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Accidents and injuries in people with epilepsy attending a tertiary care center in India

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ABSTRACT – People with epilepsy have a higher risk of accidents and injuries when compared to others in the community. Seizure frequency and other characteristics of epilepsy and its treatment are known to influence this risk. The risk of accidental injury to people with epilepsy may vary in different geographical areas, according to their life style, leisure activities and other pursuits. The objective was to ascertain the accidents and injuries experienced by a cohort of people with epilepsy in India, and to ascertain any possible predictors. The study was carried out in the Epilepsy Clinic of Sree Chitra Tirunal Institute for Medical Sciences and Technology between January and June 2007. Using a structured questionnaire, we interviewed all consenting adults attending this tertiary epilepsy center who had had active epilepsy for one or more years. Two hundred and fifty five patients completed the study. The diagnoses included localization-related epilepsy for 62.6% of the patients and generalized epilepsy for the remainder. During the 12 months prior to the interview, 44.8% had had at least one injury; 7.8% had sustained an accident. Road traffic accidents (3.1%), burns (2.5%), electric shocks (0.8%) and near drowning (0.4%) were the commonly reported accidents. Age, sex, type of epilepsy and type of medication had no significant association with the occurrence of injuries or accidents. However, we found that a quarter of the people with epilepsy studied had experienced serious injuries.

Key words: epilepsy, accident, injury, tertiary epilepsy care

People with epilepsy are considered to be at higher risk of accidental injury than people without seizures. The unpredictable nature of the seizures and the loss of control during the ictus make the subject excessively vulnerable to accidents and injuries. The risk may vary from 15 to 35% depending upon the studies. The types of accidents are likely to differ according to the lifestyle and leisure pursuits that prevail in a given locality. There may be a gender-specific difference in the type of injuries that people with epilepsy experience. The higher risk of accidents and injuries may be conferred by either the seizure itself or by various co-morbidities associated with epilepsy. Seizures may result in abrupt falling without warning, causing injuries because the subjects are often unable to employ their protective reflexes. Anti-epileptic drugs (AED) may potentially impair atten-

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tion, reaction time and motor coordination and predispose people to accidents and injuries. Absence or complex partial seizures lead to loss of awareness, preventing the person from recognizing and responding to a dangerous situation. People with generalized epilepsy appear to be at higher risk, as do those with more frequent seizures. Co-morbid attention deficit and cognitive impairment also can increase the risk of injuries. Seizures that occur exclusively during sleep may be associated with a lower risk of injuries.

People with epilepsy experience considerable limitations with regard to driving, sports and leisure activities, and occupation because of the potential risk of injuries and accidents. Although it is desirable to mandate for appropriate restrictions in order to reduce injury, excessive limitations may lead to loss of independence, impaired social development and increased psychiatric co-morbidities.

There are few data from India on accidents and injuries in people with epilepsy, although one million such people live in India. The objective of this study was to ascertain the accidents and injuries experienced by a cohort of people with epilepsy attending a tertiary care epilepsy center, and to evaluate any correlation between the clinical characteristics and patterns of accidents.

Patients and methods

The study was undertaken at the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, which is a tertiary care centre for cardiovascular and neurological diseases. Data pertaining to accidents and injuries were gathered through a structured questionnaire completed by people with epilepsy attending this hospital. The questionnaire was in the local language (Malayalam) (an English translation of the questionnaire is given in *Appendix 1*). It explored demographics, occupation, treatment details, drug compliance, the number of accidents and injuries in the past 12 months and details of the accidents and injuries. We included only a limited number of accidents (transport accidents, drowning, electric shock, and contact with heat) relevant to epilepsy. Injuries were classified as minor if they involved only the soft tissues or did not require hospitalization. Major injuries consisted of tongue biting, dental injuries, and other injuries that required hospitalization. The selection criteria included the presence of active epilepsy according to the ILAE classification for more than 12 months duration, age between 12 and 60 years, familiarity with the Malayalam language and willingness to participate in the study. The subjects were recruited from the outpatient epilepsy clinics. The first five outpatients from each epilepsy clinic session were recruited over a period of six months from January 2007. The investigators did not prompt or assist the subjects, but did not object to a family member or bystander helping them. Clinical data were obtained from their medical records. Data were transferred to a spreadsheet and analyzed with SPSS for windows statistical package. Pearson Chi-Square test and Fisher's exact test were applied.

Results

During the six month study period, 254 people (122 females and 132 males) participated in this study. Their mean age was 27.4 + 12 years. Most of them were engaged in studying (37%), home making (20.1%), manual labor (9.4%), office jobs (9.1%) or professional jobs (7.5%) while 16% were unemployed. Of the 254 patients, 95 patients (37.4%) were diagnosed with generalized epilepsy, while 159 patients (62.6%) were diagnosed with localization related epilepsy. All were on one (49.2%) or more (50.8%) AEDs. The AEDs used were carbamazepine (CBZ) 52.3%, valproate (VPA) 40.9%, phenytoin (PHT) 21.2% and phenobarbitone (PB) 11%.

Out of the 254 patients, 114 (44.8%) had experienced an injury in the previous year. The injuries included abrasions or soft tissue injuries only for 71 patients (28%), tongue biting for 64 patients (25.2%) and dental injuries for 18 patients (7.1%). There were eight instances of road traffic accidents, five burns, two electric shocks and one near drowning. The accidents or injuries occurred in an indoor situation for 100 patients (39.4%), school premises in 46 patients (18.1%), while traveling in 36 patients (14.2%), during recreational activities in 19 patients (7.5%), during bathing in 30 patients (11.8%) or during sleep in 74 patients (29.1%). The frequency of road traffic accidents was higher (7.1%) for those who admitted to driving (three of the 42) than those who did not drive (five out of 212; 2.3%), but the difference was not statistically significant. There were 65 patients (25.6%) who required medical attention and 19 of them (7.5%) required admission to hospital.

The frequency of injuries according to the epilepsy type, AED therapy, occupation and other characteristics are given in *table 1*. There were five people (two females and three males) who had sustained burns, but there was no gender bias in the risk of burns for this cohort.

Discussion

This is a cross-sectional survey of accidents and injuries in a cohort of adults with active epilepsy. We observed that 52.7% of the subjects had had at least one accident or injury during the 12 months prior to the interview. This proportion is greater than that reported in a population-based survey (Buck *et al.* 1997) and a smaller hospital-based survey (Neufeld *et al.* 1999). In another retrospective survey of 247 patients, there was one seizure-related

Table 1. Frequency of accidents and injuries according to the epilepsy type, antiepileptic therapy, occupation and other characteristics (number of subjects given in brackets).

	With injuries (%)	p
Sex		
Male(132)	40.2	0.130
Female(122)	50	
Type of epilepsy		
GE(95)	40.9	0.118
LRE (159)	51.6	
Age		
< 15 years (28)	25	0.027
≥15 years (226)	47.3	
Occupation		
Manual labor (24)	50	0.669
Other (230)	44.3	
Drugs*		
Valproate (104)	44.2	0.898
Carbamezepine (133)	44.1	1
Phenobarbitone (28)	60.7	0.106
Oxcarbazepine (10)	40	1
Phenytoin (54)	43.7	0.161
Lamotrigine (5)	0	0.065
Topiramate (18)	44.4	1
Primidone (2)	0	0.053
Clobazam (6)	43.1	0.766
Clonazepam (6)	33.3	0.694
Tiagabine (1)	0	1

GE = generalized epilepsy; LRE = localization related epilepsy.
* p value refers to the comparison where patients exposed to a given AED are compared to all other patients who were not exposed to that AED.

injury severe enough to seek medical attention for every 44 patient years. A prospective case control study had shown that people with epilepsy have significantly ($p < 0.0001$) higher risk of injuries (27%) compared to controls (17%) (Lawn *et al.* 2004). In a prospective study of patients with seizures, presenting to emergency room, (Kirby et Sadler 1995) there was a 14% injury rate associated with seizures. There is wide variability (14%-37%) in the reported frequency of accidents and injuries in people with epilepsy. The variation in life-style and leisure pursuits of the affected subjects across different countries might be one of the possible factors influencing the risk of accidents. This aspect needs confirmation in a prospective study.

Most of the injuries observed in this study were minor soft tissue injuries. Injuries to the tongue or teeth were the most frequent, serious injuries. Previous studies also have shown that soft tissue injuries are the most common forms of injury in people with epilepsy. The risk of soft tissue injuries has been reported to be as high as 74% in previous studies in adults (Nakken et Lossious 1993) and children (Dekollu *et al.* 2005). There was no instance of fracture in this series. Several retrospective studies have reported a two- to three-fold increased risk of fractures among patients on AEDs. The pattern of accidents and injuries in people with epilepsy according to various studies is given in *table 2*. A prospective study (Van den Broeck et Beghi 2004) did not find any increased risk of fractures among patients with epilepsy. Patients with epilepsy are probably at higher risk of fractures even from trivial falls, since several enzyme-inducing AEDs may predispose them to osteoporosis. Enzyme-inducing AEDs such as PHT and CBZ induce increased vitamin D metabolism and secondary hyperparathyroidism.

Head injury is significantly more common (odds ratio of 2.6) in patients with active seizures than in patients in remission (Van den Broeck et Beghi 2004). Most of the reported head injuries were concussions. Serious injuries requiring neurosurgical intervention were rare. Our study did not record any instances of head injury, either caused directly by seizures or due to accidents. Dental injuries are fairly common (5%-10%) in people with epilepsy (Wirrel 2006). In our study, there was a 7% incidence of dental injuries during the study period of one year.

In this series, the type of epilepsy, sex of the subject or occupation did not influence the risk of accident or injury. The frequency of injury was higher for patients using PB (60%) in contrast to those on other AEDs (40%); nevertheless this difference was not statistically significant. There was a trend towards increased frequency of road traffic accidents for those who were engaged in driving when compared to those who did not drive.

The most serious accidents for people with epilepsy are the submersion injuries, burns and road traffic accidents. In this series, these accidents constituted only a small minority (6%). In several retrospective surveys among adults, 3 to 16% of patients reported burns during seizures (Wirrel 2006). Nevertheless, the European cohort study did not show any increased risk compared to controls among epileptic patients. In our study, five people had sustained burns in the preceding year (1.96%).

Drowning is probably the most common type of fatal accident in patients with epilepsy. Shieth *et al.* (2004) found that the proportional mortality ratio for accidental drowning among adults with epilepsy was 4.4%. In a retrospective study of adults with epilepsy, 14% of patients had experienced a seizure while bathing or swimming in the preceding year (Buck *et al.* 1997). Another retrospective study in children, including teenagers, also demonstrated a strikingly higher risk of submersion injury in children with epilepsy. The relative risk of submersion and fatal drowning is much higher (13.9) for children with epilepsy when compared to those without epilepsy (Diekema *et al.* 1993). In the present study, there was only one instance of near drowning. The life-style characteris-

Table 2. Accidents and injuries observed in people with epilepsy according to different studies.

	Present study	Tiamkao and Shorvon	Cornaggia *et al.*	Van den Broeck and Beghi	Buck *et al.*
Year	2008	2006	2006	2004	1997
Study design	Retrospective hospital based	Retrospective hospital based	Prospective hospital based	Prospective hospital based control trial	Retrospective population based
N	254	100	631	951	696
Age in years	> 12	> 15	> 18	> 5	> 16
Setting of accident	Seizure related and seizure unrelated	Seizure related only	Seizure related and seizure unrelated	Seizure related and seizure unrelated	Seizure related only
At least one accident or injury in past 12 months	52.7%	27%	3.48%	17%	49.4%
Injuries requiring medical attention	25.6%		2.9%	16%	23.1%
Injuries requiring hospitalization	7.5%	1%	0.2%	3%	5.2%
Soft tissue injuries	28%	19%	3.6%		
Tongue injuries	25.2%				
Dental injuries	7.1%				4%
Road Traffic Accidents	3.1%				
Near drowning	0.4%				
Electric shock	0.8%				
Burns	2.5%	4%	1%		6.9%
Indoor accidents	39.4%				
School premises	18.1%				
During travel	14.2%				
Recreational activities	7.5%				
Bathing	11.8%				5.5%
During sleep	29.1%				

tics and attitude of the patients and the over-protective attitude of their relatives may account for the relatively low frequency of submersion incidents in this part of the world.

A range of driving restrictions are universal for patients with epilepsy. We observed that there was no significant difference in risk of road traffic accidents for those who drive versus those who do not drive. A large, retrospective, epidemiological study limited to driving fatalities based on the mortality data from the Center for Disease Control and Prevention for the years 1995 to 1997, showed that drivers with epilepsy had an increased risk of fatal crashes compared with drivers with other medical conditions although driving fatalities directly related to seizures are rare, accounting for 0.2% of the total number of annual driving fatalities (Sheith *et al.* 2004).

In the present study, 42 patients (16%) were driving vehicles, but only eight of them reported a road traffic accident. None of them required hospitalization.

Some AEDs may have adverse effects such as sedation or incoordination. In the present study, the most frequently used AEDs were CBZ, VPA, PHT and PB. On univariate analysis, there was no increased incidence of injuries associated with any of the drugs used. The use of CBZ was associated with an increased incidence of accidents (11.3% *versus* 4.5%, p value 0.038).

This study has several limitations. It is a retrospective enquiry, the sample size is relatively small and there is no control group. The sample is drawn from a tertiary referral center and the results cannot be generalized to the population at large. Seizure frequency is one of the potentially important predictors and was not included as a variable. Nevertheless, these preliminary data indicate that accidents and injuries are common in people with epilepsy. Over half of them may experience an injury in a given year. Half of the injuries were serious, including injury to the tongue and teeth. Approximately half of the accidents required hospital admission. The type of epilepsy, duration of epilepsy or the medication had no significant effect on the incidence of injuries and accidents. □

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Appendix 1

PROFORMA

Hospital No.:

Diagnosis:

1. Name:
2. Age:
3. Male/Female:
4. Occupation: ☐ studying ☐ housewife ☐ unemployed ☐ manual laborer
   ☐ office job ☐ professional carrier ☐ others
5. Do you drive any vehicles by yourself? Yes/no
6. Age-at-onset of first seizure:
7. Is there any history of seizure with falls? Yes/no
8. Do you have any other disorder that could make you fall down suddenly? Yes/no
9. Frequency of accidents and injuries during the last 12 months:

☐ never ☐ once ☐ two to four times ☐ more than five times

10. Details of injuries:
    - (a) tongue biting Yes/no
    - (b) dental injuries Yes/no
    - (c) skin and soft tissue injuries (cuts, abrasion, etc.) Yes/no

    Details of accidents
    - (d) traffic accidents while driving Yes/no
    - (e) traffic accidents while not driving Yes/no
    - (f) near drowning (submersion injuries) Yes/no
    - (g) electric shocks Yes/no
    - (h) burns Yes/no

    If you experienced burns, was it due to:
    - 1) your clothes catching fire directly Yes/no
    - 2) scalding from hot water/steam Yes/no
    - 3) others, if any

11. Circumstances of the accidents:
    - a) while inside the house Yes/no
    - b) at the workplace or at school Yes/no
    - c) while traveling Yes/no
    - d) during sleep Yes/no
    - e) during recreational activities Yes/no
    - f) while in the bathroom or toilet Yes/no

12. Did you have to seek medical assistance for accidents?
13. Were you hospitalized because of the accidents?
14. Is there is a history of drug default prior to the occurrence of injury or accidents?
15. Do you consider that the accident was due to a side-effect of any drug?
16. Do you think that you could have prevented the accidents or injuries?
17. If yes, what are the precautions that would have helped you to prevent them?

Date