

CAUSES AND PATTERN OF THERMAL BURNS SUSTAINED DURING SEIZURES BY PATIENTS WITH EPILEPSY SEEN AT KENYATTA NATIONAL HOSPITAL.

This dissertation is submitted in part fulfillment for the award of Master of Medicine in General Surgery of the University of Nairobi.

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DECLARATION

31st March 2013

I declare that this dissertation is my own original work and has not been presented for a degree in any other University.

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DEDICATION

I dedicate this work to my family, friends and teachers whose assistance enabled me to fulfill this noble objective.

ACKNOWLEDGEMENTS

I do acknowledge the support of my supervisors Dr: Abdulahi Adan and Dr: Tom Omulo whose efforts in reading and correcting this piece of work summed up the input into making the completion of this dissertation. I would also like to acknowledge the work of the entire Department of Surgery for the opportunity to study and acquire the relevant skills during this period.

Thank you all.

God bless you.

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ABBREVIATIONS

AEDS: Anti-epileptic Drugs

K N H: Kenyatta National Hospital

MBChB: Bachelor of Medicine and Bachelor of Surgery.

M.Med: Master of Medicine

PWE: Persons with Epilepsy.

SPSS: Statistical Package for the Social Sciences.

U O N: University of Nairobi.

TBSA: Total Burn Surface Area.

SLE: Systemic Lupus Erythematosus.

ANOVA: Analysis of variance

DEFINITION OF TERMS.

1. **Next of kin:** This means the person or persons closely related by blood to another person. That is a person's closest relative or relatives. (from free dictionary.com).
2. **Epilepsy :** chronic neurological disorder characterized by sudden recurring attacks of motor, sensory or psychic malfunction with or without loss of consciousness.
3. **Thermal burns:** tissue injury, usually skin which is caused by extreme heat.
4. **Eschar :** a slough or dry cab formed on the skin as a result of a burn by the action of a corrosive, caustic substance or thermal burns.
5. **Escharotomy:** surgical incision into a burn eschar in order to lessen its pull on the surrounding tissues.
6. **Escharectomy:** surgical excision of all or part of an eschar, usually following burns.
7. **Skin grafting.** Surgical procedure by which skin or skin substitute is place over a burn or non-healing wound to permanently replace the damaged or missing skin or provide a temporary wound cover.

ABSTRACT

Background: Burns is an important health problem in the developing countries and epilepsy is a major predisposing factor to severe burns. The severity of burns in these countries is also high. The total burn surface area and the depth of burns are important prognostic factors. In persons with epilepsy, the burns may involve a small area but may be deep. Most burns tend to occur in domestic setting and are more common in females than males. Inadequate seizure control is noted to increase the risk of burns in persons with epilepsy.

Objective: To describe the causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at Kenyatta National Hospital.

Variables that were evaluated are: Causes of burns, depth of burns (superficial, deep or mixed), distribution of the burns (head and neck, upper limbs or trunk), other injuries sustained during seizures (cuts, head injuries, fractures, or dislocations) and complications arising from the burns (contractures, traumatic amputations, wound sepsis, facial disfiguring.)

Study design: Observational descriptive prospective study.

Setting: Kenyatta National Hospital, in Nairobi, Kenya

Study duration: 1st December 2012 to 31st March 2013.

Methods and materials: Purposive sampling method was used to select 30 patients who had sustained thermal burns during seizures. The causes of burns, their depth, their distribution, other associated injuries and the complications arising from the burns were documented.

Data collection and statistical analysis: Data was collected from the patients/next of kin and from their records at Kenyatta National Hospital. Predesigned data collection sheets were used. It was analyzed using SPSS version 19 and descriptive statistics for sample variables was presented in form of tables and graphs. Data was considered significant at $p \leq 0.05$ and presented with 95% confidence interval.

Results: These were obtained from 30 PWE who sustained thermal burns during seizures and treated at KNH. The age ranges was from 10 to 38 years. There were more females than males

who sustained thermal burns during seizures among these patients; ratio 1.3:1. Open flame caused most thermal burns in this group of patients; (76.7%). Most thermal burns were deep (53.3%) followed by mixed burns (26.7%). These thermal burns involved areas less than 20% based on TBSA; this accounting to 83.3%. These burns mainly involved the upper limbs (70%) and trunk (53.3%). Head injuries and fracture/dislocations were the main injuries associated with the thermal burns. Sepsis and contractures accounted for the highest percentages of complications arising from thermal burns while skin grafting and escharectomy were the main procedures performed in the management of severe burns. Counseling on the risk of burns during seizures was noted to be statistically significant in reduction of TBSA (P=0.04).

Conclusion: The thermal burns sustained by PWE during seizures occurred in the domestic setting and affected more females than males. Most thermal burns were deep and required surgical management. Counseling on the risk of burns during seizures was noted to be associated with reduction in severity of burns.

INTRODUCTION:

Epilepsy refers to a group of chronic brain conditions characterized by recurrent seizures, while seizures are the clinical manifestations of excessive and/or hyper-synchronous abnormal activity of neurons in the brain¹

It is usually a clinical diagnosis whereby the seizures are repeated, and occur in the absence of a toxic, metabolic or febrile condition^{2,3}.

In order to verify the occurrence of seizures in these patients, the information obtained from relatives or next of kin stating that the person is known to have epilepsy and may have been on treatment is noted. Other important diagnostic investigations such as electroencephalogram may have been done previously in some patients and may be available in their records.

It has been noted that thermal injuries occur more frequently in PWE than in general population, especially during seizures and that epilepsy is a high risk factor to burns^{4,5}.

Burn injuries are among the most devastating injuries seen in emergency units and often result in severe deformities, disabilities and adverse psychological reactions which affect the patients and their relatives⁶.

The injuries sustained during seizures seem to follow a sequence of a fall, loss of consciousness then convulsions⁷.

The commonly used classification of epilepsy is as follows:-

- Simple partial
- Complex partial
- Absence
- Tonic – clonic
- Tonic
- Atonic
- Myoclonic.⁸

AEDs which are commonly used are:-

Carbamazepine

Clonazepam

Gabapentin

Phenobarbitone

Phenytoin

Sodium valproate .^{8,9}

They are very effective in controlling seizures, but most PWE in low and middle income countries do not receive appropriate treatment.¹⁰

LITERATURE REVIEW

Prevalence of epilepsy.

Epilepsy is one of the most common chronic neurological disorders and affects over 65 million people world wide. It is estimated that 80% of them live in low or middle income countries¹⁰. Its prevalence in the developing countries is estimated to be about 57 per 1000 population while in European countries is about 5 per 1000. This high prevalence is due to high levels of parasitic infections such as cysticercosis, peri-natal birth trauma and head injuries^{11, 12}. The estimated prevalence of epilepsy in Kenya as at 1988 was 18 per 1000 population¹³.

Thermal burns and epilepsy

Epilepsy is an important predisposing factor to thermal burns and often leads to deep burns due to the longer duration of contact with the burn agent as a result of patients' loss of consciousness during seizures⁷. There is however, a clear relationship between seizures and burns especially when the phenomena that trigger the onset of seizures occur in the vicinity of burn agents⁷. Some of the factors thought to trigger seizures are flickering lights and hot baths^{7,8,10}.

Thermal burns tend to occur more frequently in PWE than in general population and in a study done in the United Kingdom, 38% of patients attending an epilepsy clinic reported having sustained burns at sometime during seizures compared to 7% who recalled being burned at other times unrelated to seizures⁴.

Some unconfirmed evidences indicate that in African countries, epilepsy is referred to as the 'burn disease' due to the many PWE seeking treatment for burns sustained during seizures¹⁴. It has also been established that thermal burns are a significant cause of hospital admissions in African countries and the factors contributing to burns, hospital conditions and causes of mortality differ from those in the west¹⁵.

The population based study of Teller-Zenteno et al showed that PWE had a higher frequency of burns than general population (6.9% Vs 3.9%). In the same study burns as a consequence of seizures accounted for 1.6 – 10% of admissions to burns unit¹⁶.

Other injuries sustained during seizures

Persons with epilepsy have a higher risk of accidents and injuries when compared to others in the community⁹. The most serious accidents are submersion injuries, burns and road traffic accidents⁹. The other physical injuries commonly sustained during seizures include: - soft tissue injuries, dental injuries, head injuries and fractures.^{2, 10, 16, 17, 18.}

In a united kingdom study, PWE who suffered a seizure in the previous one year, the injuries sustained were as follows: head injuries (25%), burns (16%), dental injuries (10%), fractures (6%)⁴.

Risk of thermal burns in persons with epilepsy.

The established risk factors for burns in PWE include:- female gender, non-compliance to AEDS, the number of AEDs being used to control seizures, frequency of seizures, duration of known epilepsy, history of generalized seizures, presence of neurological deficit, level of education and socio-economic status of the PWE.^{2,4, 19, 20,21.}

In PWE, burns occur more during generalized tonic –clonic seizures and in the presence of neurological deficits^{4, 18, 22, 23}.

Causes and occurrence of thermal burns in persons with epilepsy

Most burns in PWE occur in domestic setting while carrying out activities such as cooking, bathing, blow drying hair and ironing.^{2, 4, 16, 21, 24, 25.}

In these domestic thermal burns, there is a female preponderance with a ratio of about 2.5:1^{7,19, 22}. Burns from hot fluids are the most common injuries sustained by PWE^{2, 4 22,26,27}. Other causes of burns in PWE include open flame and contact with hot surfaces^{4, 28, 29}.

Severity of thermal burns and their associated complications.

The role of TBSA (%) and depth of burns in estimating severity of burns and prognosis is very important. Superficial burns are 1st degree and 2nd degree superficial, while deep burns include the deep 2nd degree, 3rd degree, and 4th degree³⁰. In most cases the thermal burns are mixed in distribution.

In a study done at KNH by Nthumba and Oliech, it was noted that 70% of patients with deep burns died and those who survived developed complications such as severe contractures³⁰.

The burns in PWE also tend to involve vital structures like hands and face²². The documented main complications of burn injuries are severe contractures, disfiguring of face, traumatic amputations and wound sepsis³¹.

Management of deep thermal burns.

Several studies have shown that though the thermal burns sustained by PWE may involve small areas, they are usually deep and require operative treatment^{7,22,24,26,28,30}.

In the management of deep burns, operative procedures are performed. These include:- skin grafting, escharectomy, escharotomy, amputations of gangrenous limbs and digits and release of contractures³¹. This implies longer hospital stay for this group of patients.

Seizure control.

The use of AEDs to control seizures helps to reduce the risk of burns in PWE, however most patients seek treatment from traditional healers and only go to health facilities for the treatment of burns^{10,19,21,30,32}. The community based studies in Kenya that supplied free AEDs reported good adherence and response to therapy¹⁰. In Kenya, epilepsy is highly stigmatized and many communities believe it is due to curses or witchcraft and that it is contagious^{12,33}.

In a study done at KNH by Nderitu et al which looked at the epidemiological pattern and assessed the awareness of burn risk among patients admitted at KNH with burns, it was noted that public education campaigns aimed at burns reduction could be tailored to the educational level of the target population³⁴.

STUDY JUSTIFICATION

The occurrence of thermal burns in PWE is common especially in the developing countries where the prevalence of epilepsy is high and is a major risk factor to burns during seizures. The morbidity and mortality due to burns is higher in these countries too, therefore there is need to reduce or prevent the occurrence of burns sustained by PWE during seizures and institute relevant safety measures. These will include creating awareness among PWE, their relatives and the health care providers on causes of burns, their complications, and strategies to reduce or prevent them. In Kenya, there are currently no published studies on the relationship between burns and epilepsy hence there is need to carry out this type of study.

STUDY QUESTION

What are the causes and pattern of thermal burns sustained during seizures by PWE treated at KNH?

OBJECTIVES

Broad Objective

1. To describe the causes and pattern of thermal burns sustained during seizures by PWE treated at KNH.

Specific objectives

1. To describe the causes of thermal burns in PWE treated at KNH.
2. To determine the depth and distribution of thermal burns in PWE treated at KNH.
3. To establish the other injuries associated with thermal burns sustained during seizures in PWE treated at KNH.
4. To describe the complications of thermal burns sustained during seizures in PWE treated at KNH.

RESEARCH METHODOLOGY

Study population:

The study was conducted on PWE who sustained thermal burns during seizures and were treated in burns unit, burns wards, burns clinic, and Accident and Emergency department of KNH.

Study design

Observational descriptive prospective study.

Setting:

Kenyatta National Hospital in Nairobi, Kenya. This is a leading teaching and referral hospital in the East African region.

Study duration:

1st December 2012 to 31st March 2013.

Sample size calculation

Determination of sample size was based on Rita and Jose study, where burns as a consequence of an epileptic seizure accounted for 1.6 – 10% of admissions to the burns units.¹⁶

Using Fishers' formula

$$n = \frac{Z^2 pq}{d^2}$$

Where

n is the estimated sample size.

Z² is the score of confidence interval at 95% and is 1.96².

P is the prevalence in this case at 2% and q is 1 – p.

d² is the degree of error which is 0.05²

Therefore

$$n = \frac{1.96^2 \times 0.02 (1 - 0.02)}{0.05^2}$$

n = 30 patients

Variables that were evaluated:

Independent variables: patient demographic data:

1. Age
2. Gender

Dependent variables

1. Causes of thermal burns (scalds, open flames, hot surfaces).
2. Total burn surface area (%).
3. Depth of thermal burns (superficial, deep, mixed).
4. Distribution of thermal burns (face, trunk, upper limbs).
5. Other associated injuries (head injuries, dental injuries, fractures/dislocations and cut wounds).
6. Complications arising from thermal burns (Contractures, disfiguring of face, traumatic amputations, and wound sepsis).
7. Procedures performed in management of severe burns (skin grafting, escharectomy, escharotomy, release of contractures).
8. Occupation of the patient.
9. Duration of known epilepsy.

Participant recruitment

Inclusion criteria

1. PWE who sustained thermal burns during seizures.
2. Patients who signed an informed written consent/assent.
3. Ages: 6-80years.

Exclusion criteria

1. PWE who sustained thermal burns when not under seizure attack.
2. Patients who sustained thermal burns during seizures due to febrile illness, hypoglycemia, or under toxic influence.
3. Burns during seizures in persons with epilepsy under 6 years and those above 80 years.
4. PWE who sustained burns from non thermal agents.

Sampling

PWE who presented to KNH with thermal burns sustained thermal during seizures and satisfied the inclusion criteria were recruited into the study.

Patients and methods

Patients who met the inclusion criteria were requested to sign consent/assent forms or the next of kin signed the consent/assent on their behalf after pre-consent counseling. Purposive sampling method was used to select 30 PWE who had sustained thermal burns during seizures. The cause of burns was recorded as scalds, open flame, contact with hot surfaces or others. The depth of burns was recorded as superficial, deep or mixed. The information was obtained from the patients' records and entered into the predesigned data collection sheets. Additional information was obtained from the patient or next of kin and entered into the questionnaire provided.

Total burn surface area and distribution of thermal burns was estimated using Lund and Browder charts. Other injuries associated with thermal burns were documented as head injuries, dental injuries, cut wounds and fractures or dislocations. The complications arising from burns such as traumatic amputations, contractures, wound sepsis and facial disfiguring were documented. The surgical procedures performed in the management of the burns sustained by PWE during

seizures were also documented. These procedures were as follows: skin grafting, release of contractures, escharotomy, escharectomy or amputations of gangrenous limbs.

For those patients who present to the hospital immediately after burns, the follow up period was two months while for the patients who present with old thermal burns, the follow up period was less than two months because almost all the required information was available in their records. The follow up period was useful in ascertaining the complications arising from severe thermal burns and the procedures that were performed in the management of these complications.

Data handling

Principal researcher collected data using predesigned data collection sheets. The data was cleaned and analyzed. Each data collection sheet had a serial number and hospital number of the participant. Data was entered using Microsoft excel then coded and analyzed using SPSS version 19. Descriptive statistics of sample variables was calculated and presented in form of tables and graphs.

Repeated measures ANOVA was used to show any significant variation in depth, distribution of burns, other injuries associated with thermal burns, and any complications arising from thermal burns in PWE. Pearson's correlation was used to check for any relationship between duration of known epilepsy and thermal burns sustained by PWE during seizures.

The influence of sex and occupation in thermal burns sustained by PWE during seizures was assessed using the Mann-Whitney u test. Results were presented with 95% confidence intervals and were considered significant at $p \leq 0.05$.

Ethical consideration

The approval was sought from the Department of Surgery (UON) and KNH/UON Ethics and Research Committee. The study title is causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at KNH. In this study information was collected from persons with epilepsy who had sustained thermal burns during seizures and received treatment at KNH.

The objective of the study is to describe causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at KNH.

To the participants there was no harm or risk anticipated in participating in this study since the enrolment into it was not going to influence the management being instituted to the persons with epilepsy who had sustained thermal burns during seizures. The participants took part in the study on their own free will and were free to leave the study at any time they desired.

The researcher conducted pre-counseling to the participants/next of kin, obtained informed consent/assent then enrolled them into the study. For the participants who were not able to give consent/assent on their own due to mental status or were under-age, the next of kin gave the consent/assent on their behalf, and in case a patient declined to participate in the study treatment was not denied, based on such a decision.

The participant did not incur any extra costs for participating in the study. The questionnaires and record forms were locked up in a secure place to ensure confidentiality. Names of the participants were not recorded to ensure confidentiality during data collection and reporting.

RESULTS

In this study 30 patients with epilepsy who sustained thermal burns during seizures were recruited. The characteristics of participating patients are summarized below followed by analyses of causes of burns, depth and distribution of thermal burns according to anatomical site and complications arising from them.

Patient characteristics

The range of patient ages was between 10 and 38 years, with a mean of 24.9 years (SD 7.2). As shown in table 1 most of the patients (46.7%) were in the age group 20-29 years and 30-39 years (33.3%).

Age distribution of PWE who sustained thermal burns during seizures and were managed at KNH.

Table 1

Age in years	10-19	20-29	30-39	Total
Number of patients	6	14	10	30
Percent (%)	20	46.7	33.3	100

Figure 1 shows the age distribution of PWE who sustained thermal burns during seizures and received treatment at KNH.

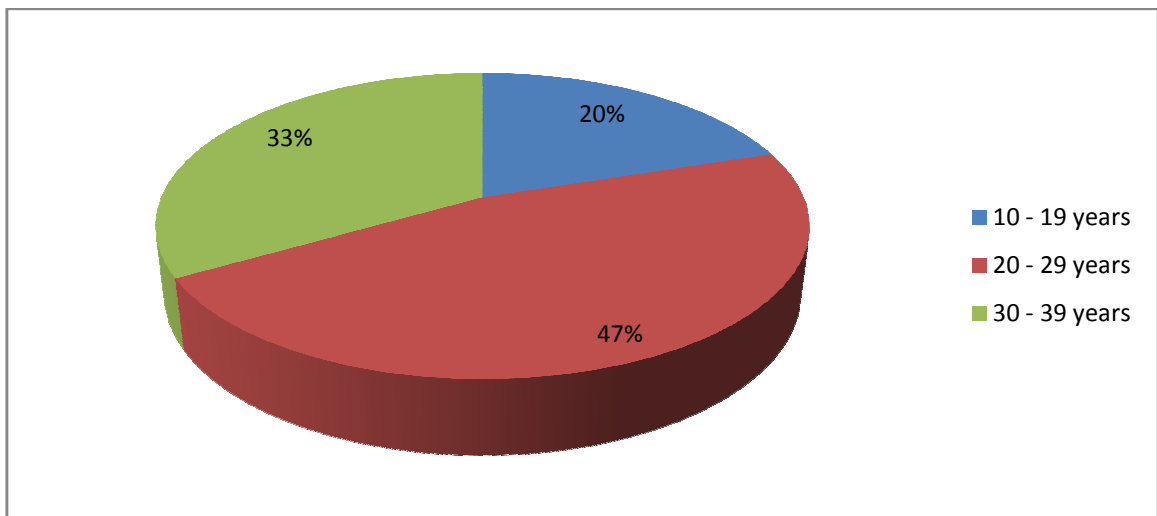


Fig.1

Figure 2 shows the gender distribution of patients with epilepsy who sustained thermal burns during seizures and were managed at KNH. There were 17 (56.7%) females and 13 males giving a male to female ratio 1:1.3.

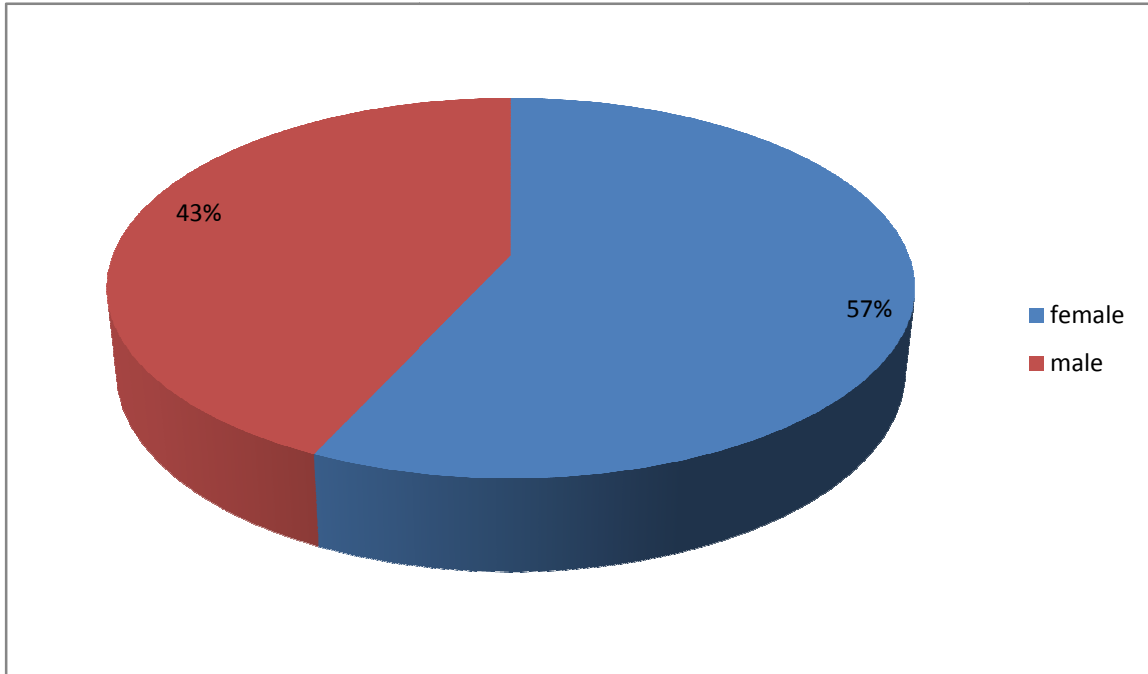


Figure 2: Gender distribution of PWE who sustained thermal burns during seizures and were managed at KNH.

The causes of burns are presented in table 2. The most common cause of thermal burns was open flames (76.7%). The remaining burns were caused by scalds (23.3%). Dry hot surfaces did not cause any thermal burns sustained during seizures. Most of the thermal burns were deep (53.3%) while 26.7% of the burns were mixed that is some areas were deep and others superficial.

Table 2: Causes of thermal burns in patients with epilepsy treated at KNH

Cause of thermal burns in patients with epilepsy.	frequency	percentage
Open flames	23	76.7
Scalds	7	23.3
Total	30	100

Figure 3 shows the causes of thermal burns sustained by PWE during seizures.

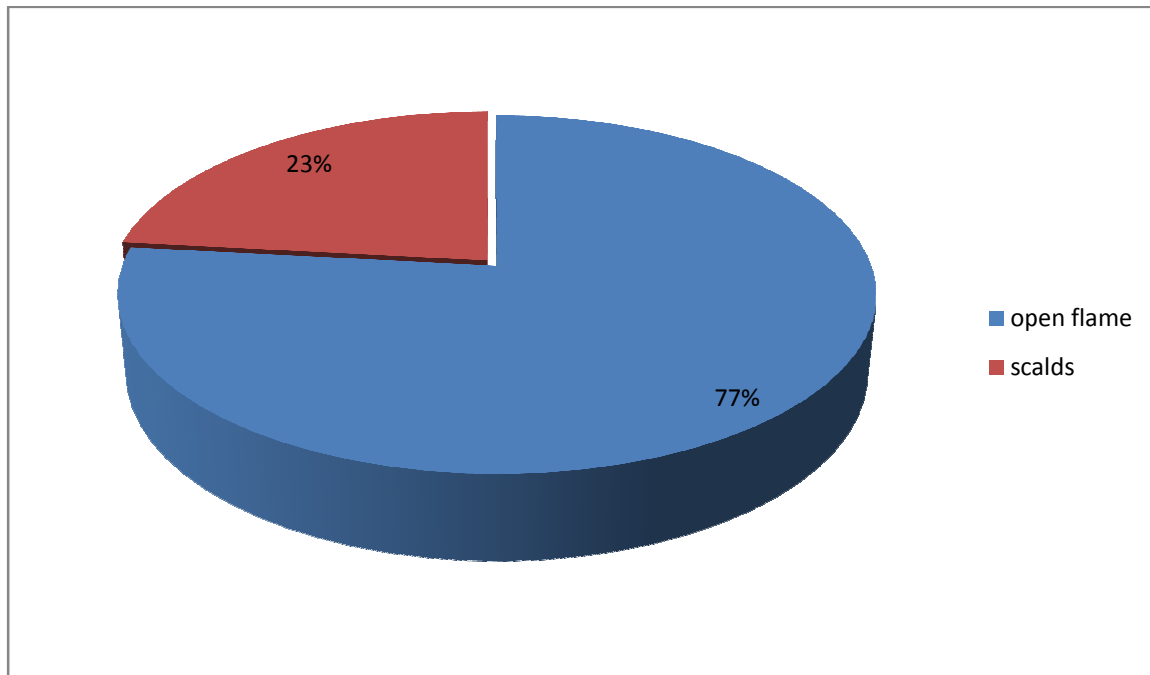


Figure 3.

Table 3 shows the depth of thermal burns sustained by PWE during seizures.

Depth of burns	frequency	Percentage
Deep	16	53.3
Mixed	8	26.7
Superficial	6	20.0
Total	30	100

Figure 4 gives the depths of thermal burns sustained by PWE during seizures.

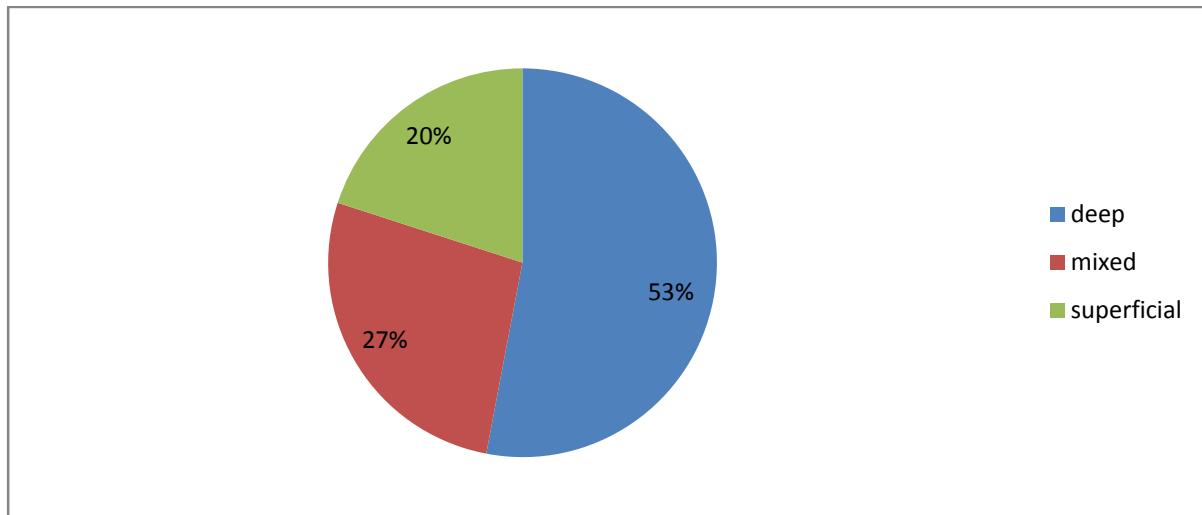


Figure 4.

There was no statistically significant association between depth of burns and the causes of thermal burns ($p = 0.73$). As shown in table 3 most of the superficial (66.7%), deep (75%) and mixed depth (87.5%) burns were caused by open flames.

Table 4:

Distribution of causes of thermal burns sustained by PWE during seizures ; according to depth.

Cause of thermal burns.	Depth of thermal burns		
	Superficial	Deep	Mixed
Scald	2	4	1
Percentage	33.3 %	25.0 %	12.5 %
Open flame	4	12	7
Percentage	66.7 %	75.0 %	87.5 %

Total burn surface area

The total burn surface areas ranged from less than 10% to 50%. Most patients (46.7%) had TBSA between 11% and 20% as shown in table 5. TBSA did not show statistically significant associations with either cause of burns (Fishers exact $p = 0.45$) or age of patients (ANOVA $p = 0.72$).

Table 5: Total burn surface area in PWE who sustained thermal burns during seizures and were treated at KNH.

TBSA	Below 10%	11-20%	21-30%	31-50%	Total
Number of patients	11	14	3	2	30
Percentage (%)	36.6	46.7	10	6.7	100

Figure 5 shows the ranges of TBSA of burns sustained by PWE during seizures.

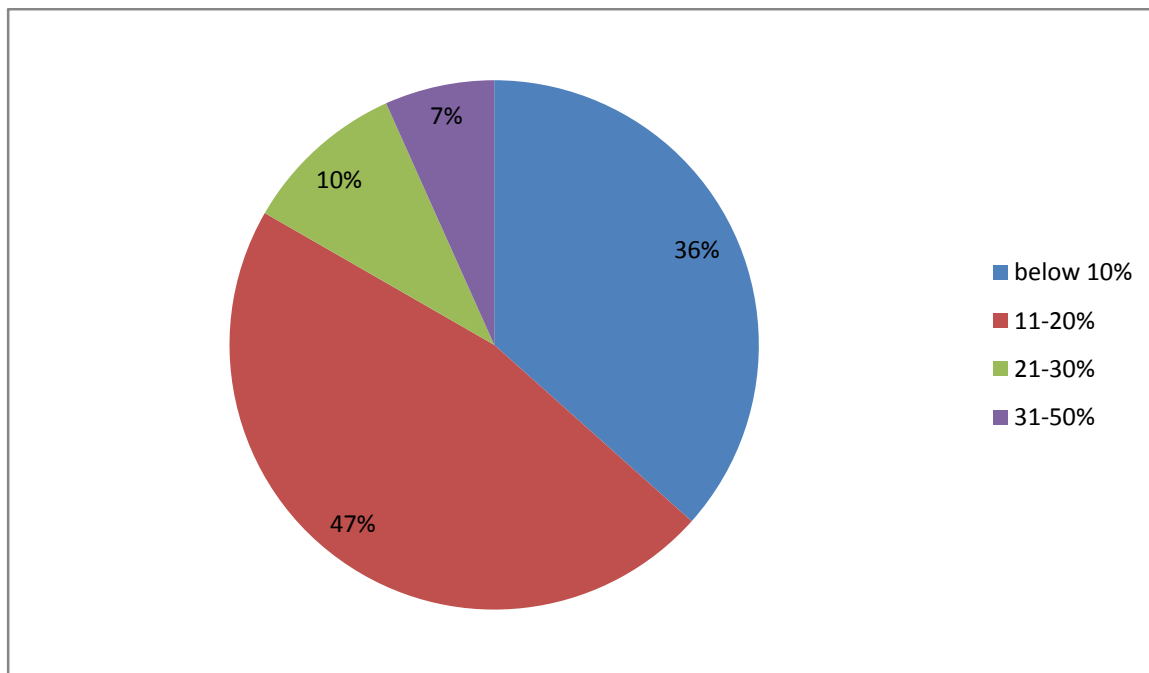


Figure 5.

The anatomical distribution of thermal burns are shown in the figure 6. It was noted that thermal burns frequently affected multiple anatomical sites. Sixty percent of the burns in this study involved multiple sites. The upper limbs were most commonly affected (70%) followed by the trunk (53.3%).

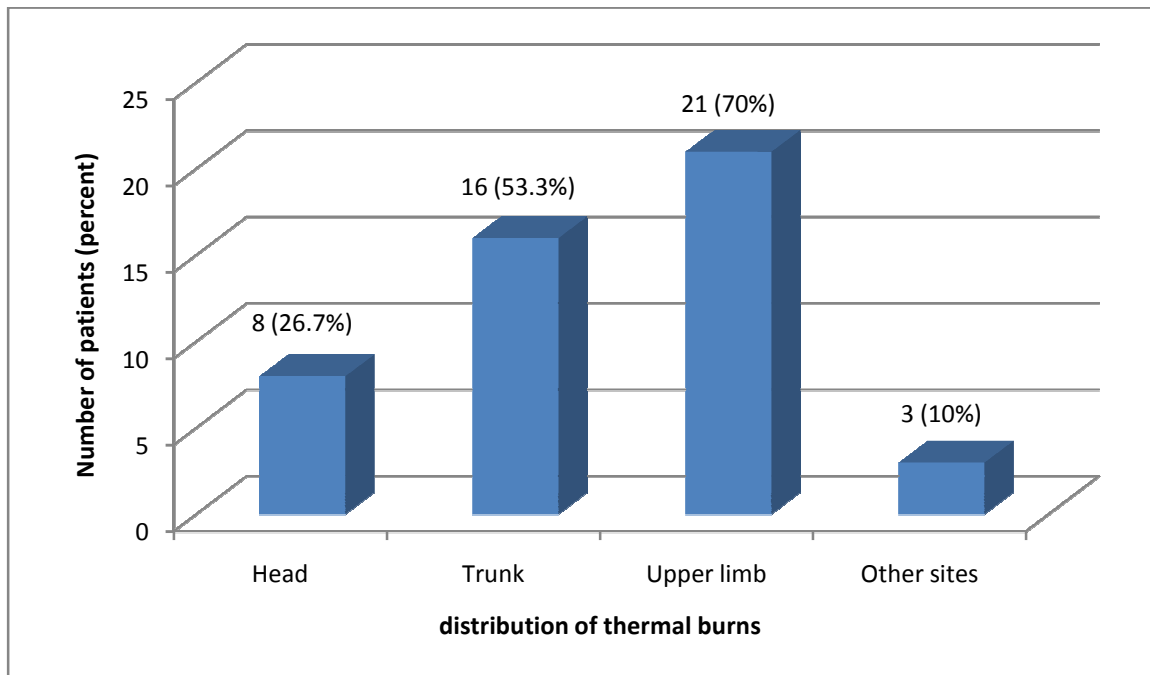


Figure 6: The anatomical distribution of thermal burns sustained by PWE during seizures.

Nine (30%) patients were noted to have other associated injuries. There were two main types of injuries associated with thermal burns namely; head injuries in 4 (13.3%) patients and fractures or dislocations in 5 (16.7%) patients.

Table 6 shows the other injuries associated with thermal burns sustained by PWE during seizures.

Associated injuries	Frequency	Percentages
Head injuries	4	13.3%
Fracture /dislocation	5	16.7%
Total	9	30%

Figure 7 shows the complications reported following thermal burns sustained by PWE during seizures and were treated at KNH. Twenty four (80%) patients developed sepsis as a result of burn injuries. The second most common complication was contracture (53.3%) followed by facial disfiguration (30%).

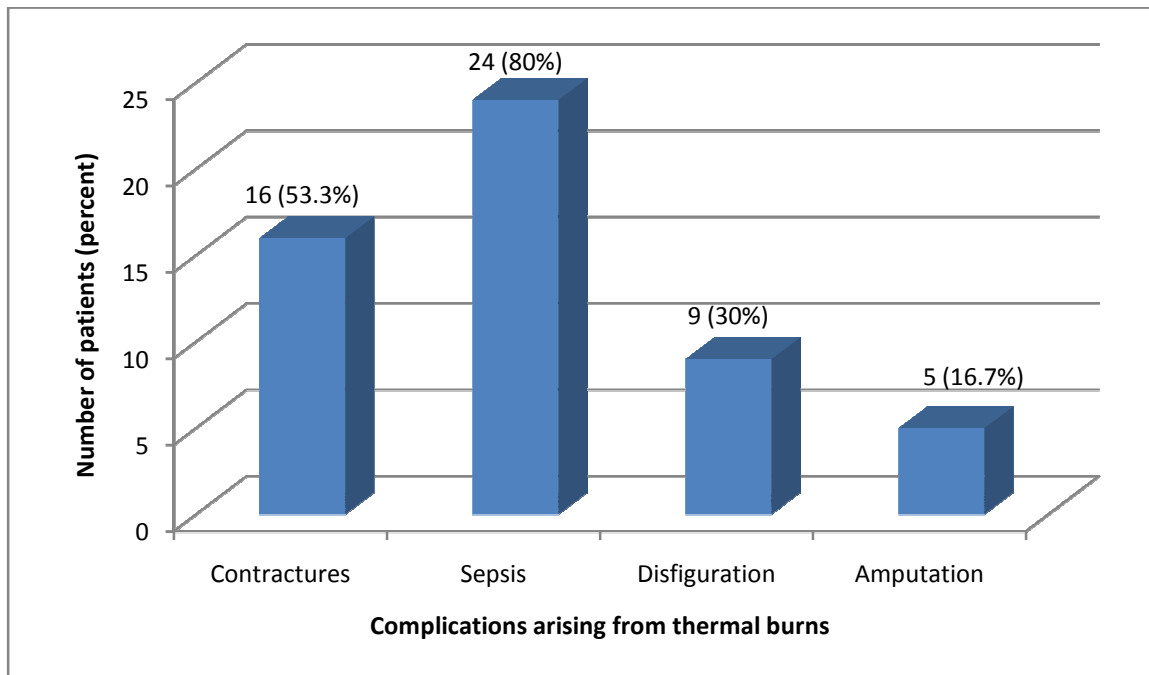


Figure 7: Frequency of different complications arising from thermal burns sustained by PWE during seizures and were treated at KNH.

Twenty eight (93.3%) PWE who sustained thermal during seizures were managed by surgical intervention and often underwent multiple surgical procedures. The surgical procedures performed in the management of these thermal burns are shown in table 5. Ninety three percent of patients underwent skin grafting while 90% underwent escharectomy.

Table 7.

Surgical procedure	frequency	percentage
Skin grafting	28	93.3
Escharectomy	27	90.0
Amputation	4	13.3
Debridement	2	6.7
Oculoplasty	3	10.0

Level of education and occupation of PWE who sustained thermal burns during seizures.

Table 8 shows that most of the PWE who sustained thermal burns during seizures or their next of kin (60%) had the highest of level of education as primary. There were 2 (6.7%) patients with tertiary level of education. One-third (33.3%) of patients were in formal or informal employment. The patients who were in the informal employment reported that they either engaged in business or farming. Half (50%) of the patients in the study were unemployed. Among the employed patients none reported having undergone pre-employment screening for epilepsy.

Table 8 shows the level of education of PWE who sustained thermal burns during seizures/the next of kin.

Patient/next of kin level of education	Frequency	Percentage
Primary	18	60
Secondary	10	33.3
Tertiary	2	6.7

Figure 8 shows the level of education of PWE who sustained thermal seizures

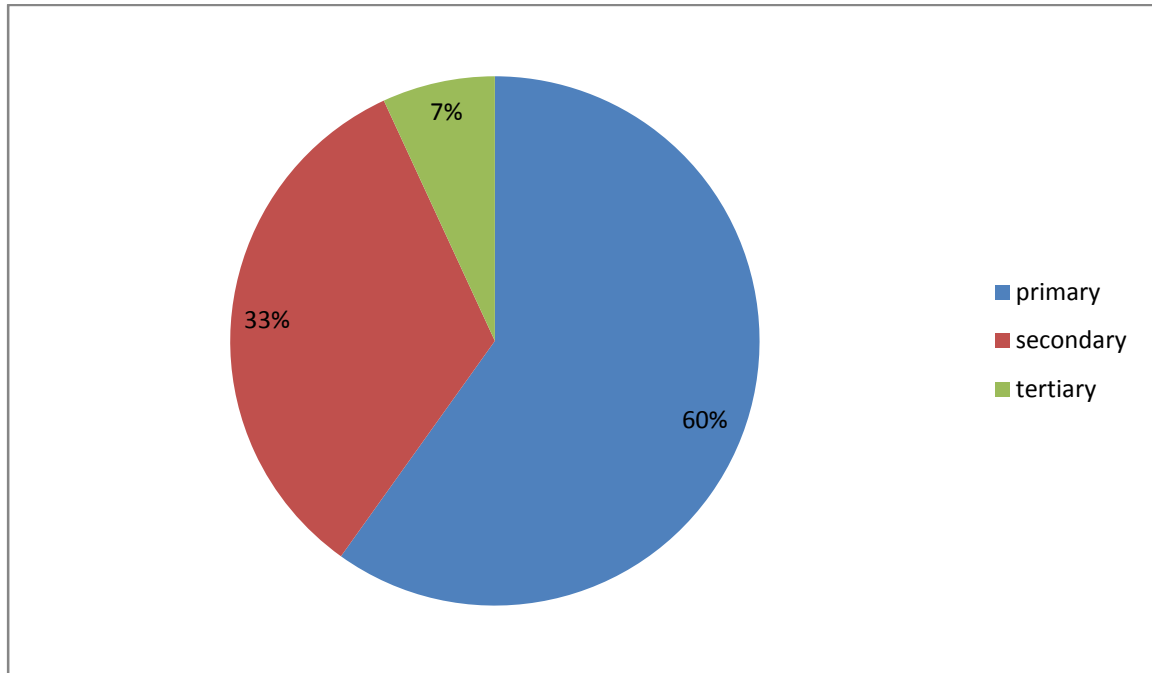


Figure 8.

Table 9 shows the occupations of PWE who sustained thermal burns during seizures.

Occupation	Frequency	Percentage
Formal/ informal employment	10	33.3
Housewife/ unemployed	15	50.0
Students/ Children	5	16.7

The figure 9 gives the schematic representation of the occupations of PWE who sustained thermal burns during seizures.

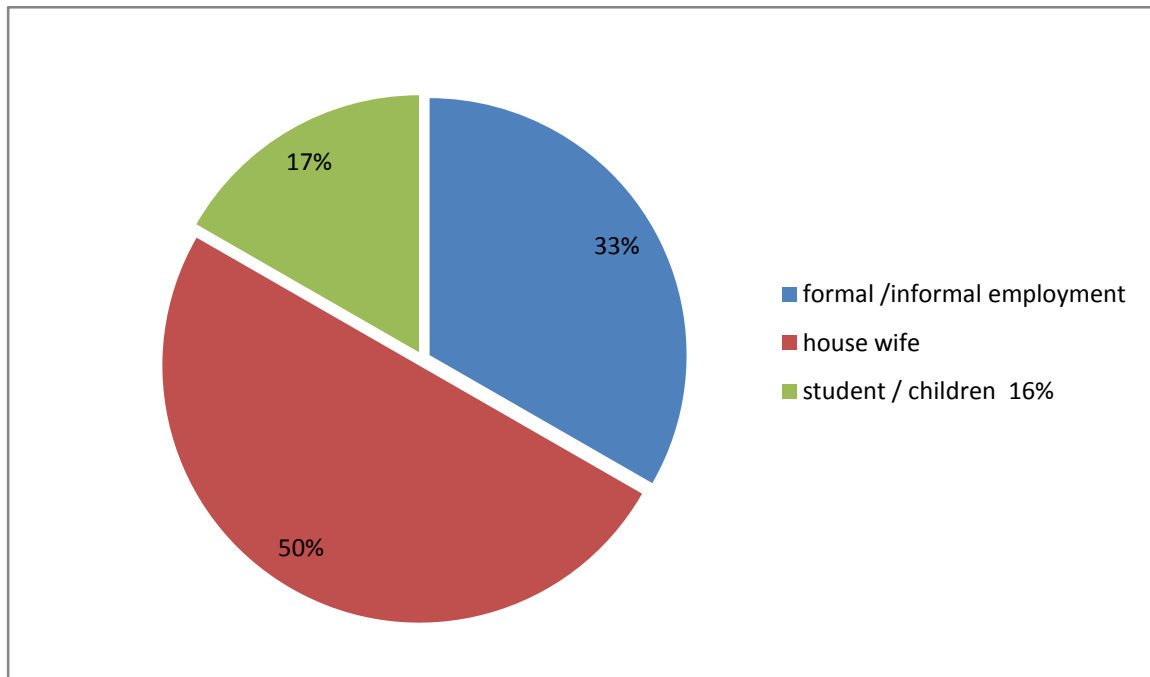


Figure 9.

Seventy percent of patients reported duration of known epilepsy illness longer than 5 years (table7). None of the patients attended neurology clinics. Twenty-six (86.7%) patients were on medication to control seizure and only 9(30%) took the medications daily. Twenty-three (83.3%) patients had received counseling on risks of burns during seizures.

Table 10: Duration of known epilepsy illness, management and counseling on condition

	No. of patients	Percentage
Duration of epilepsy		
1-5years	9	30
Over 5years	21	70
Patients on medications to control seizures	26	86.7
Patients taking AED daily	9	30
Patients attending neurology clinic	0	0
Patients who have sustained burns previously	5	16.7
Patients who perform duties such as cooking	25	83.3
Counseling on risk of injuries during seizures	23	76.7

TBSA and patient factors

Table 11 shows the findings of statistical tests of association between patient factors and TBSA. Among the examined factors which included age, level of education, complications from burns sustained during seizures, duration of known epilepsy and treatment of epilepsy, only counseling on the risk of injury during seizures showed a statistically significant association with TBSA ($p = 0.04$). None of the patients who received counseling had TBSA greater than 30%. Thirteen percent of counseled patients had TBSA between 21 and 30%, 12 (52%) had TBSA 11-20% and 8 (35%) had TBSA below 10%.

Table 11: Tests of association between patient factors and TBSA

TBSA	Below 10% (n = 11)	11-20% (n = 14)	21-30% (n = 3)	31-50% (n = 2)	P value
Mean age (years)	25.7	24.5	27.7	20.5	0.72
Males, n = 13	6 (46%)	5 (38%)	1 (8%)	1 (8%)	0.82
Primary education, n = 13	6(35%)	8(47%)	2(12%)	1(6%)	0.85
Complications					
Contractures, n=16	4(25%)	9(56%)	3(19%)	0	0.08
Wound sepsis, n=24	8(33%)	11(46%)	3(13%)	2(8%)	0.98
Duration of epilepsy					
Over 5years, n=21	7(33%)	10(48%)	3(14%)	1(5%)	0.74
Patient on AEDs	10(38%)	12(46%)	3(12%)	1(4%)	0.39
Counseled on risk of injury, n=23	8(35%)	12(52%)	3(13%)	0	0.04

Depth of burns and patient factors

With the exception of number of rooms in patients' houses the patient factors shown in table 9 were not statistically significantly associated with depth of burns sustained by PWE during seizures. Most of the patients living in single roomed houses had either deep (39%) or mixed (35%) burns, $p = 0.02$. Counseling on risk of injury during seizure ($p = 0.20$), complications from burns sustained during seizures and patient's age ($p = 0.41$) were not significantly associated with depth of thermal burns (Table 9).

Table 12: Tests of association between patient factors and depth of thermal burns sustained by PWE during seizures.

Depth of burns	Superficial (n = 6)	Deep (n = 16)	Mixed (n = 8)	P value
Mean age (years)	26	23.3	27.4	0.41
Males, n = 13	2(15%)	7(54%)	4(31%)	0.89
Primary education, n = 13	4(15%)	8(62%)	5(23%)	0.70
Complications				
Contractures, n=16	1(6%)	10(63%)	5(31%)	0.17
Wound sepsis, n=24	4(17%)	15(63%)	5(20%)	0.11
Patient on AEDs	5(19%)	14(54%)	7(27%)	0.99
Duration of epilepsy				
Over 5years, n=21	5(24%)	12(57%)	4(20%)	0.43
Counseled on risk of injury, n=23	4(17%)	11(48%)	8(35%)	0.20
Number of rooms in house (< 2 room), n = 23	6(26%)	9(39%)	8(35%)	0.02

DISCUSSION

The patient age ranges of PWE who sustained thermal burns during seizures was from 10 to 38 years with a mean of 24.9 years and most thermal burns occurred between the ages 20-29 years (46.7%). This could be related to level of activity in this group of PWE because they are young and productive. There were more females with epilepsy who sustained thermal burns during seizures as compared to males; ratio 1.3:1. This result may be due to the fact that most thermal burns occur in domestic setting while the persons are performing household chores such as cooking. However, it could be expected that most thermal burns occurring during seizures in PWE, could be due to scalds but this is not the case in this study where open flames caused more thermal burns than scalds. The use of stoves and charcoal for cooking could explain this phenomenon since light is known to trigger seizures in PWE.

In this study most thermal burns sustained by PWE during seizures were deep, this usually happens when there is loss of consciousness during seizures and hence the person is exposed to the burn agent for a long duration. Most PWE who sustained thermal burns during seizures had a TBSA of 11-20%, which represented 46.7%. The thermal burns in PWE tend to involve relatively small areas and are usually deep due to prolonged duration of exposure to the burn agent. In other types of thermal burns, such as those due to arsonist attacks or suicide the TBSA is usually quite extensive unlike in PWE. In terms of body distribution upper limbs were mostly affected probably because the thermal burns in PWE tend to occur while performing household chores such as cooking and ironing which involve handling of hot equipment.

Patients with epilepsy tend to sustain other injuries during seizures and in this study, head injuries and fracture/dislocations were noted. The falls which usually occur during seizures in PWE could be the reason for these other injuries sustained. This usually occurs in tonic-clonic type of seizure but this study did not give such details in order to draw such as a conclusion. The inadequate wound care and late presentation to hospital would probably explain why sepsis is the main complication arising from severe thermal burns sustained by PWE during seizures. Sepsis also is known to worsen the depth of burns by effect of bacteria or other pathogens causing further skin loss and necrosis. The occurrence of deep burns and sepsis therefore, is probably responsible for the need for surgical management in most thermal burns sustained by PWE during seizures as noted in this study.

The low level of education and reduced household space as depicted by less than one room occupancy in the study is a marker of low social economic status and could be a risk factor to severe thermal burns in PWE. The long duration of known epilepsy, which in this study is recorded as over five years is notably an established risk factor to thermal burns in PWE during seizures. However, there was no statistical significance to support this. Counseling on the risk of thermal burns during seizures is associated with reduction in the TBSA ($P=0.04$). This implies that counseling leads to increased awareness and hence reduction in thermal burns sustained during seizures.

Patient characteristics.

In this study the patient age ranges was 10 to 38 years (mean 24.9 years), this differs with other studies which showed much wider age ranges. In a study by Asuquo et al at university of Calabar Teaching Hospital in Nigeria, the patient age ranges was from 15 to 70 years (mean 29.4 years)⁶. Another study by Tiamkao et al which assessed the frequency, characteristics, and risk of injury during seizure attacks, the patient age ranges was from 16 to 78 years²³. In Nthumba et al study at KNH, the patient age ranges was from 0.02 to 66 years³⁰. This study however, was not specific to patients with epilepsy. The patient age ranges in a South African study by Allorto et al was from 13 to 82 years, but in the same study half of the patients studied suffered from epilepsy²⁹.

It was noted in this study that there were more females than males (ratio 1.3:1) who sustained thermal burns during seizures, however although some studies show the same pattern others tend differ. In a study by Rimmer et al at Arizona Burn Center in USA, there were more males than females (ratio 1:1.2) who sustained thermal burns during seizures³⁶. Jang et al at Hallym Burn Center in Korea showed that there were more females than males who sustained thermal burns during seizures²². Burns in epileptics, a study conducted by Jiburum et al in Nigeria showed that there were more males than females (ratio 1.25:1) who sustained thermal burns during seizures³⁷.

Causes of thermal burns

Open flames caused most thermal burns (76.7%) in this study and some studies done elsewhere gave the same findings, but others differed. Rimmer et al studied thermal injury in patient with seizure disorders and found that most thermal burns which occurred during seizures were due to open flame (34%)³⁶. Jiburum et al studied burns in patients with epilepsy and noted that most thermal burns in PWE were caused by open flame (88.9%), while scalding caused 11.1% of the thermal burns.³⁷ Eyal et al in a study at Kalafong Hospital in Pretoria also noted that most burns were caused by open flames although this was not specific to thermal burns in PWE³⁸. A study by Josty et al at a regional center for burns in Wales reported that most burns were due to scalding (54%)²⁷, and in a Korean study by Jang et al similar findings were noted that scalding caused most thermal burns²⁹. Another study, Burns risk for people with epilepsy by Tim who was a registrar at Sydney's Concord Burns Unit also reported that scalding caused most burns in PWE²⁸. The occurrences of open flame thermal burns in PWE in the developed countries is less probably due to minimal use of charcoal and firewood in these countries as compared to the developing countries.

Distribution of thermal burns

Most thermal burns during seizures in PWE burns involved the trunk and upper limbs (53.3% and 70%). This is similar to the findings by Jang et al which indicated in the study; Burns in epilepsy, that upper limbs and trunk were the most affected parts²². However, in the study by Tiamkao et al facial burns were noted to be the most common seizure-related injury (38%)²³.

Other injuries sustained during seizures.

Head injuries and fracture/dislocations were the main injuries noted to occur with thermal burns in PWE during seizures. In a study by Tiamkao et al in Thailand it was shown that soft tissue injury was the most common injury sustained by PWE during seizures (61%)²³. Ezeala-adikaibe et al in the study, Seizure-related injuries among outpatients in two hospitals in Nigeria, the most common injuries were dental injuries (10.3%) and head injuries (9.1%)³⁹. It is possible that most PWE who sustained thermal burns during seizures and are treated at KNH also sustained soft tissue injuries such as bruises and minor cuts. This may not have been reported or documented because it is usually considered trivial compared to the severe thermal burns sustained.

Surgical procedures performed in management of thermal burns.

The main surgical procedures performed in the management of thermal burns in this study were skin grafting (93%) and escharectomy (90%). This appears close to the figure reported by Tim which was at 70%. Uysal et al noted that seizure attack is a risk factor to deep burns and that these burns tend to occur in the home while performing domestic activities⁴⁰. The management of deep burns usually requires skin grafting in order to cover the skin loss or defect. Unglaub et al also reported that the burns sustained by PWE during seizures are usually deep and will require operative management⁴¹.

Study limitations

1. Some Patients who sustained burns during seizures and were not known to have epilepsy in the past.
2. Cultural beliefs about epilepsy. Some patients did not want to admit that they had epilepsy.
3. The information in some patients' records was inadequate for completion of the predesigned data collection sheets being used.

Conclusion

The thermal burns sustained by PWE during seizures occurred in the domestic setting and affected more females than males. Most thermal burns were deep and required surgical management. Sepsis was the most common complication of thermal burns sustained by PWE during seizures. The low social economic status as depicted by the low level of education and poor housing is a risk factor to burns. Counseling on the risk of burns during seizures was noted to be associated with reduction in severity of burns.

Recommendations.

1. The PWE and their relatives/caregivers should be counseled on the risk of thermal burns or other injuries during seizures.
2. There is need to educate the PWE and the care givers on the importance of seizure control with AEDS.
3. In order to implement a successful burns prevention program, PWE should be recognized as a high risk group and relevant measures be instituted to ensure their sfety.

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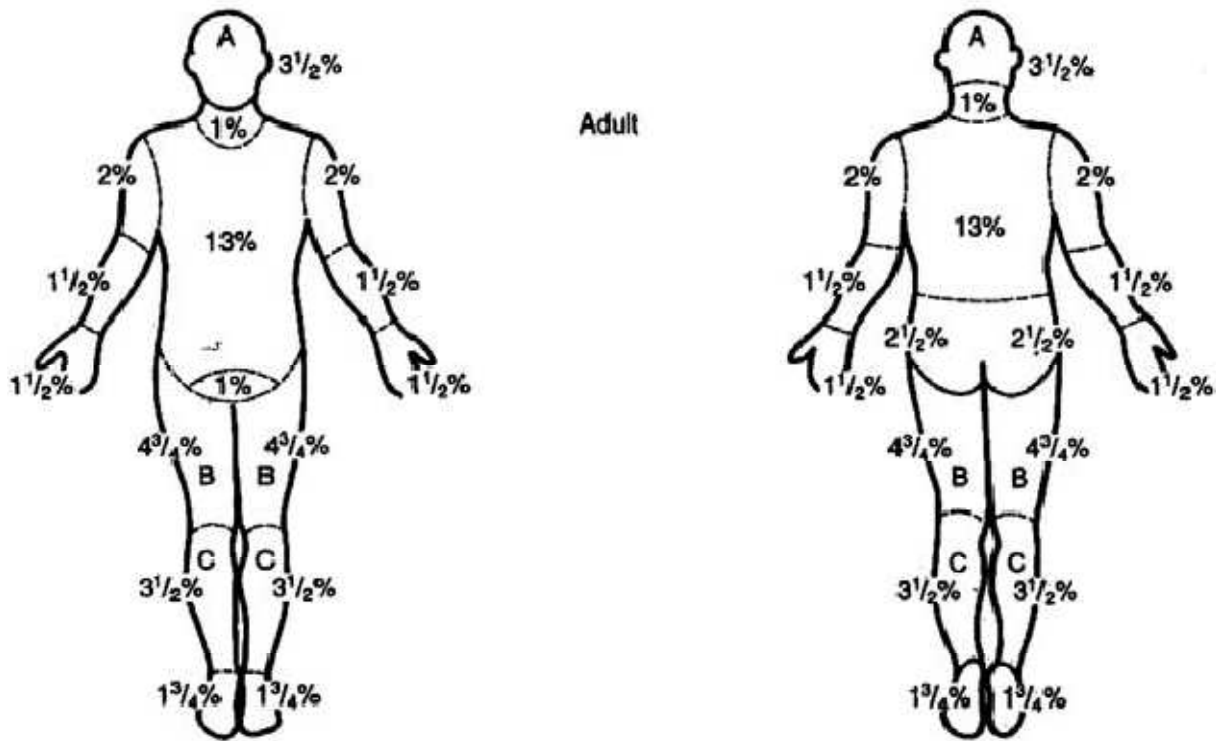
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Appendix 1: Lund and Browder chart

The use of Lund and Browder charts in estimating TBSA (%) is quite good and accurate, however in emergency setting the Wallace rule of nine is useful³⁵

Age	0-1	1-4	5-9	10-14	15
A - 1/2 of head	9 1/2%	8 1/2%	6 1/2%	5 1/2%	4 1/2%
B - 1/2 of one thigh	2 3/4%	3 1/4%	4%	4 1/4%	4 1/2%
C - 1/2 of one leg	2 1/2%	2 1/2%	2 3/4%	3%	3 1/4%



The Lund and Browder chart

Appendix 2: Data collection sheet and questionnaire

Study Number

Hospital number

Date of admission

Date of discharge

Age

Gender

Date of recruitment into the study

Cause of thermal burns sustained during seizures

Scalds

Open flames

Hot surface

Others (specify)

TBSA (%) below 10% 11-20% 21-30% 31- 50% above 50%

Depth of thermal burns sustained during seizures

Superficial

Deep

Mixed

Distribution of thermal burns sustained during seizures

- Head and neck
- Trunk
- Upper limbs
- Others (specify)

Other Injuries associated with thermal burns sustained during seizures.

- Cuts
- Head injuries
- Fractures/dislocations
- Dental injuries
- Others

Complications arising from the thermal burns sustained during seizures.

- Contractures
- Wounds sepsis
- Facial disfiguring
- Traumatic amputations
- Others

Need for surgery (Yes/No)

Procedures performed in the management of thermal burns sustained during seizures.

Skin grafting

Escharotomy

echarectomy

Amputations

Others (specify)

Questionnaire

Study number

Date

Age

Gender F or M

Occupation

Level of education of the patient/ parent/ next of kin: Primary / secondary / college

Home environment: less than 2 rooms / more than 2 rooms

- How long have you suffered from epilepsy? Months/ one year/ 1-5years/ over 5years.
- Are you on any medications to control seizures? Yes/ No
- Do you take your anti-epileptic drugs daily? Yes/No
- Are you attending a neurology clinic? Yes/ No
- Have you sustained burns previously? Yes/ No
- Do you perform any house duties such as cooking? Yes/ No
- Have you been warned about any risk of injuries during seizures? Yes/ No
- Did you undergo any pre-employment screening concerning epilepsy? Yes/ No

Appendix 3: Consent/assent for participation

I am Dr: Francis Maiyo, a post-graduate student in the department of surgery at the University of Nairobi (H58/70983/2009). I am carrying out a study on causes and pattern of thermal burns sustained during seizures by patients with epilepsy treated at Kenyatta National Hospital.

Study number

Hospital number

- **Purpose of the study:**

The purpose of this study is to describe the causes and pattern of thermal burns sustained by persons with epilepsy treated at KNH. The information obtained will be used to improve care and reduce or prevent burns in persons with epilepsy.

- **Risks and benefits:**

The recommendations of the study will be used to enhance awareness among persons with epilepsy and health care providers on the causes of burns in persons with epilepsy. There is no harm or risk anticipated in participating in this study. There will be no additional tests and no extra costs will be incurred for participating in this study

- **Ethical approval:**

Ethical approval has been obtained from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee.

- **Duration of the study:** 1st July to 31st December 2012.

- **Study setting:** Kenyatta National Hospital: (ward 4D, burns unit, burns clinic, and Accident and Emergency Department)

- **Voluntary participation:**

Participation in the study is out of one's free will and treatment will not be denied in case one declines to participate in the study. One is free to withdraw from participating in the study with no consequences whatsoever.

- **The expectations of the participant**

The information obtained from the participants' records will be used in completing the predesigned data collection sheets while the participant or next of kin will give the information which will be used in completing the questionnaire.

- **Confidentiality**

All information collected will be handled with utmost confidentiality and one's identity will not be published whatsoever.

In case of any questions or clarifications, the following contacts are available:

The secretary, KNH/UON-Ethics and Research Committee,

P .o. Box 20723-00202, Nairobi,

Telephone 0202726300-9

Email: KNHplan@ken.Healthnet.org

I, the undersigned have been explained to, have understood the above and voluntarily accept to participate in this study.

Signature/left thumb print..... Date

(patient/next of kin)

Dr Francis Maiyo : 0721956580

Appendix 4: consent/assent form for an underage participant

I am Dr: Francis kiprop maiyo, a post graduate student at University of Nairobi Department of Surgery (H58/70983/2009). I am carrying out a study on the causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at Kenyatta National Hospital.

Study number:.....

Hospital number:.....

- **Purpose of the study:**

The purpose of this study is to describe the causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at Kenyatta National Hospital. The information obtained will be used to improve care and reduce or prevent thermal burns in persons with epilepsy.

- **Risks and benefits:**

The recommendations of the study will be used to enhance awareness among persons with epilepsy and health care providers of the causes of thermal burns in persons with epilepsy. There is no harm or risk anticipated in participating in this study. There will be no additional tests and no extra costs will be incurred in participating in this study.

- **Ethical approval:**

Ethical approval has been obtained from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee.

- **Study duration:** 1ST July to 31st December 2012.
- **Study setting:** Kenyatta National Hospital (ward 4D, burns unit, burns clinic, and Accident and Emergency Department)
- **Voluntary participation:**

Participation in the study is out of one’s free will and treatment will not be denied in case one declines to participate in the study. One is free to withdraw from the study with no consequences whatsoever.

- **Confidentiality:**

All information availed to the researcher will be handled with utmost confidentiality and one's identity will not be published whatsoever.

In case of any questions or clarifications concerning this study, the following contacts are available:

The secretary, KNH/UON-Ethics and Research Committee,

P. o .Box 20723-00202, Nairobi,

Telephone 0202726300-9.

Email: KNHplan@ken.Healthnet.org

Minor's age:

The undersigned hereby give consent/assent for..... ,to be recruited into the study of causes and pattern of thermal burns sustained during seizures by persons with epilepsy treated at Kenyatta National Hospital.

Parent/next of kin's name.....

Parent/next of kin's signature.....

Home and work phone number of the parent/next of kin.....

Dr: Francis Kiprop Maiyo 0721956580

Appendix 5: kibali cha ruhusa ya kuhusika.

- Mimi daktari Francis Maiyo, ninasomea shahada ya upasuaji katika Chuo Kikuu cha Nairobi (H58/70983/2009). Ninafanya utafiti kuhusu watu wenye ugonjwa wa kifafa na ambao wamechomeka kwa sababu ya ugonjwa huo
- Nambari ya utafiti
- Nambari ya hospitali
- **Sababu ya utafiti:**

Utafiti huu unahusu watu ambao wanaugua ugonjwa wa kifafa na wamechomeka kwa sababu ya ugonjwa huo. Huu utafiti unajumuhisha wale ambao wanatibiwa katika hospitali kuu ya Kenyatta (KNH)

- **Hatari na manufaa**

Utafiti huu unanuiwa kuwezesha watu wanaouguua ugonjwa wa kifafa na wahuguzi kupunguza au kuzuia kuchomeka kwa watu wanaouguua ugonjwa huo. Hakuna hatari zozote zinaweza kutokea kwa kushiriki katika utafiti huu na pia hakuna gharama zaidi zitatozwa kwa kushiriki katika utafiti huu.

- **Ruhusa ya kufanya utafiti**

Ruhusa ya kutekeleza utafiti huu umekubaliwa na kituo cha utafiti wa chuo kikuu cha Nairobi na hospitali kuu ya Kenyatta (KNH/UON/Ethics and Review Committee)

- **Muda wa utafiti:** Tarehe mosi July hadi tarehe 31 December.
- **Pahali pa utafiti:** hospital kuu ya Kenyatta (KNH). Chumba cha watu ambao wamechomeka(4D), kliniki ya watu ambao wamechomeka, chumba cha watu waliochomeka zaidi (burns unit), na pahali pa kuhudumiwa kwa wagonjwa wanaofika hospitali (Accident and Emergency Department).

- **Kuhusika kwa hiari**

Kushiriki katika utafiti huu ni kwa hiari bila kushurutishwa. Mgonjwa akikataa kushiriki katika utafiti huu hatakatizwa matibabu kwa sababu hiyo. Mhusika anaweza kujiiondoa kutoka kwa utafiti huu wakati wowote bila madhara yoyote.

- **Matarajio ya mhusika**

Ili kujaza sheti cha kuweka habari za utafiti huu, mhusika atatakikana kutoa habari zitakazotumika na zingine zitapatikana katika vitabu maalum vya kuzajili wagonjwa.

- **Usiri**

Habari zozote ambazo zitatolewa zitawekwa kwa siri na pia jina la mhusika halitachapishwa popote.

Ikiwa mhusika ana maswali yoyote kuhusu utafiti huu, anaweza kuwasiliana kutumia njia ifuatayao:

The secretary, KNH/UON-ethics and research committee,

Sanduku la posta 20723-00202, Nairobi.

Simu 0202726300-9.

Barua pepe KNHplan@ken.Healthnet.org

Mimi nimeelezwa kuhusu utafiti huu na mtafiti na nimefahamu ujumbe wa utafiti huu. Nimekubali kwa hiari yangu kuhusika kwa utafiti huu.

sahihi/kidole cha gumba(kushoto)

mhusika/next of kin.....tarehe.....

Daktari Francis Maiyo 0721956580

Appendix 6. university of Nairobi plagiarism policy: declarations form for students

Name of Student _____

Registration Number _____

College _____

Faculty/School/Institute _____

Department _____

Course Name _____

Title of the work _____

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this _____ (Thesis, project, essay, assignment, paper, report, etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work
5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature _____

Date _____

Appendix 7. university of Nairobi plagiarism policy: declaration form for staff

Name of Staff _____

Payroll Number _____

College _____

Faculty/School/Institute _____

Department _____

Title and bibliographic details of the work

DECLARATION

1. I understand what plagiarism is and I am aware of the University's policy in this regard.
2. I declare that this _____ scholarly work (Paper, book chapter, monograph, review, etc) is my original work. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work.
4. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature _____

Date _____

Appendix 8: copy of ethical approval letter.