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**MAGNITUDE, CLINICAL PRESENTATION, AND OUTCOME
OF PEDIATRIC BURN INJURIES AT YEKATIT 12 HOSPITAL,
ADDIS ABABA, ETHIOPIA.**

BY

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MAGNITUDE, CLINICAL PRESENTATION, AND OUTCOME OF
PEDIATRIC BURN INJURIES AT YEKATIT 12 HOSPITAL, ADDIS
ABABA, ETHIOPIA.

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List of abbreviations

AAU – Addis Ababa University

FMOH- federal ministry of health

IRB-institutional review board

JUSH-Jimma University specialized hospital

LOS- length of stay

PBC- post burn contracture

SNNPR- southern nations, nationalities and peoples region

TASH- Tikur Anbessa specialized hospital

TBSA- total body surface area

WHO-world health organization

ABSTRACT

Back ground: Burn injuries are a global public health problem, accounting for an estimated 195 000 deaths annually. The majority of these occur in low- and middle-income countries and the rate of child deaths from burns is currently over seven times higher in low- and middle-income countries than in high-income countries. Burn injuries are largely considered as being preventable. However, one needs to know the patterns, causes and outcomes of burn injuries if intervention measures are to be effective..

Objective: the aim of this study was to determine the magnitude, clinical presentation and outcome of pediatric burn patients seen in Yekatit 12 hospital from January 2012 – January 2014.

Methodology: This study was conducted at Yekatit 12 hospital from December- June 2014 by implementing a retrospective cross sectional study design. A total of 422 burn patients were recruited by simple random sampling method. Data was collected from patients' medical record cards retrospectively. SPSS version 20 for windows was used for data entry and analysis. Descriptive statistics and logistic regression were used to analyze the data.

Result: Burn accounted for 6.4% of patients who had visited the pediatric department of Yekatit 12 hospital during the study period. Children less than 3 years of age had the highest proportion of patients (53.3%) and the median total body surface area (TBSA) burned was 11% with a range of 1-95% . The most frequent burn injuries were scalds, followed by flame burns, electrical burns , contact burns with hot solid object and chemical burns with 60%,32.9%, 3.8%, 2.4% and 0.9% respectively. Most of the burns (49%) healed with no or minor sequelae and 7.85% of patients died in the study period. Cause of burn has statistically significant association with death (P= 0.027).

Conclusion and recommendation: The leading causes of burn are scalds which are preventable. Children should not be allowed in the kitchen and they should be kept in their beds or in their room while their mothers are doing housework chores. The most effective way to prevent burns is public education.

Key words/phrases: pediatric burn injuries, scald, partial thickness burn, full thickness burn, TBSA

1. INTRODUCTION

1.1 BACK GROUND

A burn is an injury to the skin or other tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. Burn injuries are a global public health problem, accounting for an estimated 195 000 deaths annually [1].

Worldwide burns in under-five age group account for a quarter to a half of all burn injuries attending burn centers. The majority of burns to young children occur as accidents in the home environment usually from scalds which are mainly from hot water and other liquids being heated. Contact burns from household appliances such as oven doors, hot irons and wood stoves are also common. Electrical burns occur in young children exposed to electrical cords, plugs, outlets, and poorly maintained electrical devices. Flammable liquid burns are common from cooking accidents in developing countries and in adolescent boys experimenting with petrol and other accelerants. Males aged from 2.5 to 18 years are more likely to be hospitalized with a burn injury that has resulted from their own behaviors, possibly due to increased exposure to activities that produce injuries and a pattern of more risk taking and rougher play than females [2].

The majority of burn injuries occur in low- and middle-income countries and the rate of child deaths from burns is currently over seven times higher in low- and middle-income countries than in high-income countries [1].

Burn injury is a leading cause of emergency department visits and hospitalization for young children. It is estimated that over half a million children are hospitalized with burn injuries per year in the world, with the majority occurring in low to middle income countries in Asia and Africa. Low socio-economic status of the family and low educational level of the mother are the main demographic factors associated with a high risk of burn injury. Other factors associated include high population density, high levels of household crowding, absence of water supply and psychological stress within the family [3].

Thermal (heat) burns occur when some or all of the cells in the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns), or flames (flame burns). Fire and burn deaths are combined because deaths from burns in fires cannot always be distinguished from deaths from toxic smoke or other non-burn causes [1].

Burn injuries are classified by two major factors that influence management and prognosis; the extent of injury and the depth of burn. The extent of injury is expressed as a percentage of total body surface area (TBSA), which is calculated according to age. The depth of burn is expressed as either full thickness or partial thickness burn. In practice most burns are a combination of both types [4].

Non-accidental burn injury (i.e., abuse) is present in a higher proportion of families with a single parent, a younger mother, a low income or an unemployed parent. Many children with non-accidental burns have a higher incidence of previous notifications for suspected abuse or neglect to child protection agencies. Up to 50% of children requiring admission to a burns centre are reported to have pre-morbid developmental delay, sensorimotor difficulties, and impoverished home environment. The presence of parental factors such as physical illness, substance abuse, psychiatric illness, behavioral problems, and inadequate social support is often causally related to the burn injury and influences the child's recovery [2].

The developmental progress of a child between the ages of 0 to 15, at both a neurocognitive and physical level, influences the type of burn injury most frequently sustained, as well as the child's ability to remove him/ herself from a dangerous situation [1]. Parents can also inadvertently contribute to the mismatch between their child's developmental skills and the demands of tasks by allowing or asking a child to perform an activity for which s/he is not developmentally capable [2].

1.2 STATEMENT OF THE PROBLEM

Burn injuries are among the most devastating of all injuries and a major global public health crisis. Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls, and interpersonal violence. Burns which occur in low to middle income countries generally lack the necessary infrastructure to reduce the incidence and severity of burns [5].

Burn injury is a serious pathology, potentially leading to severe morbidity and significant mortality, but it also has a considerable health-economic impact [6]. A sufficient knowledge of the epidemiological characteristics of burns is necessary for their prevention. Sustained research on the epidemiology of burns in many developed and high-income countries such as the United States has made a great contribution to primary and secondary prevention of fires and burns. However, this is not true for many developing or low- and middle-income countries like Ethiopia [7].

Burn injuries are largely considered as being preventable. However, one needs to know the patterns and causes of burn injuries if intervention measures are to be effective [8].

1.3 SIGNIFICANCE OF THE STUDY

Since children are the windows of hope for the future development and existence of a country, it is a great deal to concern about their health and safety. It is very crucial for every burn institution to know the specific pattern, cause and management outcome of burn injuries for appropriate treatment and prevention of burn injuries.

In the developing countries like ours, there is a wide gap between the number of burn patients and available resources to manage them. There is only one functional specialized burn unit in our country. So, some of severe burn patients, who require specialized care, are forced to be managed in general wards in the hands of general practitioners or surgeons who do not have specialized training in managing burn patients. As a result, we have not been able to lower the burn related deaths as compared to the western world.

Pediatric burn injuries are least explored areas among other injuries. Very little is known about the patterns and clinical presentation of burn injuries in Ethiopia. This study will determine the magnitude, clinical presentation and outcome of pediatric burn injuries, which are the prerequisite for planning preventive measures and improving the effectiveness of services delivered by burn care facilities.

1.4 LITERATURE REVIEW

Published literature indicates that burn injuries remain a major health problem in developing countries. In view of the cultural, economic and geographic similarities among the developing countries, summarising the literature will describe the extent of the problem, and highlight common features and differences regarding the epidemiology of burn injuries. Such information will be useful for planning prevention strategies and identifying further research questions that need to be answered [9]

A study was conducted to determine the cause of burn injuries among paediatric Patients in Nepal at patan hospital emergency and surgical department. The study revealed that the etiology of burn injuries varies as the child progresses through the stages of normal development. Scald burn predominates in most series and constitute seventy percent of all thermal injuries in infants, toddlers, and preschool children. Scalds mostly occur at home and mostly affect upper part of body. Incidence of spill is always more than immersions [6].

A prospective hospital based study done in Isfahan Iran showed that of all burn patients admitted to Imam Kazem Hospital of Isfahan University of medical science from March 2007-2009, showed that 45.5% were under the age of 15, indicating an annual incidence of 50 in 100,000 children. Among this patients 60% were boys and 40% were girls; the male-to-female ratio was 1.5:1 and Scald was the most common mechanism of burn injury i.e. it accounts 51.8% of the cases[10].

A case control study was performed in the national institute of child health in the United states of America which showed that Burns most commonly occurred in the patient's home (77.5%) and in a room used for cooking in more than half of the cases (67.8%). this study also showed that Burns peaked in the summer season and during school vacations where the child was alone at the time of the injury [11].

A systematic literature search aimed to include all studies from 1985 to December 2009 reporting on aetiology, incidence, prevalence, and/or outcome of severe burn injuries as the major topic, from all European states and territories witnessed that, the annual incidence of patients with severe burn injury in 22 studies lies between 0.2 and 2.9/10,000 inhabitants and it

was higher among children, even up to 8.3/10,000 for children younger than 5 years in one Norwegian study and 8.5/10,000 for all children younger than 15 years in a Czech study. A higher incidence has been associated with a lower standard of life and ethnic minorities [12].

In most studies, an overall male predominance of 55% to 75% was described. The great majority of the burns are accidental, and especially in children, the majority occurred at home (80% to 90%). The average length of stay (LOS) in the paediatric population was 15 to 16 days. In most hospitalized populations with severe burn injuries, the mortality rate lies between 1.4% and 18% (maximum, 34%). The mean total body surface area (TBSA) was higher among the deceased patients (44% to 50% overall; 73% in a paediatric study and 22% in an elderly population) [12].

A retrospective study was conducted on burn patients aged younger than seven years who were admitted to the Hacettepe University Burn Center. As per the results of this study 80% had second-degree burns and 20% third-degree burns. None of the patients had first-degree burns and there was a significant difference in causes of burns between age groups. The difference in TBSA was also significant between the children with different causes of burns ($p < 0.001$). However, there was no significant relation between causes of burns and gender and between causes of burns and degree of burns [13].

Similarly, a study conducted in south eastern Nigeria showed overall male predominance and hot water was the most common cause of burn followed by flame burns. 7.5% of the cases of hot water burn were intentional, with the parents/relatives either dipping the victims in hot water or pouring it on them for the purpose of treatment of convulsion. In 13.2% patients there was no initial pre hospital intervention and 17.0% of patients received pre hospital intervention, which the investigators of this study considered appropriate. These included cold water irrigation, dermazine cream, gentamycin, analgesics, tetanus toxoid and gentian violet dressing in various combinations. 69.8% patients had initial intervention, which the investigators considered either of unclear benefit or out rightly harmful. These included application of engine oil, palm oil, olive oil, aloe vera, dry salt, raw egg, honey, cutting open the blebs and beating the child. In this study 47.2% patients presented over in less than 6 hours of the injury, 9.5% presented between 6 and 24 hours of injury while the remaining 43.4% presented later than 24 hours [14].

A study done in Israel to assess childhood burns, revealed that two thousand seven hundred and five children were hospitalized with burns (51% of all burn admissions). Infants (ages 0-1) had the highest prevalence (45%). Scalds caused 68% of burns. Burn extent in 83% of the patients was less than 20% TBSA, 3% suffered 40%TBSA burns. Surgical intervention increased from 6% in 1998 to 21% in 2002[15]

According to the results found in a study conducted to assess the epidemiology of childhood burn injuries in South Africa the incidence of burn injuries is higher in toddlers (15.8%) followed by infants (14.6%).The vast majority of burn injuries comprising infant scalding were incurred by infants and males and the scalding suffered on the upper body parts. Burns among old children with an over representation of flame related burns occurred in winter at night and early morning hours [2].

A study conducted in Dar es salaam, Somalia illustrated Scalding from hot water, hot food and hot cooking oil accounted for 75.8% of the burns while open flame burns accounted for 16.2% of the cases. Regarding the place of injury, 82.9% of patients came from the low-income settings, and 94.4% of the burns occurred in the home environment [8].

A study which was conducted to analyze an audit of first aid treatment of pediatric burn patients and their clinical outcomes showed that, First aid was used on 86.1% of patients, with 8.7% receiving no first aid and unknown treatment in 5.2% of cases. A majority of patients had cold water as first aid (80.2%), however, only 12.1% applied the cold water for the recommended 20 minutes or longer. Some positive clinical outcomes were associated with recommended first-aid use; however, wound outcomes were more strongly associated with burn depth and mechanism of injury [16].

A study was conducted to determine the cause of morbidity and mortality in burn patients at Ahmadu Bello teaching hospital. The findings of this study witnessed that the severest injury was caused by petrol burn with a mean TBSA of 53% and range. Clothing injury was a cause of extensive burns accounting for 12% of burn injury with TBSA of 36%. Complications leading to morbidity and mortality include, wound infection leading to septicemia and septic shock,

hypovolemia with hypovolemic shock, which gave a mortality of 100% of those who developed shock state and a crude mortality was 35%.[17].

A community based cross sectional survey was done to determine the epidemiology of burn injuries in Mekelle town, northern Ethiopia. According to this survey the annual incidence of burn injuries was 2.1% among which children less than five years of age has the highest incidence (4.8%). Unlike the findings of the above studies females showed a slight overall predominance which accounts for 52% of the cases and 98% of burn injuries were accidental and the rest were intentional [18].

A retrospective cross sectional study conducted to determine the magnitude and pattern of injury in Jimma University specialized hospital (JUSH), revealed that significantly fewer males had burn and road traffic accident than females [19].

A study conducted to analyze the admissions to the pediatric emergency room of Tikur Anbessa specialized hospital (TASH) shows there were 29 (1.1%) burn injuries out of 2522 admissions during the study period [20].

A survey of burn admissions to the Ethio-Swedish hospital from January 1978-December 1987 revealed that a total of 347 cases were seen, accounting for 1.73% of all hospital admissions during the study period. According the results of this study second degree burns involving the extremities were most frequent and forty (11.5%) of patients died [21].

A prospective cross sectional study was conducted to determine the description of patients admitted to a burn unit of Yekatit 12 hospital. According to the findings of this study the median age was 22 years (range 2 month – 70 years). The overall median hospital stay was 44 days and the mortality was 11.6% [22].

2. OBJECTIVES

2.1 GENERAL OBJECTIVE

To assess the magnitude, clinical presentation and outcome of pediatric burn patients at Yekatit 12 hospital.

2.2 SPECIFIC OBJECTIVES

- To determine the magnitude of burn injuries among pediatric patients
- To assess the cause and settings of burn injuries
- To assess the clinical conditions of pediatric burn patients at time of presentation
- To assess the outcomes of pediatric burn injuries

3. METHODOLOGY

3.1 Study area and study period

The study was conducted at Yekatit 12 hospital, Addis Ababa Ethiopia from November to March 2014. Yekatit 12 hospital is one of the hospitals under Addis Ababa city administration health bureau that has been giving routine health services for Addis Ababa and other referral cases from different regional states of Ethiopia. The hospital provides services for a population of approximately 4 million people. It has 9 departments and 6 units and has 265 beds. It has been the main referral hospital for treatment of severe burns for many years. The burn unit has 19 beds of which 7 of them are reserved for pediatric burn victims.

3.2 Study design

A retrospective descriptive cross sectional study was employed to assess the magnitude, clinical presentation and outcome of pediatric burn injuries from January 2012 – December 2013 G.C.

3.3 Source population

Source population for this study was all pediatric patients who had visited the inpatient and outpatient departments of Yekatit 12 hospital for medical care during the study period.

3.4 study population and study unit

The study population for this study was those patients less than 18 years of age who had sustained burn injury and visited Yekatit 12 hospital for medical care during the study period. Patients' medical record cards were the study units of this study.

3.5 Eligibility criteria

3.5.1 Inclusion criteria

Burn patients less than 18 years of age

Admitted and outpatient children with burn injuries

3.5.2 Exclusion criteria

Incomplete cards were excluded from the study

3.6 Measurement variables

3.6.1 Dependent variables

Outcomes of burn injuries

3.6.2 Independent variables

Age and sex of the child

Concomitant medical conditions

Presence of disability

Provision of pre hospital care or first aid

Length of hospital stay

Clinical presentation (shock, airway compromise, loss of consciousness etc...)

Severity (degree) of burn

cause and setting of burn injury

Presence of Hospital acquired infections

Child abuse versus accidental injuries

3.7 sample size and sampling procedure

3.7.1 Sample size determination

The sample size for this study was determined by using single population proportion formula by considering 50% prevalence of burn injury and 95% confidence interval and 5% margin of error.

$$n = (Z_{\alpha/2})^2 p(1-p) / w^2$$

Where n is sample size

$Z_{\alpha/2}$ - with 95 % confidence interval equal to 1.96

P- Estimation of population proportion which is 50%

W –margin of error which is 1-confidence level=1-0.95=0.05

$$\text{Then, } n = (1.96)^2 (0.5) (0.5) / 0.05^2 = 384$$

I have added 10% contingency for illegible hand writing and incomplete cards, So 422 patients' medical record cards were included for final analysis.

3.7.2 Sampling procedure

Simple random sampling method will be used to obtain the study unit

3.8 Operational Definitions

Burn is an injury to the skin or other tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals.

Total body surface area (TBSA) is an estimate of the percentage of total body surface area involved in burn exposure and injury.

First-degree (superficial) burns only the epidermis or outer layer of skin is affected. The burn site is red, painful, dry, and with no blisters.

Second-degree (partial thickness) burns involve the epidermis and part of the dermis layer of skin. The burn site appears red, blistered, and may be swollen and painful.

Third-degree (full thickness) burns destroy the epidermis and dermis. Third-degree burns may also damage the underlying bones, muscles, and tendons. The burn site appears white or charred. There is no sensation in the area since the nerve endings are destroyed.

Scald is a type of burn injury caused by hot liquids or gases

Guardian is a person or care giver legally responsible for someone unable to manage their own affairs.

3.9 Data collection

Data was collected from patients' medical record cards by using pre tested data collection sheet. Three nurses were involved during the data collection process who were trained on how to collect the relevant data using the data collection sheet. The Principal Investigator was continuously supervising the data collectors and 10% of the records were cross checked against hospital medical records. The contents of the data collection sheet are included in annex 3.

3.10 Data entry and analysis

Data entry and analysis was done using Epi info version 6 and SPSS version 20.0 for windows. The data was double entered and cleaning was done. The generated data is compiled by frequency tables, charts, and graphs. Descriptive statistics and Multiple logistic regression were used to analyze categorical variables and significance is set at P value of < 0.05.

3.11 Quality control

The data collecting sheet was standardized by testing it in 5% of the sample size before the study to make sure that the data collecting sheet is capable of yielding the required data for the study and some modifications were done according to the results found. The collected data was checked for completeness consistency and clarity.

3.12 Ethical consideration

Ethical clearance was obtained from departmental research and ethical review committee of the department of emergency medicine and critical care and from the department of pediatrics and child health, faculty of medicine Addis Ababa University. Official letter of permission from the department was submitted to Addis Ababa health bureau and Yekatit 12 hospital in order to conduct the research. All the collected data was kept confidential and no one except the members of the research team had access to the collected information. All paper and computer records of the study is kept in a secured place under lock and the name and/or other personal information is not be notified in any report.

3.13 Dissemination of the result

The finding of the study will be presented to the department of Emergency Medicine and Critical care / AAU. It will also be disseminated through presentations in different professional association meetings and annual conferences. The paper will also be submitted to national or international peer reviewed scientific journals for possible publication.

4. Result

In the study period 24,731 patients aged less than 18 years of age had visited Yekatit 12 hospital both in the inpatient and outpatient departments of which 1599 (6.4%) patients had sustained a burn injury. Among patients who sustained a burn injury 326 (20.3%) patients were admitted to the burn unit and the rest were managed on the outpatient basis.

Age and sex

A total of 422 patients were studied of which 203 (48.1%) patients were males and 219 (51.9%) were females. The mean age of the children was 4.77 years (range 2 months to 17 years). Children less than 3 years of age had the highest proportion of patients (53.3%) and the number of children who sustained a burn injury decreases as their age increases. Sixty-six percent of children aged 4-6 were females, but the number of boys was higher in the less than 3 and 16-17 age groups.

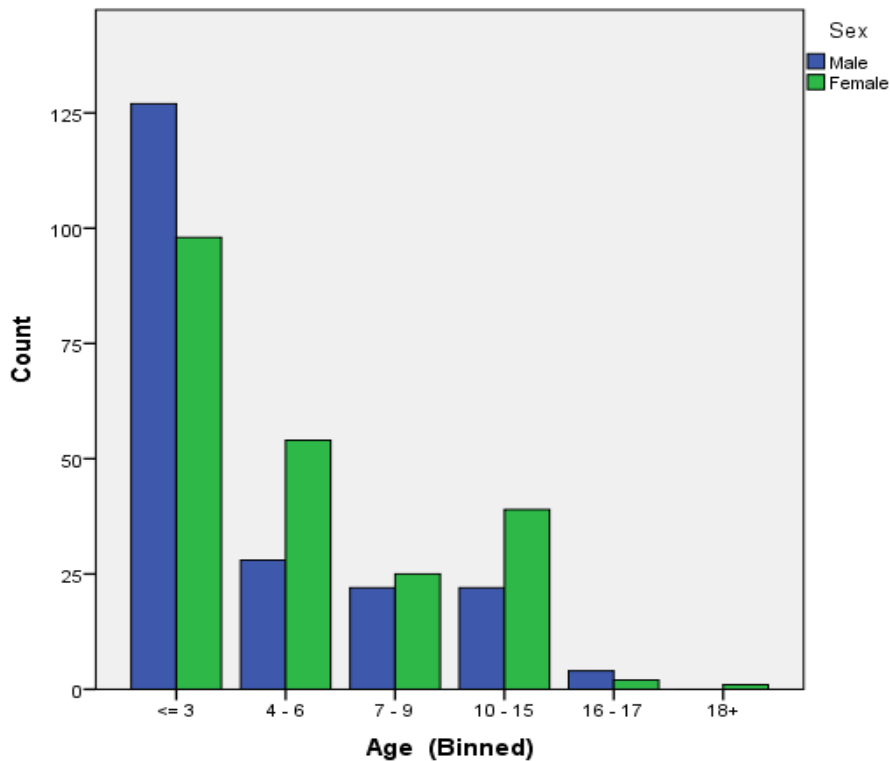


Fig. 1 distribution of burns by age and sex

Geographical distribution and residence

Of the 422 patients 271 (64.2%) lived in Addis Ababa, 106 (25.1%) came from Oromia and the rest were from Amhara, SNNPR, Harar, Diredawa and Afar in descending order. Significant number of patients (36%) were referred by health institutions located in other regional states of Ethiopia.

Extent and severity of Burn injuries

The median total body surface area (TBSA) burned at the time of presentation, determined based on the medical records was 11% with a range of 1-95% (mean: 14.7; SD: 12.3). Burn extent in 80.1% of patients was less than 20% of TBSA, 16.4% of victims had sustained burn injury that had covered 20-40% of TBSA and one patient had suffered 95% TBSA burn. Among 422 subjects 64.5% of burn victims had second degree burns, 18.5% had sustained third degree burns and the rest had experienced first degree burns.

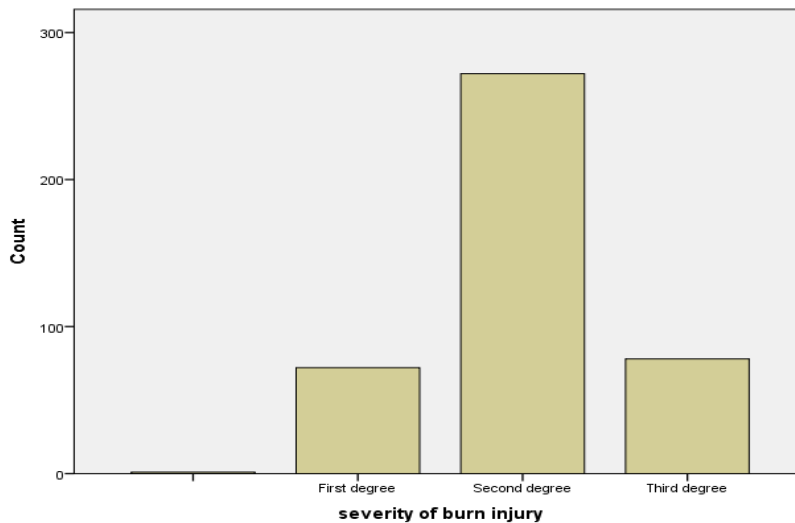


Fig .2 severity (degree) of pediatric burn injuries at Yekatit 12 hospital from January 2012- December 2013G.C.

Causes of burn injuries

The most frequent burn injuries were scalds, accounting for 60% (253) of all injuries and followed by flame burns at 32.9% (139), electrical burns at 3.8% (16), contact burns at 2.4% (10) and chemical burns at 0.9% (4). Of all scald injuries, 50.1% (127), 28.9% (73), 11.9% (30), 5.92% (15), and 3.16% (8) were due to hot water, hot milk, hot tea, hot sauce, and hot oil respectively.

The most frequent cause of burn in children less than 6 years of age was scald. Children aged 16-17 years did not have contact burns, but contact burns were seen in the remaining age groups though rarely. The children aged 10-12 years of age constituted 50% of all electrical burn injuries (8 out of 16). flame burn injuries were more prevalent in children less than 3 years of age and in the 10-15 years age group and among those patients who sustained flame burn injuries females contributed for 60.5%.

Table I Cause of burn trauma in different age groups

	Cause of burn trauma					Total
	Scald	Flame	Electricity	Chemical agents	CONTACT	
<= 3	173	46	1	0	5	225
4 – 6	50	29	0	0	3	82
7 – 9	12	26	4	4	1	47
10 – 15	14	35	11	0	1	61
16 – 17	4	2	0	0	0	6
18+	0	1	0	0	0	1
Total	253	139	16	4	10	422

Anatomic locations and setting of burn injuries

Anatomically the majority of the burns are confined to the lower extremities (18.5%) followed by burns on the upper extremities (15.9%). Upper extremities and trunk were affected in 8.3% of the victims and anterior trunk was burnt in 4.3% of the study subjects. The vast majority of injuries happened in domestic environment (86.3%), followed by outdoor settings in 11.1% of the incidents, 1.4% injuries in the school and the rest happened in other settings like the restaurant and in the car. Of the 6 injuries that happened in the school, 4 of them were caused when burning rubbish, 1 was caused by malfunction of an electric outlet and 1 was due to chemical burn of unknown agent.

Provision of pre hospital care

Among 422 study participants, pre hospital intervention was provided in 325 (77%) of patients. Of those patients who had received pre hospital interventions only 56 (17.3%) of them received interventions which are considered to be appropriate. These included cold water irrigation, analgesics, TTC eye ointment, alcohol and gentian violet. (9.84% 4.61%, and 2.76%

respectively). Two hundred sixty nine (82.7%) patients had pre hospital interventions which are considered either of unclear benefit or out rightly harmful. These included dough, cooking oil, coffee powder, honey, herbs, ‘Areke’ (local alcoholic beverage), tooth paste, salt, Vaseline, and ice in descending order.

Length of Hospital Stay and duration of injuries before presentation

The mean length of hospital stay was 21.25 days (median: 4.5; range: 1-257 days). Most of the patients (58.8%) came to the emergency department within 6 hours, 21.6% of the subjects seek health care within 7hours-24 hours.

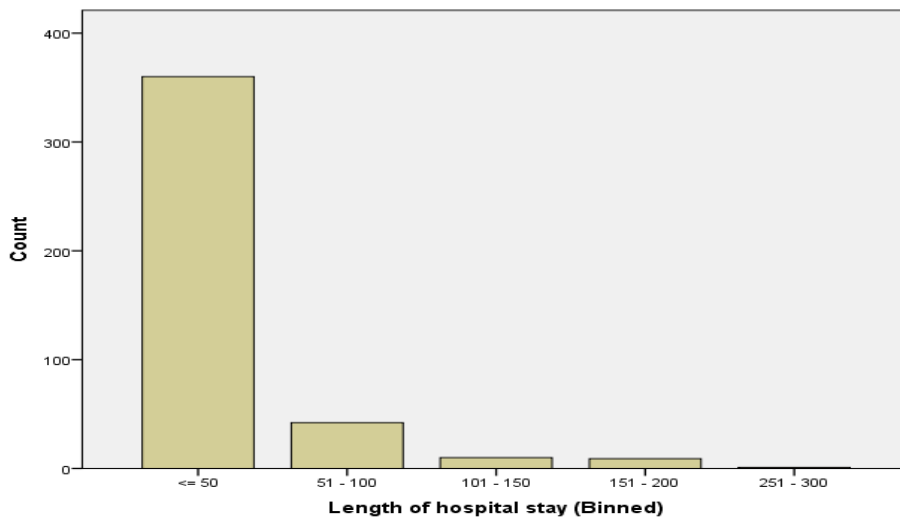


Fig 3. Lengths of hospital stay of pediatric burn patients at Yekatit 12 hospital from January 2012-December 2013 G.C.

Table III. Duration of time before seeking medical care after injury

No of days after injury, before presenting to the hospital	Frequency	Percent
<= 6hours	248	58.8
7hours – 1day	91	21.6
2days – 5days	67	15.9
6days-10days	15	3.5
11 – 15 days	1	0.2
Total	422	100

Clinical condition at time of presentation

Seventeen (4.3%) of the burn cases were due to child maltreatment, with parents, care givers or relatives dipping the victims in hot water, pouring hot fluids on them, contact with hot metal (knife, fork and hot iron) or burning the child with candle flame. Majority of victims of these intentional injuries are children aged between 4-6 years of age (47%). The reason for child maltreatment was to punish misbehaving children, to punish those children who did not obey orders or as revenge to parents when care takers argue with the parents.

Sixty nine percent of patients (290) were healthy before the burn incident and the rest had concomitant medical conditions like malnutrition (11.3%), epilepsy (5.92%), and anemia (5.45%). There were 6 patients with Down's syndrome, 6 patients who had developmental delay and 3 psychiatric patients (attention deficit hyperactivity disorder).

Regarding clinical presentation at time of evaluation, 66 patients presented with sign of wound infection. Thirty nine patients presented with post burn contracture (PBC), while 5 patients presented with skin discoloration and decreased sensation and 15 patients were unconscious at time of presentation. Flame burns were associated with facial and peri orbital edema (11 patients)

Outcome of pediatric burn patients

Most of the burns (207) healed with no complication or with minor scar and 33 (7.85%) of patients died in the study period. Among those who died, most of them had flame burn injuries (84.8%).

A multiple logistic regression was performed to ascertain the effect of age, sex, cause of burn, severity of burn, presence of shock and child maltreatment on the outcome of burn i.e. death. From the results of multiple logistic regression only cause of burn has statistically significant association with death.(P= 0.027)

Children less than 3 years of age constituted 36% of deaths and children aged between 4-6, 7-9 and 10-15 years of age accounted for 21.21% of the overall deaths each.

Twenty three (5.4%) of patients had significant morbidity in the form of contractures, unsightly scars (11.13%) and amputation of extremities in 4 (0.94%) of patients. One hundred four (24.64%) of patients required surgical interventions in the form of escharotomy, contracture release and /or skin graft.

5. Discussion

Burn injuries remain a leading cause of injuries in children. This form of trauma is one of the commonest causes of hospitalization due to accidents among pediatric patients. Care for the burned child continues to demand close attention of a multi disciplinary team.

In this study the incidence of pediatric burn injuries found to be 6.4% which is higher than the findings of the study which was conducted to analyze the admissions to the pediatric emergency room of Tikur Anbessa specialized hospital (TASH) which was 1.1% [20]. This significant difference could be explained by the fact that our study was conducted in the hospital that serves as the main burn referral hospital in the country where majority of burn cases are treated and unlike our study the above mentioned study only deal with admitted cases, while this report includes all patients who sustained burns, even if only attending the outpatients department.

This study showed a slight overall predominance of female patients (52%) in comparison to male patients. Shresta SR and Kidanu EN. et al also found similar data in their study[6,18]. However, studies done by other authors have found predominance of male patients in comparison to female Patients [8,10,12,13,14]. The main cause of predominance of male child may be possibly due to increased exposure to activities that produce injuries and a pattern of more risk taking and rougher play than females.

Our study showed that most of pediatric burn injuries occurred at home (86.3%) and is comparable with other studies which revealed 94.4%[8],86.36% [6] and 80-90% [12] of burns occurred in domestic settings.

We found that 53.3% (n=225) of the burn-injured children were under three years old. This age Group has also been reported in other studies to be the most vulnerable to burn injuries [6,8,13,14]. This finding is consistent with the results found in a study conducted to assess the epidemiology of childhood burn injuries in South Africa that the incidence of burn injuries is higher in toddlers (15.8%) followed by infants (14.6%) [2]. The other age groups according to our study, more vulnerable for this injury after this age group were 4-6 years of age group (19.43%).

Significant numbers of patients were referred from health institutions found outside Addis Ababa because there is organized burn facilities in our country elsewhere.

Various observations had reported that scald was the most common cause of burn injuries [6,8,10,11,14]. Similarly in the present study the most frequent cause of burn injuries was scald (60%). This can be explained by the fact that children especially toddlers and preschool children stay with their mothers or care takers at home, and would probably be left playing in the kitchen environment. With the explorative and inquisitive nature of children, it is not surprising that they get scalded by liquid foods being cooked by their parents or care takers. In our study scalds were commonly caused by hot or boiling water which is consistent with the findings of the study done in Turkey which was conducted to assess burn injuries among children aged up to seven years [13].

In our study flame burn injuries were the second most common frequent cause of burn trauma and is often caused by open flames when burning rubbish and cooking food outdoors with no safety precautions, house burn accidents and careless use of different flammable substances that serve as a light source in rural areas like candles and traditional kerosene light equipments ('Kuraz'). Flame burn injuries were more prevalent in children aged 10-15 years which is in agreement with the finding of the study conducted in South Africa to assess the epidemiology of childhood burn injuries [4]. This may be related to increased physical mobility and social independence of older children and children in this age group may be exposed to high risk activities such as cooking and lighting fires to burn rubbish.

In the present study, only 10(2.4%) children had burns caused by contact with hot solid objects. These hot solid objects were usually those placed on the coal burning stoves which are used for cooking in many households of Ethiopia. Likewise, a Turkish study done to assess burn injuries among children aged up to seven years , reported that only 4.5% of children had encountered burns caused by contact with hot solid objects [13] . Burns due to hot solid objects might affect large body surface areas but that they usually caused burns over small areas so the victim may not present to health institutions. This may explain why few cases of burns due to hot solid objects presented to our center, which mainly treats severe burns.

Our study witnessed that electrical burns accounted for 3.8% of all burn injuries and this electrical burns occur in late childhood owing to an increase in their activity and curiosity. This is consistent with what Balseven A et al had reported [13]

This study revealed that Seventeen (4.3%) of the burn cases were due to child maltreatment. The incidence of suspected abuse was higher in the Nigerian study that it accounted for 7.5% of the cases of hot water [14]. The increased incidence of abuse in the above study could be attributed to the traditional practice of Nigerian people to dip or pour hot water on a child who is convulsing for the purpose of treating the convulsion. In Ethiopian context, parents, relatives or guardians of children abuse them just as a form of punishment and there is no such a practice of pouring hot water as a treatment of convulsion in our set up. Since children included in this study were younger than eighteen years and they were supposed to be under the care of their parents or guardians, It should be remembered that parental abuse and neglect may play a role in burn injuries in these children. It is known that some childhood burns result from neglect. However, it is not easy to distinguish deliberate actions from neglect and accidents. Therefore, pediatric forensic examination should be performed if a child is likely to suffer from abuse, neglect or intentional injury.

Regarding duration of injury before seeking medical care, most of our study participants (85.8) presented to the emergency department within 24 hours of injury. When compared with the above Nigerian study, only 56.7% of children presented to the hospital within 24 hours. This could be explained by the fact that majority of the injuries in the above mentioned study were minor so that the victims did not seek medical attention early [14]. We found that the median length of hospital stay was 4.5 days (mean: 21.25 days; range: 1-257 days). A study done by Mulat T et al to assess the description of patients admitted to a burn unit of Yekatit hospital reported that the overall median hospital stay was 44 days[22]. The difference in LOS between the two studies could be attributed to the difference of age in the study subjects, i.e. unlike our study participants, the above study includes adult burn victims in whom the commonest cause of burn injury was flame, which in turn is associated with increased involvement of body surface area due to clothing ignition accidents and is also associated inhalational injuries, which could have forced them to have prolonged stays in hospital. The other factor for this significant

variability in the duration of hospital stay could be justified by the fact that wounds in children typically exhibit faster rates of healing compared to adults.

In this study Burn extent in 80.1% of patients was less than 20% of TBSA, 16.4% of victims had sustained burn in jury that had covered 20-40% of TBSA and one patient had suffered 95% TBSA burn and this finding is comparable with a study conducted in Israel in which Burn extent in 83% of the patients was less than 20% TBSA [15]. Previous study showed that the average mean total body surface area (TBSA) burnt was 17.1 % [22]. However, the median TBSA burnt in our study at the time of presentation, determined based on the medical records was 11% which is lesser. This might be attributable to the variability of the causative agents of burns between the two studies i.e. unlike ours flame was the commonest cause of burn in their study, which is most probably associated with large body surface area burned.

As per the results of a study done in South Eastern Nigeria, Partial-thickness burn occurred in 84.9% patients and full-thickness burn 15.1% of patients [14] which is consistent with our finding that 81.5% of patients had sustained partial thickness burn and 18.5% had experienced full thickness burn.

In the current study, Four hundred twenty two children with burns had too many distinct anatomical sites of injury with 34.4% of the burn injuries being confined to the extremities which is in agreement with what Daniel E et al found in a survey of burn admissions to Tikur Anbessa specialized hospital that burns involving the extremities were most frequent [21]. The similarity of locations of burns on the body in the two studies may be attributable to the similarity of the causative factors. Scalding most frequently occurred when children reached for a container of hot liquid while playing, either by pulling a hot substance from a cooking stove or a countertop. This could result in immersion or spilling of the hot substance on the children's extremities. In addition children might step on fire or hot solids while playing.

Concerning provision of pre hospital interventions, 77% of our study subjects received Pre hospital interventions. Almost the same findings were reported from a study conducted in Australia in terms of the provision of first aid measures that most (86.1%) of pediatric burn victims got pre hospital interventions [16]. However, when we compare the measures that were used as first aid to burn victims in the two studies we noticed that they vary greatly. In our study though the majority of burn victims had received first aid measures, only 17.3% had received first aid measures which we considered appropriate. These included cold water irrigation, analgesics and TTC eye ointment. However, in the above study, the majority of patients (80.2%) had the recommended first aid measure i.e. cold water irrigation. In this study among those who had received first aid 82.7 % patients had interventions which are considered either of unclear benefit or out rightly harmful. These included dough, cooking oil, coffee powder, honey, herbs, 'Areke' (local alcoholic beverage), tooth paste, salt, Vaseline, and ice in descending order. Deleterious interventions in children are still very common in our environment. Application of raw eggs may enhance wound infection as it creates a favorable media for bacterial growth. Additionally, the application of dry salt or Areke may worsen inflammation and ice application could lead to deepening of burn depth. Appropriate health education should be given to abolish these harmful practices.

The mortality rate was only 3.8% in a study done in Nigeria to assess childhood burns [14]. On the other hand the mortality in our study was much higher which was 7.8% (n= 33). The increased mortality in this study could be explained by the in availability of fast trucks and ambulances right and left to transport all pediatric burn victims to the hospital while providing resuscitating measures and there is also lack of experienced nurses dedicated to the care of these patients as the increased work load may hinder the quality of care provided.

In Iranian study the mortality of pediatric burn patient was 5.6% [10]. Among those patients who died 67.8% of them died because of fire and flame injuries which is comparable with our finding that that most of the patients died had sustained flame burn injuries (84.8%). Complications resulting in morbidity and mortality include, wound infection leading to septicaemia and septic shock, hypovoleamia with hypovolaemic shock, which gave a mortality of 100% of those who developed shock state.

6. Limitation

A retrospective cross sectional study design was employed to conduct this study due to time constraint. All the data was collected from patients' medical record cards. So, it is impossible to get clear and consistent clinical features of patients as all of the information might not be recorded on the cards. There are some features that could only be assessed by observation or by taking history. It might be good to use a prospective study design which may help to overcome the above mentioned problem

7. Conclusion

The incidence of burn among pediatric patients was 6.4% and children less than 3 years of age had the highest proportion of patients and the number of children who sustained a burn injury decreases as their age increases. Most of the injuries were anatomically confined to the extremities.

The most common cause of burn was exposure to scald followed by flame. The mean TBSA was 11% and the majority of the burns were second degree. Majority of patients had received pre hospital interventions which are considered to be either of unclear benefit or out rightly harmful. The mortality was 7.8% and complications resulting in morbidity and mortality include wound infection, leading to septicemia and septic shock, hypovolemia and hypovolemic shock, which gave mortality of 100% in those who developed shock state.

Finally, burn injuries are very common throughout the world and especially in the Underdeveloped countries like ours where people frequently use traditional coal burning stoves and open fire cooking and in our setting availability and access to burn care facilities and proper treatment are compromised. Burns in childhood cause huge financial and social burdens on individuals, families, society and the nation

8. Recommendation

The leading causes of burn are hot water, milk, oil, and soup which are preventable.

Children should not be allowed in the kitchen and they should be kept in their beds or in their room while their mothers are doing housework chores. Crawling children are especially at risk of burns since they move around the house. They should not be left unattended.

A high rate of childhood burns requires hospital admissions and prolonged hospital stays. To reduce this burden, a burn prevention strategy and prevention program for the country should be developed. Simple preventive measures can help to eliminate burn injuries. Playing and lack of parental care were leading predisposing factors for burns in children. Keeping children out of kitchen is a simple measure that could avert injuries. However this is not possible in one room household. The most effective way is public education. Especially parents with preschool children should be offered education about preventive measures against burns and the initial intervention of burn injuries. Certain harmful practices like applying raw egg and ice as a means of treating burns is based on ignorance and must be discouraged.

Since childhood burn injuries are a prevalent public health problem, it is strongly suggested to have a well equipped burn units in other hospitals in addition to Yekatit 12 hospital; the only burn center in Ethiopia. Availability and accessibility of burn units in all parts of the country will hopefully improve the outcome and quality of care and reduce unnecessary transport and service costs to the victims.

It will be valuable if further studies are conducted to assess the standard management trends of pediatric burns since almost all patients who had developed shock had died which could possibly due to inadequate resuscitation.

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Appendices

Annex 1 information sheet

Name of the investigator Achamyelesh Tadele (Bsc, Msc candidate)

Research title magnitude, clinical presentation and outcome of pediatric burn injuries at Yekatit 12 hospital from January 2012- December 2013, Addis Ababa Ethiopia.

Research objective the aim of this study is to assess the magnitude, clinical presentation and outcome of burn injuries among pediatric patients seen at Yekatit 12 hospital from January 2012- December 2013.

Study procedure to achieve the planned objective of this study, socio demographic data, clinical history and course of management of patients will be taken from patients' medical records.

Confidentiality the collected information will be kept confidential and used only for research purpose. No one except the members of the research team will have access to the information collected. The name and/or other personal information of patients will not be notified in any report. All paper and computer records of the study will be kept in a secured place under lock when not in use.

Person to contact if the data collectors or other hospital administrative staffs have any question regarding the study they are free to contact me in person or by the following addresses

Achamyelesh Tadele Cell phone: 09 34 41 31 65

Email: achamtadele@gmail.com

Annex 2 Hospital consent form

This is a study that will be conducted in yekatit 12 hospital, the main referral hospital for treatment of severe burn injuries in Ethiopia. The main objective of this study is to characterize the magnitude, clinical presentation and outcome of children with burn injuries seeking medical care at the pediatric department of Yekatit 12 hospital. Such assessment is needed for preventive and therapeutic approaches in the area of childhood burn injuries that should be based on appropriate knowledge of general epidemiologic data of burn injuries in our region and on a national scale and also for the availability of information to help emergency department personnel on the proper management of burn cases. Pediatric burn injuries are least explored areas among other injuries and very little is known about the patterns and clinical presentation of burn injuries in Ethiopia. Therefore the hospital's participation and collaboration is very much helpful in generating the required information and will be very much appreciated.

In this study data will be collected from the patients' medical record cards retrospectively. Information regarding any specific personal identifiers like the name of the clients will not be collected and information generated will be disclosed in totality. In addition confidentiality of any personal information will be maintained throughout the study process and no unauthorized access to the information is allowed.

Finally, the hospital has all the right to refuse to participate in this study at any time. If you have any questions or need further information regarding the planned study you are free to get clarification from the principal investigator or from the institution or through the following address. Achamyesh Tadele , telephone 0934413165 (the principal investigator). Therefore, if you would like to participate in this study, would you please confirm it by signing here. Thank you very much.

Participant Hospital----- principal investigator-----

Annex 3 Data collection sheet for pediatric patients in Yekatit 12 hospital burn center

I. Socio-demographic data of the child

1. Serial number_____
2. Card number_____
3. Age_____
4. Sex_____
5. Address_____
6. Family size_____
7. Birth order__

II .socio demographic data of the parent or guardian

1. Age_____ 2.sex_____
3. Marital status of parents or guardians a. Married b. single c. widowed
d. divorced e. separated
4. Educational status of the parent or the guardian a. not educated b.1-8 c.9-12
d. college and above
5. Monthly income in birr _____
6. Relation of the care taker to the child a. parents b. grandparents
c. guardian d. others (specify)

III Clinical data

1. Cause of burn trauma
a. Scald b. Flame c. electricity d. chemical agents e. others (specify)
2. Place of injury or setting of injury: a. home b. school c. others
(specify)
3. Anatomic location/s of the burn
a. upper extremities b. lower extremities c. trunk d. head e. abdomen
f. perineum e. face and neck
4. Degree or severity of burn injury
a. superficial/first degree burn b. partial thickness/second degree burn c. full
thickness/third degree burn
5. Extent of burn injury (% of total burn surface area) _____
6. Duration of time in home before getting medical attention after burn
injury_____
7. Pre hospital intervention provided a. yes b. no
8. If the answer to question number 7 is yes, what was the care provided before
hospitalization_____
9. Length of hospital stay _____
10. Month at which the child sustains injury_____

11. is the injury intentional or non intentional_____

12. if the injury is intentional was it a. immersion b. pouring c. other (specify)

13. Any concomitant medical condition of the child a. epilepsy b. diabetic mellitus c. down's syndrome d. others (specify) e.none

14. Clinical presentation at the time of admission

a. airway compromise

b. shock

c. arrhythmia

d. loss of consciousness

e. others (specify)

f. none

15. Outcome of a child who had sustained a burn injury

a. recovery without any complication

b. contracture

c. death

d. scarring or disfigurement

e. if other specify

Amharic version of information sheet

ገጽ ፩ ~ ገጽ ፮

ጥናቱን የሚያካሂደው ሰው አቻምየለሽ ታደላ (የመጀመሪያ ዲግሪ ምሩቅና የሁለተኛ ዲግሪ ተማሪ)

የጥናቱ ርዕስ

በየካቲት 12 ሆስፒታል ከጥር 2012-ጥር 2014 እ.ኤ.አ የታከሙ የቃጠሎ አደጋ የደርሰባቸው ህጻናትን ብዛት የህመም ሁኔታና የደርሰባቸውን ጉዳት ለማወቅ ይሚደርግ ጥናት

የጥናቱ አላማ

ጥናቱ የሚካሄድው የቃጠሎ አደጋ ደርሰባቸው በየካቲት 12 ሆስፒታል በታከሙ ሕጻናት ላይ ሲሆን አላማውም በህጻናት ላይ የደረሰውን የቃጠሎ አደጋ መጠን ፣ የህመም ሁኔታና ጉዳት መዳሰስ ይሆናል

የጥናቱ ቅደም ተከትል

ከላይ የተጠቀሰውን የጥናቱን ዓላማ ለማሳካት ከበሽተኞች የህክምና ቻርት የበሽተኞች የግል ሁኔታ እና የህክምና ታሪክ ይወሰዳል

ሚስጥር አጠባባቅ

በዚህ ጥናት ላይ የሚሰበሰበው መረጃ በሙሉ ሚስጥራዊ በሆነ መንገድ የሚቀመጥ ሲሆን የተገኙት መረጃዎች በሙሉ ለጥናቱ አላማ ብቻ የሚውሉ ይሆናል ። የበሽተኞች ስም ወይም ሌላ የግል መረጃ በማንኛውም ሪፖርት ላይ አይጠቀስም ። ከጥናቱ ተመራማሪዎች ውጪ ማንም ስው የበሽተኞችን የህክምና ታሪክ በማንኛውም መንገድ በቀጥታ ሊያገኝ አይችልም ። ለጥናቱ ተብለው በወረቀት ወይም በኮምፒውተር የሚሰፍሩ መረጃዎች በማንጠቀምባቸው ጊዜ ተቆልፈው ይቀመጣሉ።

ግኑኝነት

መረጃ ሰብሳቢዎች እንዲሁም የተለያዩ የሆስፒታሉ አስተዳደር ስራተኞች ተጨማሪ መረጃ ማግኘት ከፍሉጉና ጥያቄ ካላቸው የሚከተሉትን ሰዎች በአካልም ሆነ በስልክ ማግኘት ይችላሉ።

አቻምየለሽ ታደላ ስልክ 09 34 41 31 65

Email: achamtadele@gmail.com

Amharic version of hospital consent form

የሆስፒታል ስምምነት ቅጽ

ይህ ጥናት ሚካይደው በኢትዮጵያ ዋና የከፍተኛ ቃጠሎ አደጋ ሪፈራል ሆስፒታል በሆነው የካቲት 12 ሆስፒታል ነው ሲሆን የጥናቱ ዋና አላማ በህጻናት ላይ የደረሰውን የቃጠሎ አደጋ መጠን ፣የሕመም ሁኔታና የደረሰባቸውን ጉዳት መዳሰስ ነው ።

ይህ አይነቱ ዳሰሳ በአዲስ አበባ እንዲሁም በሀገር አቀፍ ደረጃ በህጻናት ላይ የሚደርሰውን የቃጠሎ አደጋ በአግባቡ ለማከምና ለመከላከል ይረዳል ። በህጻናት ድንገተኛ ክፍል ለሚሰሩ የጤና ባለሙያዎችም ስለ ቃጠሎ ህክምና መረጃ ይሰጣል ። ከሌሎች አደጋዎች አንጻር ሲታይ በሀገራችን በህጻናት ላይ ስለሚደርስ የቃጠሎ አደጋ ብዙ መረጃ አይገኝም። ስለሆነም ሆስፒታሉ ለዚህ ጥናት የሚያስፈልጉ መረጃዎችን እንድንሰበስብ መፍቀዱ ለጥናቱ መከናወን ከፍተኛ የሆነ አሥተዋጾ ያበረክታል ።

ለጥናቱ የሚፈለገው መረጃ የሚሰበሰበው ከበሽተኞች የህክምና ቻረት ላይ ሲሆን የበሽተኛው ስም ወይም ሌሎች ግላዊ መረጃዎች አይወሰዱም። በተጨማሪም ለጥናቱ ተብሎ የተሰበሰበው መረጃ በሚሰጥር የሚጠበቅና ከጥናቱ ተመራማሪዎች ውጪ ማንም ስው ሊያግኘው አይችልም ።

ይህ ጥናት በፍቃደኝነት ላይ የተመሰረተ እንደመሆኑ መጠን ሆስፒታሉ በማንኛውም ወቅት ከጥናቱ መውጣት ይችላል ። ከጥናቱ ጋር በተያያዘ ጥያቄ ወይም ተጨማሪ መረጃ ካስፈለገ በሚከተለው አድራሻ ጥያቄዎን ማቅረብና ማብራሪያ ማግኘት ይችላሉ።

አቻምየለሽ ታደለ(ዋና ተመራማሪ) ስልክ 0934413165

በዚህ ጥናት ለመሳፍ ሆስፒታሉ ፍቃደኛ ከሆነ እባክዎ በፊርማዎ ያረጋግጡልን።

እናመሰግናለን

ተሳታፊው ሆስፒታል-.....

ዋና ተመራማሪ.....

Annex 4

ASSURANCE FORM

I, the undersigned, assert that this MSc. thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been accordingly acknowledged.

M. Sc candidate: Achamyesh Tadele (**BSC**)

Signature: _____ Date _____

Advisor:

Tigist Bacha (MD, MPH, pediatric emergency specialist, assistant professor of pediatrics)

Signature: _____ Date _____