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Injury Deaths among People with Epilepsy in Rural Bangladesh:

A Retrospective Population-Based Study

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Abstract

Background—Accidental death in people with epilepsy (PWE) has been described in high income settings where the relative risk of death is known to be higher than in the standard population. Population-based studies of injury deaths among PWE in developing countries are uncommon.

Methods—A population-based verbal autopsy study in Matlab, Bangladesh, performed at a health and demographic surveillance system site (mean population 223,886 in 142 villages), was used to assess the possible causes of all deaths. All cases of accidental injury (2005–2008) were evaluated and compared between people with and without a diagnosis of epilepsy.

Results—There were 12 accidental deaths among PWE (8 female, age range 12–58 years old) out of a total of 316 deaths due to accidental injuries (3.8% of all injury deaths). Causes of mortality were drowning (n=10) and burns (n=2). The proportion of deaths due to drowning among PWE was significantly higher than that of the standard population (83% (10/12) vs. 7% (21/304), relative risk 12.6 (95% CI, 7.7–20.7, p<0.0001)). Mortality due to injury in PWE occurred at a younger age compared to people without epilepsy (mean difference 20.7 years (95% CI 6.7, 34.3), p<0.004).

Conclusions—There is a high proportion of accidental deaths due to drowning in PWE in Bangladesh compared to the standard population. Given the risk of seasonal flooding and low level of formal education, programs targeting water safety for PWE at all ages should be emphasized, appropriate for level of ability.

Keywords

accident; Bangladesh; drowning; epilepsy; mortality

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Introduction

People with epilepsy (PWE) are at risk for fatal accidental injury, particularly in locations where public health measures for epilepsy-related education and widespread antiepileptic drug treatment are lacking. In developed countries, there is a 1.6–3.0-fold increase in mortality in PWE compared to the general population.¹ Drowning risk has been estimated to be 15–19 times higher in people with epilepsy², but few mortality studies from low income countries exist^{3–6} including few that are population-based.^{3,4}

Unintentional injuries however may be an important cause of death among PWE in developing country settings, including burns, drowning, falls, electric shocks, and road accidents. In an epilepsy clinic-based study in India⁷, 45 percent of patients reported at least one injury in the previous year, most often including road traffic accidents. In northeast Thailand, a study of 300 consecutive patients with seizures found accidental injury was most commonly associated with soft tissue injury, head injury, near-drowning, and burns.⁸ In rural China, accidental drowning death was the single leading cause of death and was unwitnessed in 85% of cases.⁹ In developed country settings, awareness of the risk profile of epilepsy-related deaths has led to heightened public health awareness campaigns and strategies for counseling during clinical care. Such information is also a priority for developing countries where avoidable deaths among PWE must be identified and may impact a high number of people. Herein, we retrospectively analyze the cause distribution of accidental deaths among PWE compared to the general population in rural Bangladesh.

Methods

A health and demographic surveillance system (HDSS) in Matlab, Bangladesh (55 kilometres outside of the capital city, Dhaka) collects all cause-specific mortality data on people of all ages. There was an average population of 223,886 people in 142 villages at the end of 2008.¹⁰ Causes of death were determined by verbal autopsy, an interview-based method to ascribe cause of death in resource-poor settings where formal vital registration systems are lacking. Informants on the circumstances surrounding the death must be closely related to the individual or a caregiver, present at the time leading to death, and able to clearly convey the circumstances that led to death. A verbal autopsy instrument was developed by the World Health Organization and modified by the INDEPTH Network for use in multiple surveillance sites in 2003.¹¹ Each verbal autopsy sheet was reviewed by a trained medical assistant with a level of education from high school completion to 3 years of medicine. The medical assistant assessed possible causes of death and assigned diagnostic codes. Diagnoses were made using the 10th edition of the International Disease Classification manual. Epilepsy in this study was determined when: the decedent had a history of recurrent seizures occurring at any time of the day with a brief period of loss of consciousness, was diagnosed by a medically qualified doctor as epilepsy (“mirgi” in Bangla), and received medicine for epilepsy. A typical narrative is provided in Appendix 1. All injury deaths were reviewed from 1 Jan 2005 – 31 Dec 2008. Frequency of death by injury type was compared among PWE and people without epilepsy.

Results

There were 12 injury deaths among PWE (8 female, age range 12–58 years old, mean years of formal education 1.75, range 0–5). PWE accounted for 3.8% of all injury deaths (12/316 total injury deaths, 95% CI 1.98–6.54%). Demographic and clinical features including age, sex, number of educational years, occupation, place of death, receipt of medical care prior to death, and cause of injury death among PWE are given in table 1. Injury deaths among PWE occurred at an average younger age compared to people without epilepsy (mean difference

20.7 years (95% CI 6.7–34.3), $p < .004$). PWE accounted for 32.2% of all drowning deaths (95% CI 16.7–51.4%). The proportion of deaths due to drowning among PWE was significantly higher than that of the standard population ((10/12) 83% vs. 7% (21/304), relative risk 12.6 (95% CI, 7.7–20.7, $p < 0.0001$). The most common causes of death among people without epilepsy were falls (80/304, 26.3%), boat or boat launch accident (49/304, 16.1%), and road or train accident (40/304, 13.2%).

There were two cases of death due to fire among PWE. One individual was smoking and experienced seizures with loss of consciousness while lying under a mosquito net at night. The net caught fire and she died of complications of a burn injury. Medical care was sought. The other case of death due to burns in a person with known epilepsy occurred when a woman had a seizure and fell onto a burning oven at home. She died of complications of burns despite treatment.

Conclusions

Drowning may be an important, unaddressed cause of death among PWE in Bangladesh and other developing countries where water safety counseling and infrastructure are minimal. Drowning is six times more common in Bangladesh and other developing countries than in high income countries¹², leading to the United Nations International Children's and Education Fund (UNICEF) programming to combat drowning in children.¹³ This includes such methods as swimming lessons, instructions on appropriate rescue measures, and education on how and why to seek medical care.

Unlike in high income settings, where drowning deaths are reported predominantly among young children, all drowning deaths seen here were among individuals ages 12 years and older. This suggests that adults too, including those with disabilities, are a necessary target group for water safety instruction and educational programming, appropriate to their level of skill and abilities. In a prior study of 489 childhood drowning deaths in this site (age 5 years and younger), traditional rescue measures included spinning the victim to remove water, treatment from the village practitioner, applying pressure to the stomach, massaging with ash, and putting the child in sunlight.¹⁴ Care seeking was higher for boys than girls among childhood drowning deaths. In this study, no fatal drowning events among PWE were associated with seeking medical care. This is likely due to the location of the injury and the care seeking pattern for injury in the population in general rather than a problem unique to PWE.

The number of deaths among PWE due to drowning in Matlab is comparatively higher than in wealthier countries. In a meta-analysis of 51 separate high-income cohorts of PWE in the English literature, there were just 88 deaths due to drowning reported among PWE.² In the United Kingdom national registry, drowning deaths occurred in 22 people in one year (1999–2000), accounting for 18% of all drowning deaths.² This is relatively lower than the approximately 32% of drowning deaths accounted for by PWE seen in rural Bangladesh in this study.

This study is limited by a number of factors. Deaths are monitored by verbal autopsy using an instrument that has not been validated for the study of epilepsy and is subject to both recall and reporting biases. Validation of verbal autopsy instruments in adult deaths is a widespread problem, not limited to this study.¹⁵

The treatment of epilepsy, disease course, and type of epilepsy were not reported in these cases. The exact relationship between drowning and an incident seizure is not documented. Moreover, deaths due to flooding, boating, or water transport are not coded as “drowning” and would be overlooked, potentially under-estimating the number of epilepsy and drowning

cases.¹⁴ The included cases were known cases of diagnosed epilepsy but other cases of undiagnosed epilepsy who never reached medical attention may have been overlooked. Given these limitations, it is more likely that injury-related death among PWE is under- rather than over-estimated, although further studies will be necessary. In general, there is a need to carry out prospective studies with better methodology in developing countries on the preventable causes of death among PWE.

The high burden of drowning deaths among PWE can be avoided. Basic measures may include adequate treatment of PWE with cheap and cost-effective outpatient therapies such as phenytoin. Education of village practitioners of traditional medicine on water safety is also crucial since many villagers do not access hospitals and medical providers of Western medicine. Among those who are diagnosed with seizures, fences around pools and ponds, draining of ponds which are considered a status symbol in some cases¹⁴, filling canals and ditches¹⁶, supervision of swimmers, special precautions during monsoon season, lifejackets, inflatable water wings and other floatation devices, and instructions on showering instead of bathing will all be potentially life-saving. Unlike other interventions for unintentional injuries which usually require changes in legislation, infrastructure, or equipment, drowning prevention among PWE may prove to be both cheap and easy to implement, especially when high risk individuals are identified.

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Appendix 1. Example of a verbal autopsy narrative for a person diagnosed with epilepsy, included in this study

The deceased girl had convulsions time to time since 2 years of age. Different persons spoke about different diseases [that she may have had] and [possible] healthcare providers to visit. [Her] parents visited those providers, including spiritual healers and kabiraj (herbalists), etc.

She was taking two tablets daily, prescribed by a medical doctor ([who had a] Bachelor of Medicine and Bachelor of Surgery, MBBS), for the last six years, but convulsions, followed by cessation, occurred for some time. Then the convulsions continued, and then got cured, and this continued. On the day of death, she went to the nearby river [note that Matlab is a riverine area] with other girls for a bath. As part of her bath, she dived and did not raise her head. Accompanying girls seeing this informed her parents at home. Her uncle stepped into water and raised her body out of the water, but there were no signs of respiration anymore.

Table 1
Demographic and Clinical Features of Injury-related Deaths among People with Epilepsy

Case	Age/Sex	No. Educational Years	Main Cause of Death	Place of Death	Received Medical Care Prior to Death	Occupation
1	47F	0	Burns	Home	Y	Unpaid family worker
2	12F	5	Burns	Home	Y	Student
3	44M	0	Drowning	Unknown	N	Farmer/Landowner
4	28F	0	Drowning	On-site	N	Unpaid family worker
5	20F	2	Drowning	On-site	N	Unpaid family worker
6	27F	6	Drowning	On-site	N	Unpaid family worker
7	37F	3	Drowning	On-site	N	Unpaid family worker
8	21M	0	Drowning	On-site	N	Farmer/Landowner
9	43F	0	Drowning	On-site	N	Unpaid family worker
10	16F	1	Drowning	On-site	N	Unpaid family worker
11	19M	4	Drowning	On-site	N	Small trade worker/proprietor
12	58M	0	Drowning	On-site	N	Bricklayer/Carpenter/Construction