salaam showed a slight difference with boys having 1% higher than girls. Out of 126 under 15 years children with burn injuries 50.5% (n=64) were boys while 49.5% (n=62) were girls [6]. Another study in Ghana that was conducted at Komfo Anokye teaching hospital found that boys were 54% (n=23) outnumbered the girls who were 45.2 (n=19) [11].

The male children are vulnerable to burns because they are more active than girls as they would want to discover things [5]. Furthermore, male children are naturally curious and impulsive which increase their likelihood of sustaining burn injuries [5].

Sometimes male children would want to exercise power of independence, and would want to dominate in activities that happen among the children [9].

In Malawi just like any other country girl children spend most of their times in the kitchen with their mothers, therefore burn injuries might be a result of spending much time in kitchen where they imitate what their mothers do such as cooking [9]. The female children have high probability of exposing themselves to open fire, hot liquids such as tea, porridge and other substances [9].

The study in England at Birmingham Hospital, concluded that 34 girls are the most vulnerable to burn injuries because they are always in the kitchen. In another study which was conducted in United States of America, found that female children in the kitchen attempted to reach up and pull a pot of hot water off the stove or from the fire place and ending up spilling the contents over themselves resulting into burn injuries. These studies, though conducted in African and western culture found similar results on sex distribution of burn injuries.

Burns and age

The findings indicate that the common age group affected by burn injuries was 0-5 years. The finding concurs with another retrospective study conducted in Ghana on pediatric burns mortality and risk factors in a developing country's tertiary burns intensive care unit. The study found that 73% of the children with burn injuries were children under the age of five years [17]. Similar results were found in another study in Tanzania. The explanation was that some young children sustained the injuries while carried by their mothers on the lap while they were taking hot beverages and accidentally spilled over them [14].

Children of this age group are preschoolers and they spend their time at home. This puts them at risk of accessing the sources of heat if not supervised. In addition, the children of this age group are active and discover new things on their own.

Sources of burn injuries

In the current study hot liquids such as hot porridge, boiled water meant for tea or for bathing were the leading cause of burn injuries. This result is similar to findings of the studies that were conducted in other countries. In Maputo in Mozambique where a study found that hot liquids were the leading source of burn injuries in children [12].

In Tanzania a study found that most burn injuries in children were scalds. It was concluded that burn injuries were related to hot water and food like porridge [6]. In Ghana, a retrospective study on epidemiological study on burns found similar results.

The explanation for this is that Malawi just like other low-income countries, the commonest cooking place is on the ground level using firewood and charcoal burner. The children under study were in the age group in which they start walking while not knowing anything harmful to them [7].

Anatomical distribution of burn injuries (the body parts involved)

The findings indicate that the parts of the body which were affected most were the arms, trunk, abdomen and the legs. This concurs with what was found in a study that was conducted at Red Cross Children's hospital in Cape Town South Africa. It was found out that the extremities and the trunk were the parts of the body which were mostly affected by the burn injuries [13].

The explanation is that children under the age of five years like to discover things on their own [13]. Malawi just like other low-income countries, cooking mostly happens on the ground level which was easily accessible to children [18]. They touch cooking equipment like pots by the handles which are placed on the fire. While pulling the pot from fire by the handle, the contents spill over them starting from the hands and arms then trunk and abdomen going down to the legs. This is the same when the child pulls the table cloth while there are some containers of hot liquid such as Tea [19].

Depth of burns

The study results indicate that the children suffered different types of depth of burn wounds. The depths included the superficial, superficial partial, deep partial and full thickness burns. The leading type was the superficial burns. The variations in depth of wound were usually due to factors such as source of heat, length of time of exposure to heat source, delayed first aid treatment and length of time before reaching the hospital or receiving the right treatment.

The young children are vulnerable to full thickness burns due to the nature of their skin which is very soft and can also allow the heat to penetrate deeper [20].

Burns and the TBSA

The study indicated some correlation between TBSA and outcome of the burn injuries. The smaller the TBSA, the greater were the chances of survival. The results of this study had shown that as the TBSA of the burnt children increased, the

chances of survival decreased. The results were consistent with findings of other studies which concluded that TBSA determine the outcome of burn injuries [14]. Another study in America found that any burn injuries which had TBSA of 20% or more resulted in acute systemic response known as shock [21]. The explanation was that the increased surface area that was affected by burn injuries resulted in increased permeability of the blood capillaries [21].

Conclusion

The study concluded that the male and female children were almost equally vulnerable to burn injuries. Hot liquids and open fire were found to be the only sources of burn injuries in this study. This was due to cooking places that were at ground level which were easily accessible by the children.

Those that were referred from other health facilities were associated with 4 times odds of death from burn injuries compared to those that were admitted straight to Queen Elizabeth Central Hospital [OR 3.79 (95% CI: 1.33-10.79)], $p < 0.001$. Based on the results, it could also be concluded that burn injuries mostly affected children under the age of five years. The mortality was greatly influenced by the referral systems, total burnt surface area (TBSA), depth of the burns, and age of the child. Results of the study have implications on improving the referral system and community sensitization on the prevention of burn injuries.

Recommendations

Need for health promotion activities: mass media, radios, dramas, televisions, posters to empower the communities on the characteristics and outcomes of burn injuries so that prevention measures can be emphasised.

Referral system policies need to be strengthened for proper resuscitation in all health centres.

Need to conduct a qualitative study to hear from the guardians of children themselves for richer data.

Conflict of Interest

The authors declare that there is no conflict of interest.

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