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A five-year prospective study of the Aetiology, Pattern of Presentation, and Management of patients with burns in Ekiti State University Teaching Hospital

Innih Asuekome Kadiri^{1*}, Kolawole Olubunmi Ogundipe¹, Kehinde Sunday Oluwadiya²

¹Division of Plastic Surgery, Department of Surgery, Ekiti State University Teaching Hospital, Ado Ekiti. Ekiti State, Nigeria

²Division of Orthopaedics and Traumatology, Department of Surgery, Ekiti State University Teaching Hospital, Ado Ekiti. Ekiti State, Nigeria

*Correspondence should be addressed to Innih Asuekome Kadiri: innih.kadiri@eksu.edu.ng

Received 23rd February 2022; Revised 29th March 2022; Accepted 30th April 2022

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ABSTRACT

Background: Burns constitute a significant public health problem worldwide, with most reported mortalities occurring in low and medium-income countries (LMICs). Therefore, this study aimed to generate epidemiological data on the aetiologies, patterns of presentations, and outcomes of burn injuries in Ado Ekiti, the capital of Ekiti State.

Methodology: This was a five-year prospective study of all patients with burns managed at Ekiti State University Teaching Hospital. The required information was entered into a hospital-based burn data collection form from admission to discharge. The data generated were exported to IBM SPSS version 23 for analysis.

Results: A total of 160 patients were included in this study. The median age was 10.5 years (IQR 2 – 33). Half of the patients were aged <10 years old. About 66.9% of the injuries occurred indoors, with the kitchen being the most common injury site (49.4%). Scald was the most common aetiology, and most injuries occurred in the morning. While 71.9% had first aid at the injury site, the first aid agents used were potentially harmful in most cases. The injuries were predominantly partial-thickness with a mean TBSA burn of 14% and a median ABSI of 4 (IQR 3 – 5). The lower limbs were the most frequently affected body regions, with an overall mortality rate of 5%.

Conclusion: Scalds are the most common aetiology of burns in Ado Ekiti, with most injuries occurring in the kitchen. The populace needs to be adequately educated on the suitable materials to provide first aid to burn victims.

Keywords: Epidemiology, Aetiology, Pattern of presentation, Ado Ekiti, ABSI, Outcome.

1. INTRODUCTION

Burns is a global public health problem with high morbidity and mortality rates [1–5]. Approximately 300,000 people die annually from burn-related injuries [6–9]. Most documented burn deaths occur in low and medium-income countries (LMICs), including Nigeria [2, 3] and account for over 90% of reported cases [10, 11]. Burn injuries can be very devastating when severe, often leading to disfigurement in victims that may ultimately cause significant disability. Burns have been noted to be the fourth most common cause of death from trauma,[12] often putting a huge financial burden on the patient, especially in our environment where patients have to pay out-of-pocket for their treatment and cannot afford proper care due to the high poverty rate. This may be one of the reasons why death from burns are more prevalent in low and medium-income countries like ours. Most cases of burns occur at home and are mostly accidental. The most common aetiology are flame and scald.

The epidemiology of burns differs and is unique to each environment based on prevailing cultural practices, demography, geography, and occupation [13]. Data from epidemiological studies are valuable for planning, developing, and implementing burn management and prevention strategies to improve outcomes [1, 14].

There are few published data on burns in Ekiti State, Southwest Nigeria, and little is known about the epidemiology of burns in Ado Ekiti, its state capital. Therefore, this prospective study was designed to determine the common aetiologies of burns at the Ekiti State University Teaching Hospital (EKSUTH), their pattern of presentation, and outcomes. This study will enable us to understand the major causes of burns across various age groups in our locality. It can also generate epidemiological data that can be domesticated for our practice in our environment.

2. METHODOLOGY

This was a prospective study of all burn patients seen at the Ekiti State University Teaching Hospital (EKSUTH) Ado Ekiti from 1 January 2016 to 31 December 2020. It included all patients managed as both outpatients and inpatients. Patient information was entered into a 59-item proforma at presentation designed to collect burn data.

The EKSUTH burn data form is a modification of the International Society of Burn Injuries (ISBI) burn data form, which contains information about the biodata of the

patient, aetiology and location of burn injury, mechanism of injury, presence or absence of an eye witness, first aid given at the scene of injury, whether the patient was wearing clothes at the time of injury, burn size estimation including abbreviated burn injury severity index score (ABSI), body parts affected, nature of the burn wound, presence or absence of inhalational injury, complications during the period of admission, method of disposal from the hospital and challenges with treatment.

Information was filled out as necessary on the questionnaire until the time of disposal from the hospital, irrespective of the treatment outcome. A copy of this form has been attached to the appendix. Data collected over the five (5) year study period were entered into a Microsoft Excel spreadsheet after each form per patient. The data generated from this information were imported into IBM SPSS version 23 for analysis.

The percentage of total body surface area (TBSA) burn was calculated using Wallace's rule of nines for adults, Lund and Browder chart for children up to 15 years of age, and the rule of the palm in both age groups. The diagnosis of inhalational injury was based on a history of burn injury occurring in an enclosed environment, facial burns, singed nasal hair, presence of cough with or without carbonaceous sputum, and a change in voice calibre. The patients were admitted to the adult and paediatric emergency rooms and managed according to our unit's burn management protocol. Those who met the criteria for admission were admitted, whereas those who did not meet these criteria were managed as out-patients. Ethical clearance for this study was obtained from the Research and Ethics committee of the hospital.

3 RESULTS

A total of 160 patients with burns were observed during the study period from January 2016 to December 2020 at a rate of 0.83 patients per week. This was 0.6% of all cases presenting to the hospital's adult and child Accident and Emergency units during the study period

3.1 Age and gender

The median age of the patients during the study period was 10.5 years, with an age range of 0.01 to 79 years (IQR 2 – 33 years). The modal age group was two years. The 0 – 10-year age group accounted for half (80, 50.0%) of the total number of patients. There were 88 (55%) patients aged <15 years and 72 (45%) aged >15 years. Only 5 (3.1%) patients were older than 60 years. A total of 93

(58.1%) males giving a male-to-female ratio of 1.4:1.

3.2 Admission status and sources of referral

One hundred and ten (68.8%) patients were treated as in-patients. Of all in-patients, 106 (96.4%) were seen within one week of sustaining their burn injuries, while the remaining 4 (3.6%) were seen and admitted after one week. The majority of the patients (102, 63.8%) came directly to the hospital after sustaining the injury, twenty-six (16.3%) patients had initial treatment at private hospitals before being referred to our centre areas 28 (17.5%) patients were referred from government-owned primary and secondary health facilities. Four (2.5%) were persuaded to come to the hospital by their neighbours who also brought them.

3.3 Time of injury and duration before the presentation.

Only 129 patients could clearly state the time of day when the burn injury occurred. Most burn injuries occurred in the morning (n=49, 38.0%) and evening (n=41, 31.8%). Others occurred during the day (n=32, 24.8%) and night (n=7, 5.4%) 63 (39.4%) patients presented between 1- 4 hours after injury. Only 27 (16.9%) patients presented within the first hour of sustaining a burn injury. Table 1 shows the distribution of the time it took for patients to visit our center after the injury

Table 1: Duration Before Presentation

Duration	Frequency (%)	Cumulative Percent
<1 hour	27 (16.9)	16.9
1 – 4 hours	63 (39.4)	56.3
5 – 8 hours	9 (5.6)	61.9
9 – 12 hours	3 (1.9)	63.8
13 – 24 hours	21 (13.1)	76.9
2 – 4 days	19 (11.9)	88.8
5 – 7 days	6 (3.8)	92.5
>7 days	12 (7.5)	100
Total	160 (100)	

3.4 Place of injury

One hundred and seven (66.9%) patients sustained their injuries indoors. Among those who sustained injuries indoors, a more significant proportion (79, 73.8%) had injuries in the kitchen. Bathrooms had the next highest frequency (14, 13.1%). Ten (9.3%) patients sustained burns in the living room, while bedroom and dining had the

lowest frequency of occurrence in 2 (1.9%) patients each. Most of the injuries (n=120, 80.0%) occurred at home. Others occurred in various other places including workplaces, traffic, farms, churches, and health centers (Table 2).

Table 2: Location where the injury occurred

Location	Frequency %
Home	128 (80.0)
Work Place	13 (8.1)
Traffic	14 (8.8)
Farm	2 (1.3)
Church	2 (1.3)
Health Centre	1 (0.6)
Total	100

3.5 Aetiology and Mechanism of injury

Flame, scald, electricity, chemicals, and contact are the common aetiologies of burns. No radiation burn was observed. Half (80, 50.0%) of the patients had scald burns. Flame burns were next in frequency accounting for 40.6% (n=65) of the patients. Electrical, chemical, and contact burns collectively accounted for 9.4% of burns (15 patients). Most of the injuries were caused by hot water followed by cooking gas (Table 3).

The mechanisms of injury were accidental in most cases (Table 4). One hundred and forty-seven (91.9%) burns occurred accidentally, 8 (5.0%) were work-related and occurred at the place of work, 4 (2.5%) were suspected to be self-inflicted, and 1 (0.6%) as a result of an assault. Sixty-eight percent (110) of the injuries occurred in the presence of an eye witness, whereas there were no eye-witnesses in 50 (31.3%) cases.

3.6 Clothing on the affected parts of the body

Most patients (89, 55.6%) wore clothes on the affected parts of the body, and 71 (44.4%) did not wear any clothing on the parts of the body burned. Sixty-eight patients (76.4%) who had clothes on the parts of the body affected reported that they had their clothes removed immediately following the burn injury, whereas 21 (23.6%) patients did not remove their clothes immediately. Cotton was the most commonly worn fabric (64.0%). The other fabric types were Silk and Wool, which accounted for 14.6% and 11.2%, respectively. Six patients (6.4%) could not state the type of fabric their clothes were made of, while three (3.4%) others were made of other types of fabrics

Table 3: Etiologic Agents reported in Ekiti State University Teaching Hospital

Agent	Frequency	Percentage (%)
Chemical	2	1.3
Hot Water	52	32.5
Hot Oil	16	10.0
Cooking Gas	27	16.9
Petrol Flame	23	14.4
Kerosene Flame	5	3.1
Burning Fire/open fire	10	6.3
Hot Meal (Food)	6	3.8
Hot Soup	4	2.5
Electricity	9	5.6
Motorcycle Exhaust Pipe	3	1.9
Hot Perfume	1	0.6
Hot Engine Oil	1	0.6
Hot Cooking Pot	1	0.6
Total	160	100.0

Table 4: Mechanisms of Injury reported in Ekiti State University Teaching Hospital

Mechanism	Frequency	Percentage
Accidental spillage of hot water/other fluids	57	35.6
Kerosene explosion from lantern/stove	5	3.1
Gas explosion	27	16.9
Hot oil spillage	18	11.3
Road traffic crash	5	3.1
Fall into a burning fire	14	8.8
petrol fire/explosion	14	8.8
Pushed into a burning fire	1	0.6
Contact with the Motorcycle exhaust pipe	4	2.5
Assault	2	1.3
Contact with electricity	9	5.6
Explosion of asbestos	1	0.6
Hot fomentation applied due to failure to cry after birth	1	0.6
Contact with Hot metal	2	1.3
Total	160	100.0

apart from the ones stated.

3.7 First aid

Only one hundred and fifteen (71.9%) patients had immediate first aid administered at the incident scene. Various agents were used as first aid including tepid water, pap, raw egg, engine oil, and several others (Table 5). These were used either as a single first aid agent or in various combinations. Trepid water (21.7%) was the most commonly used first-aid agent, followed by engine oil (11.3%).

3.8 Pre-injury condition

Only 14 patients (8.7%) had premorbid medical conditions: these include substance abuse, hypertension, alcoholism, smoking, leg ulcers, asthma, and birth asphyxia.

3.9 Nature of injury and pattern of presentation

The total body surface area burned (TBSA) percentage ranged from 1% to 94%, with a mean of 14%. The modal TBSA burn was 1%. The distribution of the percentage of TBSA burn is shown in table 6. The predominant burn depth was partial thickness (112, 76.3%). Thirty-eight (23.8%) patients had full-thickness burns either occurring alone or with associated superficial or deep partial-thickness burns, while only 9 (5.6%) patients had full-thickness burns alone without an associated partial-thickness burn, and 29 (18.1%) had mixed partial and full-thickness burns. However, 94 (58.8%) patients had purely superficial partial-thickness burn alone. The median abbreviated burn severity index (ABSI) was 4 with a range of 2 – 15 (IQR 3 – 5). The modal ABSI score was 3, with a probability of survival of $\geq 98\%$.

When the burn was limited to a single body region, the lower limbs were the most affected (17, 10.6%), followed by the upper limbs (12, 7.8%). However, most patients had involvement in multiple body regions (Table 7). Nine (5.6%) patients had circumferential full-thickness burns affecting various parts of the body, for which they had immediate escharotomy. No complications were observed following escharotomy. Inhalational injuries were recorded in 23 (14.4%) patients. Only one patient was intubated for airway management. Three other patients who required ventilatory support were referred to other centers where they could be ventilated.

3.10 Management outcome

Four (2.5%) patients had other associated injuries apart from the burn injury. Two patients had a head injury, while the other 2 had long bone fractures. The two pa-

Table 5: Type of Agents Used as First Aid

First Aid	Frequency	Percentage (%)	Valid Percentage (%)
Tepid water alone	25	15.6	21.7
Pap alone	6	3.8	5.2
Engine oil alone	13	8.1	11.3
Raw egg alone	12	7.5	10.4
Gentian violet alone	6	3.8	5.2
Honey alone	6	3.8	5.2
Pap and Raw egg	3	1.9	2.6
Tepid water and pap	2	1.3	1.7
Engine oil and raw egg	2	1.3	1.7
Others	9	5.6	7.8
Tepid water and gentian violet	2	1.3	1.7
Raw egg and others	3	1.9	2.6
Engine oil and honey	1	.6	.9
Tepid water, pap and raw egg	2	1.3	1.7
Tepid water and raw egg	3	1.9	2.6
Tepid water and others	3	1.9	2.6
Raw egg and gentian violet	3	1.9	2.6
Pap, engine oil, and raw egg	4	2.5	3.5
Raw egg and honey	2	1.3	1.7
Pap, engine oil, honey, and others	1	.6	.9
Gentian violet and others	1	.6	.9
Tepid water and engine oil	2	1.3	1.7
Engine oil and Gentian violet	1	.6	.9
Pap, raw egg, and gentian violet	2	1.3	1.7
Pap and others	1	.6	.9
Total	115	71.9	100.0
Not applicable (No first aid)	45	28.1	
Total	160	100.0	

Table 6: Percentage of Total Body Surface Area Burn

TBSA	Frequency	Percentage
<10	86	53.8
10-19	40	25.0
20-29	13	8.1
30-39	9	5.6
40-49	3	1.9
50-59	2	1.3
60-69	3	1.9
80-89	2	1.3
90-99	2	1.3
Total	160	100.0

tients with fractures were victims of high tension electrical injury and were ejected from the electrical pole, while the two who had head injuries were involved in a vehicular motor crash with associated burn injury. The most significant complications we recorded include anemia, severe sepsis, metabolic acidosis, wound infection, and renal impairment. The range of hospital stay was one day to 66 days, with a mean of 13.9 days. Most of the patients (48, 30.0%) were discharged within seven days of admission. Fifty-eight (36.3%) were managed as outpatients. Figure 1 shows the frequency distribution of the duration of hospital stay. Our mortality rate recorded was 5.0%, representing 8 out of the 160 patients seen within the study period. Six (3.8%) patients were referred to other

Table 7: Body Parts Affected

Body Part	Frequency	Percentage	Valid Percentage
Head	3	1.9	1.9
Neck	1	.6	.6
Right upper limb	7	4.4	4.5
Left upper limb	5	3.1	3.2
Right lower limb	9	5.6	5.7
Left lower limb	8	5.0	5.1
Anterior trunk	6	3.8	3.8
Posterior trunk	4	2.5	2.5
Two body parts affected	32	20.0	20.4
Three body parts affected	23	14.4	14.6
Four body parts affected	21	13.1	13.4
Five body parts affected	9	5.6	5.7
Six body parts affected	14	8.8	8.9
Seven body parts affected	15	9.4	9.6
Total	157	98.1	100.0
System missing	3	1.9	
Total	160	100.0	

centers for continued care. The reasons for referral were for proper ICU care (3, 1.9%), due to industrial action in the hospital (2, 1.3%), and proximity to relatives (1, 0.6%). Table 8 summarises the overall outcome of management. The major challenge we had with treatment was financial constraint. None of the patients that died had a post-mortem done. At the time of discharge, up to 50% of our patients still had a residual wound for which they continued outpatient dressing.

DISCUSSION

Management of burn injuries in resource-poor settings is a major challenge. Therefore, an incidence rate of approximately one burn injury per week constitutes a significant challenge for our hospital which has no dedicated burn unit and a high dependency unit (HDU) with just

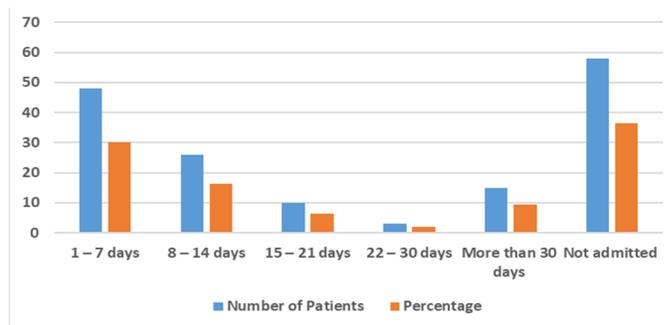


Figure 1: Duration of Hospital Stay

Table 8: Overall Treatment Outcome

Outcome	Frequency	Percentage
Death	8	5.0
Left against advice	16	10.0
Discharged	130	81.3
Referred	6	3.8
Total	160	100.0

two beds and just one elective surgery session per week in the theatre.

Consistent with the literature from around the world, this study found that most burn injuries occur at home [1, 2, 13, 15–20] with the kitchen being the most common scene in the house. The second most common scene of burn injury at home is the bathroom, accounting for 13.1% of all burns sustained indoors. Together, close to nine-tenths of all indoor burns occurred in the kitchen and the bathroom. This finding implies that if attention is focused on preventing burn injuries in the kitchen and the bathroom in our study environment, close to 60% of burn injuries will be prevented. One factor that has probably contributed to the high incidence of bathroom-associated burn is the lack of bathroom water heating facilities in most of the buildings in the study environment. Even when the facilities exist, there may not be any electricity to power them. Therefore, most resorted to heating water in the kitchen and carrying it to the bathroom. Spillage can occur in the process causing burn injuries.

Traffic and haste also appear to be predisposing factors to burn in this study. More burn injuries occur in the morning than at any other time of the day. The rush hour at home is between 6 am and 8 am when people are getting ready for work and school. Everyone in the house will need to get to the bathroom (most households have just one bathroom) to take their bath and most will go to the kitchen for hot water and their food. Thus, there is in-

creased traffic of persons who are mostly in hurry in kitchens and bathrooms, and which may lead to an increased likelihood of burn injuries.

Scald is the most common cause of burn in this study. This finding differs from most published studies from Nigeria and abroad,[21–25] but is consistent with the findings by Datubo-Brown [17], Iregbulem [26], and Gupta [27]. These findings can perhaps be explained by the fact that most of our patients were in the paediatric age group and studies have shown that scalds are more common in children than adults [8, 12, 14, 28]. The scalding agents include hot water, hot oil, hot soups and food, hot engine oil as well as hot perfume fluid.

The severity of burn wounds, their clinical manifestations, and the outcome depends not only on the treatment in the hospital but also on the initial management at the burn site as well as the interval between injury and initiation of specific burn treatment in the hospital [29]. About one out of every four patients did not have any form of first aid at all. These are probably better-off than the 71.9% who had first aid as most of the agents applied to the wounds as first aids such as engine oil and pap were harmful making the burn injury worse. Engine oil, alone or in combination with other agents was the most commonly used harmful agent. Cool running water at a temperature of between 10 and 15 °C for 20-30 min is considered adequate burn first-aid treatment [29]. No patient had running water applied as first aid, the closest to this were the 21.7% of the patients who had tepid water applied.

The most commonly affected body region in our study is the lower limb. Even when multiple body parts were burned, the lower limbs were mostly involved. Compared to other previously published studies, there appears to be a wide variation in the body parts reported by different authors [30–36]. Oladele and Olabanji in a review article in 2010, reported the trunk as the most commonly affected region of the body in 56% of the cases they reviewed [4]. This inconsistency is likely because the aetiology and mechanism of burn injury vary for different localities.

The outcome of burn treatment is a measure of several factors, which include the time of instituting proper and definitive care, immediate first aid is given, the severity of the injury, and presence or absence of pre-morbid medical conditions.

More than half of our patients presented to the hospital within the first four hours of sustaining the injury, thus having proper resuscitation and definitive care started

within the first 8 hours of injury. This coupled with the fact that the majority of our patients had burns less than 15% TBSA added to the low mortality recorded. Our mortality rate was 5% which is consistent with many other published burn mortality rates. However, several studies both locally in our country and abroad have reported mortality rates much higher than ours [37–40]. The possible reason for this may be that the number of patients we saw during the study period is fewer than some of those quoted by other authors. Also, more than 50% percent of our patients were in the paediatric age group and many studies have corroborated the fact that burn mortality is generally less in the paediatric age group as compared to adults [41, 42]. Three-quarters of our patients had predominantly partial-thickness burn which is known to have a better outcome as compared to full-thickness burns. Four-fifth of the total number of patients seen had an ABSI of at least 5 and below. With an ABSI of 5 or less, the threat to life is low and the probability of survival is between 98% – 100% [43, 44].

A discharge against medical advice of 10% (16) is quite significant. This is so because most people in our study environment are poor and usually cannot afford the cost of prolonged hospital stay especially as they had to pay out of pocket. So they prefer to discharge against medical advice and then seek alternative care which they consider cheaper. Media campaign on proper first aid for burn injuries is imperative considering the effect that improper first aid could have on the outcome of the burn injury.

Proper preventive measures should be advocated in kitchens and bathrooms to reduce the incidence of household burn injuries. For example, people must be educated to carry cold water to hot water and not the other way round in order to prevent accidental burn injuries in the homes [45].

In conclusion, scald from hot water is the most common aetiology of burns in Ado Ekiti, Southwest Nigeria, and children below the age of 10 years are most commonly affected, with the kitchen and bathroom being the site of most injuries. Knowledge of the adequate and proper application of burn first aid is still lacking as most people end up using agents that are potentially harmful and could worsen the burn injuries as first aid.

Acknowledgement

We thank all the resident doctors in the department of surgery of Ekiti State University Teaching Hospital (EKSUTH) who helped to fill the burn data forms at the

time of presentation of the burn patients and Mr. Sunday Ibiyemi for data entry into SPSS for analysis.

Conflict of interest:

The authors declare no competing interests

Source of funding:

None

Authors' Contributions:

IAK, conceptualized the study, contributed to literature review, analysis and interpretation of data and manuscript writing as well as assembling the research team. **KOO**, contributed to literature review, and manuscript writing. **KSO**, contributed to the interpretation and analysis of the data, literature review, manuscript writing as well as proof-reading and editing the manuscript. All authors have approved the final copy of the manuscript.

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