



Burn injury in epileptics: The trend and risk factors in the middle belt of Ghana

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ABSTRACT

Background: Burns is one of the injuries associated with epilepsy. Unfortunately, epileptics are afflicted with severe burns when they come in contact with burn substances, due to loss of consciousness while seizing.

Objective: This study is designed to inform stakeholders about the incidence, outcomes and trends of burn accidents among epileptics predominantly in the middle belt of Ghana.

Methods: A retrospective study of all burn cases (May 2009 to April 2016) resulting from seizures reporting at the Komfo Anokye Teaching Hospital was undertaken. Patient demographics, burns aetiology, total burnt surface area and length of admission were obtained from stored electronic data (Excel) of the Burns Intensive Care Unit (BICU). History related to burn injury were obtained from patients' folders. Data was statistically analysed using Excel version 2013.

Results: Epileptics formed 3.1% (n = 21) of the total BICU admissions and average annual incidence of 2.6 persons per year. Majority of the patients were females (71.42%). Age group 11–30 years formed the preponderance of our patients (n = 18, 85.7%). Only one 0–10 years old and no ≥50 years old patient was admitted. Scalds was the major aetiology (81.0%, n = 17). Ninety-five percent of the patients suffered moderate to major burns. Mean TBSA = 19.1%. Average days on admission was 69.1 days. Mortality rate was 9.5%.

Conclusion: Though burns among epileptics is comparatively low in the middle belt of Ghana, it is important that stakeholders continually educate the public on epilepsy and burns prevention.

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1. Introduction

Epilepsy is a neurologic disorder often associated with injuries and trauma [1] and considered a comorbid risk factor [2]. Burns is one of the injuries popularly associated with epilepsy [3]. Unlike other burn victims, when epileptics sustain burn injuries during a seizure, the result is often fatal [4] due to prolonged contact with the burn source [5]. Potential rescuers fail to rescue them because of the superstitious beliefs such as visitation by evil spirits and curse attached to the disease and the misconception that the disease is contagious [6]. As a result, victims are left to their fate

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and plagued with severe injuries, temporal or permanent disabilities, disfigurements and in worst cases, death. The situation has been the same in most Low-Middle-Income Countries (LMICs) where epilepsy prevalence is high and often untreated. In rural Ethiopia for example, epilepsy was the cause of 44% of adult burns, most of them necessitating hospital admissions [7]. In Zambia, within a year, 31% of epilepsy patients reporting to the Chikankata Hospital were involved in burns or a fall which required hospitalization [8]. In rural Bangladesh, 0.7% of deaths in women (15–44 years old) were as a result of fall in fire during a seizure experience [9]. Thirty out of fifty-four epileptic patients also admitted in a burns unit in India required surgical intervention for effective burns management [2]. In Pakistan, Liaquant University Hospital within 5 years admitted 54 epileptics with burn injuries, who were consequently afflicted with varying degrees of negative burn

sequelae [1]. It is very disheartening that superstitious beliefs, misconception about the disease being contagious and the horrendous social stigma associated with the disease remain the major reasons for the high incidence of burn accidents among epileptics [1,2,4–9].

A cohort study by Prasad et al. revealed that the risk of epileptics getting involved in burn accidents is 49% higher than individuals without epilepsy [10]. This and many other country and community specific studies [5,11,12] have helped most developed countries to move stride length in reducing burns in epileptics. Country and community specific studies are vital to inform stakeholders on the trends, prevalence and outcomes in their country or communities in order to formulate policies and management practices, specific and effective to their regions. This will help reduce the prevalence of burn accidents among epileptics.

Unfortunately, Ghana has no clinical assessment in literature on this subject: burns in epileptics. It is for these reasons that we present a study of the incidence and outcome of burn accidents among epileptics admitted at the BICU of Komfo Anokye Teaching Hospital (KATH), Ghana.

2. Materials and methods

2.1. Study setting

Komfo Anokye Teaching Hospital located in Kumasi is the second-largest hospital in Ghana. It is the main referral hospital for Ashanti, Brong-Ahafo, Northern, Upper East and Upper West Regions (the middle belt of Ghana), and the only tertiary health facility in the middle belt of the country. The hospital was built in 1954 and converted into a teaching hospital in 1975, with its affiliation to the School of Medical Sciences of the Kwame Nkrumah University of Science and Technology (KNUST). KATH currently has about 1000 beds in the old block and an additional 500 in the newly commissioned Accident and Emergency Center. The Surgery Directorate is among the nine directorates in KATH which includes the Division of Plastic and Reconstructive Surgery (DPRS). The Burns Intensive Care Unit is a section of the DPRS and is located in the new Accident and Emergency Center. The BICU has 6 room suits, fully furnished with the state of art equipment for severe burn patient management.

2.2. Study design

A retrospective study of all burn cases resulting from seizure attacks reporting at the BICU of Komfo Anokye Teaching Hospital was undertaken. Data was obtained from stored electronic data (Excel) of the Burns Intensive Care Unit. Data from May 2009 to April 2016 (8 years) were analysed. Patient demographics, burns aetiology, total body surface area and length of admission were obtained from the stored electronic data. Severity of burn was described in terms of depth and size. Minor burns: a first or second degree burn that covers less than 15 percent of an adult's body or 10 percent of a child's body. Moderate burns: second degree burns that cover more of a patient's body or a third degree burn that covers less than 10 percent of a patient's Body Surface Area (BSA). Major burns: third degree burns that cover more than 10 percent of a patient's BSA [16]. History related to burn injury were obtained from patients' folders. Only patients who had history of seizures prior to burns were included in this study. Data were statistically analysed using Microsoft Excel Version 2013.

3. Results

Over the 8-year period, a total of twenty-one epileptic patients were admitted at our BICU with severe burn injuries. This repre-

sents 3.1% of the total admissions ($n = 681$) in the unit over the period stated. The average annual incidence was 2.6 persons per year. Majority of the patients were females (see Fig. 1).

Age group 11–30 years formed the preponderance of our patients ($n = 18$, 85.6%). There was only one patient between 0 and 10 years and two patients within 31–49 years age bracket. No ≥ 50 years old with burn injuries resulting from a seizure attack was seen at our BICU.

Scalds was the major aetiology (see Fig. 2). More than half of the patients suffered moderate burns ($n = 11$), followed by major ($n = 9$) and then minor burns ($n = 1$), thus, 95.2% of patients had moderate to major burns.

The data also indicates that the average Total Body Surface Area (TBSA) burnt was 19.1%.

Seven patients spent more than 90 days on admission, 8 patients spent between 14 and 90 days and 4 spent less than 14 days on admission. Two deaths were recorded with mortality rate of 9.5% (Table 1).

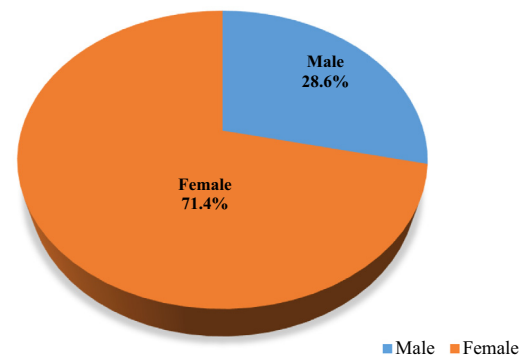


Fig. 1. Sex distribution.

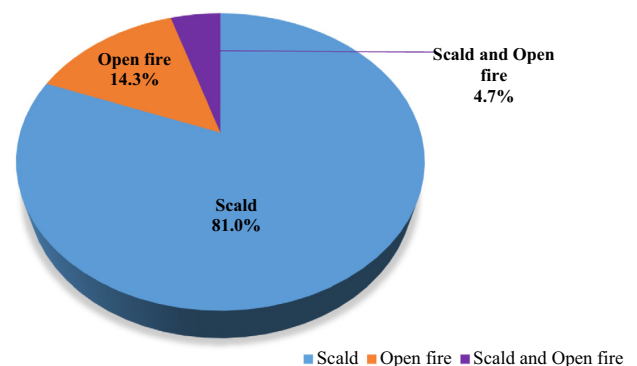


Fig. 2. Aetiology of burns among epileptic burn patients admitted.

Table 1
Days on admission and mortality.

Days on admission	Frequency	Percentage (%)
<14	4	19.0
14–31	3	14.3
32–49	3	14.3
50–64	1	4.8
65–90	1	4.8
>90	7	33.3
Total frequency	Mortality	Mortality rate (%)
21	2	9.5

4. Discussion

Comparing our number of epileptic burnt inpatients over a period of 8 years to that of others described in literature over shorter periods, it is evident that our incidence is comparatively low [12]. It is also similar to the results from a study at Liaquat University Hospital in India and in Ladoke Akintola University of Technology Teaching Hospital in Nigeria [1,6]. The low incidence is very encouraging, and suggests that the condition is comparatively not a burden to this country. It also shows that the efforts by the International League against Epilepsy in collaboration with Ghana's Ministry of Health and other Epilepsy advocate agencies, since the year 2012 [13], is yielding very good results. On the other hand, there could have been under reporting of such cases in our facility for a number of reasons. For example, there might have been a gap in reporting between rural community health centres and our tertiary hospital. Others might have also resorted to self-treatment and failed to report to health centres. A few cases have been reported where epileptics resorted to "spiritualists" for treatment [13]. Financial constraint could also be a reason for not reporting to the hospital for treatment. The above points notwithstanding, the low incidence of burns recorded so far in this group is very good.

A review analysis of data from Kenya, South Africa, Uganda, Tanzania and Ghana by Ngugi et al. showed that, the incidence of epilepsy is higher in males than females in four out of the five countries [14]. Despite this, females have a higher risk of burn accidents among epileptics [1,3]. This is in line with our findings as females formed 71.4% of the patients. Burns among epileptics are often domestic [2,4,12], and in Africa, females are more prone to burns due to their constant role in domestic chores. This can possibly explain why females are mostly affected. This has been the trend in several earlier studies, though there are a few exceptions [6] and we keep recording the same trend in recent ones. It is either, the recommendations after studies done earlier were not adhered to or the public is not well educated on female epileptics being at higher risk of burn accidents. It is therefore prudent that during public education on the disease and preventing its comorbid factors, females are more cautioned on domestic activities most especially cooking and handling hot liquids. This will help reduce the incidence of burns.

A study in 5 selected sub-Saharan African countries including Ghana, Kenya, South Africa, Uganda and Tanzania recorded the highest prevalence of epilepsy in children [14]. We therefore anticipated high burns incidence among epileptic children. On the contrary, we recorded only one admission for 0–10 year's age bracket at our BICU. This shows that indeed most parents who are aware of their wards' disease condition (epilepsy) keep an extra eye on them so they do not injure themselves. However, as epileptics grow, they are left on their own and often without proper care. As mentioned earlier, others live with neighbours who have their own superstitions about the disease and stigmatize epileptics. As a result, we recorded very high burns incidence among adolescent and adult epileptics. No ≥ 50 years old reported to our unit with epilepsy. This was anticipated because Ngugi's study recorded that the least epilepsy prevalence was among the >50 years old age bracket in all the countries including Ghana, with the exception of Kenya.

A study by Agbenorku et al. using the same data we extracted our data from, recorded that the major cause of burns reported in our facility was open fire [15]. Though in other facilities or studies a number of burns in epileptics have been due to open fire [1,3,6], among epileptics in our data set, scalds was the major aetiology. Our result is similar to recent studies by Akhtar and Josty et al. [4,5]. There seem to be a shift in the major aetiology of burns among epileptics from open fire to scalds with advancement in technology. Unlike previously when firewood and charcoal used to be the major energy for cooking (open fire), technological

advancement introduced LPG gas with stove at elbow height, a much more concealed flame and fire covering a very small area. Thus, hardly will a seizing victim fall onto it to cause burns. On the other hand, while handling hot liquids, epileptics stand a higher chance of burn accident when they start seizing or lose consciousness [17]. Josty et al. described similar findings in the year 2000, stating the changing epidemiology started over 3 decades before [11]. This trend is expected in most developing countries.

Though we did not record the location of burn accidents, the major accident being scalds, females and age group 11–30 years being the most affected predicts accidents were domestic, specifically occurring in the kitchen while victims were cooking or handling hot liquids. In Meirelles et al.'s study where open fire was the major cause of burns among epileptics, they explained that open fire could be a photo stimulant for seizure attacks [17]. This explanation might not be entirely true because with the regular use of gas stove in our setting where victims hardly see large open fire, they still have seizures. Studies to elucidate the link between domestic activities; especially handling hot liquids and seizure attack will take us a step further in reducing burns among epileptics. Also, public education over the years might have focused on preventing epileptics from driving, swimming, working with machinery, etc., neglecting frequenting the kitchen and handling hot liquids. Including these as risk factors in public education henceforth can be of much help.

Scalds generally do not result in severe burns but for few cases. However, among epileptics who frequently lose consciousness during a seizure, this is not the case. While seizing, most of them lose consciousness and are unable to detach themselves from the source of burn hence develop though small, but moderate to major burns. Consequently, they spend more days on admission because their injuries often necessitate surgery and extended hospital stay for faster and complete healing [4,12]. This was evident in our results as 95.2% of our patients were inflicted with moderate and major burns, mean TBSA; 19.1% with an average hospital stay of 69.1 days. The length of days on admission suggests most patients had 2nd to 3rd degree burns. The average number of days on admission in our series is higher than the average for other studies: 51, 16.8 and 32 days [3,5,12], and also higher than the mean length of admission recorded in the unit [15] over the period. This could possibly be due to complications resulting from delay in patient presentation.

A study by Nei et al. stated that deaths may be increased in people with uncontrolled epilepsy [18]. We recorded two deaths (mortality rate = 9.5%) out of 21 cases. Comparing the percentage mortality rate among all burn patients admitted at our BICU including epileptics; 24.2% [15] with that of epileptics alone, it is clear there is reduced mortality among epileptic burn patients. We associate this result to the minor severity of burns scalds usually cause. We believe mortality resulting from burns, especially scalds can be eliminated with extra public education and concern. There is the need to intensify education on early presentation of burns to health centres, and also make standard burn protocols available at all health facilities. The KATH Burns Protocol can be found as [Appendix I \[19\]](#).

5. Conclusion

We have identified burns among epileptics as comparatively low in the middle belt of Ghana. They are often scalds with females at a higher risk of burn accidents as well as adolescents and young adults. Despite the low incidence, the cost of such long admissions is appreciable and a burden to the country's economy. It is very important that stakeholders intensify education on burns prevention and make epileptic drugs readily available and affordable.

Conflict of interest

The authors declare that there is no conflict of interest.

Limitation of studies

We could not obtain data on whether or not patients were on anti-epileptic drugs.

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Ethical consideration

Ethical approval for the study was granted by the Committee on Human Research, Publications and Ethics of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital.

Authors' contributions

Contribution	Author
The conception and design of the study, or acquisition of data, or analysis and interpretation of data	Pius Agbenorku, Abdul-Rahman Adamu Bukari, Angelina Tima Effah, Jonathan Bayuo
Drafting the article or revising it critically for important intellectual content	Angelina Tima Effah, Abdul-Rahman Adamu Bukari
Final approval of the version to be submitted	Pius Agbenorku, Abdul-Rahman Adamu Bukari, Angelina Tima Effah, Manolo Agbenorku, Nana Yaa Odamea Asare, Jonathan Bayuo

Appendix I: KATH burns treatment protocol

1. Apply the principle of ABC as in trauma management
2. Ensure the patient is conscious
3. Ensure the airway is patent and the patient is breathing
4. Check the pulse and BP
5. Set up IV line with Ringers Lactate running
6. Quickly and systematically identify the threatening conditions
7. Keep the patient warm; use blankets if necessary
8. Intubate/Arrange for intubation of patient if indicated
9. Administer 100% humidified oxygen if necessary
10. Insert Foley's urinary catheter. Achieve a urine output of 0.5 ml/kg per hour in adults and 1.2 ml/kg per hour in children
11. Take a quick history, including medication, allergies and mechanism of injury; complete clerking of patient
12. Give analgesics: IV Morphine 0.1 mg/kg or oral syrup Morphine sulphate 10 mg/kg bodyweight; Diclofenac injection 1 mg/kg and or Diclofenac suppositories for less severe cases, while in very severe cases IV Pethidine 1 mg/kg bodyweight every 6 h; Paracetamol suppository/syrup for children
13. Estimate percentage of burned body surface areas involved. You may use the Wallace's Rule of Nines for initial assess-

ment; however Lund and Browder Chart is preferable and would be used for final assessment by the plastic surgery team on duty

- Recommended fluid formula

Parkland's Formula:

4 ml/kg for each percent of TBSA. $4 \times \text{mass (kg)} \times \text{B SA (\%)} \text{ mls/24 h.}$

Give 50% in the first 8 h of the incident and the rest in the next 16 h.

14. Administer tetanus prophylaxis as dictated by the patient's immunization status
15. Inspect the wounds. NO NEED TO RUSH TO DO BURN-BATH DRESSING!
16. Criteria for admission:
 - Adults with TBSA of 15% or more
 - Children with TBSA of 10% or more
 - Burns of special areas - face, perineum, hands, feet and joints
 - People of extremes of life - young children and the aged
 - Burns with other trauma or any other disease
 - Infected burned wounds
17. Detain the patient at the Emergency Unit
18. Inform plastic surgery team-on-duty: Resident/House Officer/Consultant

References

- [1] Shaikh BF, Memon AR, Tahir SM. Presentation and complications of burn injuries among epileptic patients presenting to burns unit, Liaquat University Hospital. *Burns* 2010;16:91–3.
- [2] Ansari Z, Brown K, Carson N. Association of epilepsy and burns: a case control study. *Aust Fam Physician* 2008;7:584–9.
- [3] Boschini LP, Tyson AF, Samuel JC, Kendig CE, Mjuweni S, Varela C, et al. The role of seizure disorders on burn injury and outcome in sub-saharan Africa. *J Burn Care Res* 2014;6:406–12.
- [4] Akhtar MS, Ahmad I, Khan AH, Khurram MF, Haq A. Burn injury in epileptic patients: an experience in a tertiary institute. *Ann Burns Fire Disasters* 2014;3:126–9.
- [5] Josty IC, Mason WT, Dickson WA. Burn wound management in patients with epilepsy: adopting a multidisciplinary approach. *J Wound Care* 2002;1:31–4.
- [6] Jiburum BC, Olaitan PB, Otene CI. Burns in epileptics: experience from Enugu, Nigeria. *Ann Burns Fire Disasters* 2005;3:148–50.
- [7] Courtwright P, Haile D, Kohls E. The epidemiology of burns in rural Ethiopia. *J Epidemiol Community Health* 1993;1:19–22.
- [8] Birbeck GL. Seizures in rural Zambia. *Epilepsia* 2000;3:277–81.
- [9] Fauveau V, Blanchet T. Deaths from injuries and induced abortion among rural Bangladeshi women. *Soc Sci Med* 1989;9:1121–7.
- [10] Prasad V, Kendrick D, Sayal K, Thomas SL, West J. Injury among children and young adults with epilepsy. *Pediatrics* 2014;4:827–35.
- [11] Josty IC, Narayanan V, Dickson WA. Burns in patients with epilepsy: changes in epidemiology and implications for burn treatment and prevention. *Epilepsia* 2000;4:453–6.
- [12] Faurie MP, Allorto NL, Aldous C, Clarke DL. A closer look at burn injuries and epilepsy in a developing world burn service. *S Afr J Surg* 2015;3–3:1–3.
- [13] Adjei P, Akpalu A, Laryea R, Nkromah K, Sottie C, Ohene S, et al. Beliefs on epilepsy in Northern Ghana. *Epilepsy Behav* 2013;2:316–21.
- [14] Ngugi AK, Bottomley C, Kleinschmidt I, Wagner RG, Kakooza-Mwesige A, Aegibise K, et al. Prevalence of active convulsive epilepsy in sub-Saharan Africa and associated risk factors: cross-sectional and case-control studies. *Lancet Neurol* 2013;3:253–63.
- [15] Agbenorku P, Agbenorku M, Effah AT, Bukari AR, Asare NY. Descriptive epidemiological study of burn admissions to the Burns Intensive Care Unit of the Komfo Anokye Teaching Hospital, Kumasi-Ghana, 2009–2016. *J Acute Dis* 2017;3:112–9.
- [16] Encyclopedia.com www.encyclopedia.com/medicine/news-wires-white-papers-and-books/burns-and-scalds [accessed 10.04.18].
- [17] Meirelles RPC, Piccolo NP, Piccolo PP, et al. Epileptic burn patient's profile: prospective and retrospective study of epileptic patients admitted at pronto socorro para Oueimaduras, Goiania, Brazil. *Burns* 2017;33:102–3.
- [18] Nei M, Bagla R. Seizure-related injury and death. *Curr Neurol Neurosci Rep* 2007;4:335–41.
- [19] Agbenorku P. Modernized standards in burns management: a comparative study in Komfo Anokye Teaching Hospital, Kumasi, Ghana. *Burns* 2013;39:990–6.