SEIZURE-RELATED BURN INJURIES IN PEOPLE WITH EPILEPSY: A NARRATIVE REVIEW WITH EMPHASIS ON LOW- AND MIDDLE-INCOME COUNTRIES

BRÛLURES LORS D'UNE CRISE D'ÉPILEPSIE : REVUE FOCALISÉE SUR LES PAYS EN DÉVELOPPEMENT

Ndaba E.M.,✉ Netshiongolwe T.

Department of Surgery, University of the Witwatersrand, Charlotte Maxeke Johannesburg Academic Hospital, Johannesburg, South Africa
Division of Plastic and Reconstructive Surgery, Charlotte Maxeke Johannesburg Academic Hospital, University of the Witwatersrand, Johannesburg, South Africa

SUMMARY. Epilepsy is a neurological disease characterized by an enduring predisposition to recurrent seizures. Approximately 1% of the global population is affected by epilepsy, making it the second most common neurological disease after stroke. Individuals with epilepsy are at heightened risk for both seizure-related and unrelated injuries, including soft tissue injuries, head injury, dental and tongue injury, burns and orthopaedic injuries. Several individual studies on epilepsy and burn injuries have been published from various countries. However, there is a paucity of review summaries on epilepsy-related burn injuries, especially in low-resource settings. In this review we highlight an underreported cause of burn injuries in epilepsy patients, particularly in low-resource settings where both epilepsy and burn care remain challenging.

Keywords: epilepsy, seizure, burn injuries, seizure-related burn injuries, retrospective studies

RÉSUMÉ. *L'épilepsie est une neuropathie caractérisée par la survenue de crises convulsives. Elle touche à peu près 1% de la population, ce qui en fait la neuropathie la plus fréquente derrière l' AVC. Lors d'une crise, les patients sont à risque de traumatismes divers tels les contusions, les traumatismes crâniens, dentaires, linguaux, osseux, ainsi qu'aux brûlures. Plusieurs séries, de pays différents, ont été publiées sur ce sujet. Rares cependant sont celles provenant de pays en développement. Nous centrons donc cette revue sur la survenue de brûlures dans les pays en développement où la prise en charge de l'épilepsie est difficile, à l'instar de celle des brûlures.*

Mots-clés : *épilepsie, convulsions, brûlure, étude rétrospective*

✉ Corresponding author: Ndaba EM, BScMedSc, MBBCh, Department of Surgery, University of the Witwatersrand, Charlotte Maxeke Johannesburg Academic Hospital, Johannesburg, South Africa. Tel.: +27 74 618 9924; email: maleselandaba22@gmail.com
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Introduction

Epilepsy is a neurological disease, characterized by an enduring predisposition to recurrent seizures.[1] Epilepsy remains one of the most common neurological conditions. Approximately 1% of the global population is affected by epilepsy, making it the second most common neurological disease after stroke.[2] Close to 50 million people worldwide live with epilepsy and 90% of the affected population is made up of those living in developing countries.[3]

People living with epilepsy are at increased risk of identified seizure and non-seizure related injuries in different environments, namely, the workplace, home and streets.[4] A retrospective study in Turkey reported various types of injuries: 82.5% of patients with epilepsy in the study sustained injuries due to seizure, followed by soft tissue injuries (70.2%), head injury (61.5%), dental and tongue injury (58.6%), burns (24%) and orthopaedic injury (21.2%).[5] According to a review published in 2006 under the official journal International League Against Epilepsy, burn units report 1.6% to 3.7% of admissions are due to seizure-related burn injuries.[6]

Despite numerous reports from different regions, there is no consolidated data evaluating the prevalence, mechanism of injury, disease severity, and outcomes of seizure-related burn injuries, especially in low- and middle-income countries (LMICs). In this review we highlight global evidence on one of the most underrepresented and unrecognized complications of epilepsy, and its implications for prevention.

Material and methods

Literature search

This review employed a narrative review design to explore the global burden of seizure-related burn injuries. Literature search was conducted across multiple databases: PubMed, Scopus, Google scholar, Web of sciences and World Health Organisation (WHO) website. The search terms used were 'Seizure' OR 'epilepsy' AND 'burn injuries' OR 'thermal injury'. The search was limited to articles published in English, examining the seizure-related burn injuries. Selected study method was limited to retrospective and cross-sectional studies conducted in burn units or centres. No specific timelines applied.

Studies that were included provided quantitative data on the prevalence, patient characteristics, mechanism of injury, disease severity, length of hospital stay, mortality rate, management strategies and preventative measures. No meta-analysis or formal statistical synthesis was conducted.

Results

Prevalence

Multiple burn units across the globe have provided care for patients who sustained burn injuries due to epilepsy and have shared their experiences with the world scientific community through published clinical studies on the prevalence of seizure-related burn injuries. The prevalence of seizure-related injuries varies between countries. A 7-year retrospective study in Ghana reported a prevalence of 3.1%,[7] while a 4-year retrospective study in India reported a prevalence of 1.3% of burn injuries associated with epilepsy.[8]

Mean age

Despite epilepsy affecting various age groups, there is a repeated pattern of age group in clinical studies on epilepsy and burn injuries. The prevalence of seizure-related burn injuries is higher in adults than paediatric patients. Retrospective studies in Iran and Paraguay reported a mean age of 42.2±2.99 and 40±16.5 years, respectively.[9,10]

Gender variation

A tertiary centre in Egypt randomized 1000 patients, 500 females and 500 males, with epilepsy in their outpatient department.[11] The study concluded that generalized tonic-clonic seizures are common in males, while epilepsy syndrome is common in females, of subtype juvenile myoclonic epilepsy, idiopathic generalized tonic-clonic epilepsy, and temporal lobe epilepsy.[11]

To better understand gender differences in epilepsy that may influence burn risk, we reviewed demographic studies on seizure patterns. A retrospective study conducted in South Africa reported 66.6% were

females with epileptic burn injuries over a two-year period.[12] This is supported by another 10-year retrospective study conducted in Iran with 51.3% female epileptic burn injuries.[13] The conclusion regarding the most affected gender remains controversial. The larger population size (n=7640) study in the United States of America reported 69% of seizure-related burn injuries to occur in the male population.[14]

Mechanism of injury

Identified mechanisms of burn from various studies included, but were not limited to, flame or fire, hot liquid, hot surface, gas explosion, electrocution, hot surface, hot food, and hot glue.[8,9,10,12,13] Flame and hot water were both common causes of burn injuries across the studies, highlighting no clinical difference in burn patients without epilepsy. Proposed causes of burn injuries include loss of consciousness[8] and failure to rescue the patient during an attack because of superstitious beliefs.[15]

Severity of injury

Seizure-related burn injuries present with low total body surface area (TBSA) but can potentially be deep. A clinical study in Paraguay categorized patients into the groups minor (15% TBSA or less), moderate (16-25% TBSA) and major (>25% TBSA) with outcomes of 94.28%, 5.71% and 0%, respectively.[10]

The depth of burn severity from a similar study outlines unique concepts after grouping into 1st degree, superficial 2nd degree, deep 2nd degree and 3rd degree with outcomes of 0%, 40.00%, 37.14% and 22.85%, respectively.[10] A study in Philadelphia categorized injuries according to depth of burn: superficial partial thickness, deep dermal, full thickness and mixed burns had outcomes of 19.82%, 20.72%, 40.54% and 18.92%, respectively.[16]

Length of hospital stay and mortality

A 10-year retrospective study of a sample size of 7640 compared the difference in length of hospital stay in patients with seizure-related burn injuries and those with non- seizure-related burn injuries.[6] Median hospital and intensive care unit (ICU) length of hospital stay was 5 days (OR=2.85, 95% CI=1.73-4.67), with no significant difference in mortality rates (adjusted 7% increase compared to non-seizure related of 3.8%) between seizure-related and non-seizure-related burn injuries (OR=2.28, 95% CI=0.87-5.95).[6] In contrary to the study outcomes, a South African study with a smaller sample size (n=21) reported length of hospital stay to be longer than 14 days and mortality rate to be 9.5%, with no statistical tests used.[12]

Table I outlines the main characteristics of the studies selected: country, sample size, prevalence, age, gender, mechanism of injury, disease severity, length of hospital stay and mortality.

Preventive measures

As previously stated, there are various types of seizure-related injuries that primarily concern the patient, family, and coworkers. Various preventive measures have been developed depending on the injury of interest. Seizure episodes are undeniably associated with increased risk of injuries, including burns. General measures to prevent seizure episodes include, but are not limited to, seizure medical treatment and regular exercise.[17]

The International League Against Epilepsy released guidelines to prevent injuries in children with epilepsy. Children with epilepsy should be monitored closely in high-risk environments, including bathing, recreational areas, sports, and around stoves and ovens.[18] According to Rimmer et al., the proposed preventative measures against burn-related injuries were derived from the mechanism of burn injuries that patients sustained: patients were encouraged to use a microwave instead of using the stove, take a bath in water at a temperature of 48.9℃, and have a shower instead of a hot bath.[19]

Surgical treatment

Unfortunately, there is still a significant number of patients with epileptic burn injuries that require surgical intervention. Principles of burn reconstructive surgery are applied for seizure burn injuries. Common surgical procedures include, but are not limited to, surgical debridement, amputation, split skin graft, full thickness skin graft, muscle flap, release of contractures, ectropion release and circumcision.[8,16] Surgical intervention is primarily indicated for patients with deep dermal and full thickness burn

Table I - Summary of seizure-related burn injury studies

Author (Year)	Country	Sample size (n)	Prevalence (%)	Mean age (years)	Gender (M/F)	Mechanism of burn	Burn severity	Hospital stay (days)	Mortality (%)
Ziabari (2022)	Iran	40	Not stated	42.2 ± 9.99	67.5% M	Flame (37.5%) Hot food (32.5%) Hot liquid (15%) Gas explosion (7.5%) Electrocution (7.5%)	1st: 0% 2nd Superficial: 40% 2nd Deep: 37.1% 3rd: 22.8%	10.3 ± 3.18 days	17.5%
Montiel (2020)	Paraguay	70	3.73%	40 ± 16.6	67.5% M	Direct fire (57.1%) Hot liquids (42.9%)	1st: 0% 2nd Superficial: 40% 2nd Deep: 37.1% 3rd: 22.9% TBSA <15%: 94.3%, 16-25%: 5.7%, >25%: 0%	Not stated	Not stated
Ghoddusi (2019)	Iran	39	1.7%	30 ± 11	48.7% M	Flame (66.7%) Scald (17.9%) Contact (15.4%)	Mean TBSA: 19.7% ± 8.4%	Not stated	2.6%
Atwell (2019)	USA	7640	1.31%	46.5 ± 17.7	69% M	Flame (46%) Scald (49%)	Mean TBSA: 9.0%	Median: 11 days	7%
Agbenorku (2018)	Ghana	21	3.1%	19.3	28.6% M	Scald (81%) Open fire (14.3%) Mixed (4.7%)	Mean TBSA: 19.1% Mostly minor-moderate	33.3% >30 days; 19% <14 days	9.5%
Faurie (2015)	South Africa	39	20%	36.5	33.4% M	Flame (61.5%) Scald (23.1%) Hot surface (10.3%) Chemical (2.6%) Hot oil (2.6%)	Partial: 42% Deep: 29% Mixed: 29%	Mean: 32 days	Not stated
Akhtar (2014)	India	54	1.3%	Median: 34 (30-40)	22.2% M	Scald (56%) Hot surface (22%) Electrical (11%) Flame (11%)	85% <20% TBSA 1st: 11% 2nd superficial: 11% 2nd deep: 33% Mixed: 28%	Not stated	Not stated

where the healing process will be impaired.[16] In some instances, multiple surgical procedures may be carried out at different stages, i.e. multiple debridement or regrafting.[8]

Conclusion

Knowledge of seizure-related burn injuries is of paramount importance for proper health care service delivery, especially in low- and middle-income countries (LMICs). Currently, there are few clinical studies that have focused on seizure-related injuries with a big enough sample size and statistical testing. Currently, the available clinical data highlights the need for a multi-disciplinary team approach - from prevention of seizure episodes to surgical management of burn injuries associated with seizure episodes - to prevent morbidity and mortality associated with this preventable complication.

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