Seizure-Related Injuries in Northeast Thailand

Somsak Tiamkao MD*,
Orawan Amornsin MD*, Chatlert Pongchaiyakul MD*,
Thanin Asawavichienjinda MD**, Prapun Yaudnopakao MD***,
Suthipun Jitpimolmard MD****, Suwanna Arunpongpaisal MD****,
Warinthorn Phuttharak MD****, Narong Aaauevitchayapat MD****,
Suda Vannaprasaht MD****, Siriporn Tiamkao MD****,
Kutcharin Phunikhom MD****, Aporanee Chaiyakum BCT****,
Jiamjit Saengsuwan MPsarm****, Surin Saetang MD****

** Department of Medicine,Faculty of Medicine, Khon Kaen University, Khon Kaen*
*** Maharaj Nakhon Ratchasima Hospital, Nakhon Ratchasima*
**** Surin Hospital, Surin*
***** Epilepsy Research Group, Srinagarind Hospital, Faculty of Medicine, Khon Kaen University, Khon Kaen*

Objective: *The authors aimed to assess the frequency, characteristics, and risk of seizure-related injuries from traffic accidents, near-drowning, burns, fractures, head and soft tissue injuries.*
Material and Method: *Attending physicians assisted 300 consecutive seizure patients to complete a questionnaire. The types and frequency of injuries were then expressed in terms of the type of seizure and related activity.*
Results: *The male (154) and female (146) patients were between 13 and 91 years of age (mean, 36.27 14.55). The seizure types comprised of Generalized Tonic-Clonic (GTC) (26%), secondary GTCs (21%) and complex partials (19%). Secondary causes accounted for 34% of seizures, and post-stroke was the most common (25.5%). The total number of seizure events per year was 8,525 and of these 7,306 included a fall with soft tissue injury (70%), head injury (22%), near-drowning (3%), burns (3%) and fracture or dislocation (1%). The ranking of significant risk factors for injuries was: 1) GTC seizure; 2) seizure with a fall; and, 3) number of seizures.*
Conclusion: *Seizure-related injuries are common among Thai epileptic patients; thus, consistent treatment and education about the risk of injury would protect patients.*

Keywords: *Epilepsy, Seizure-related injuries*

J Med Assoc Thai 2006; 89 (5): 608-13
Full text. e-Journal: *http://www.medassocthai.org/journal*

Knowing the nature and risk-factor of seizure-related injuries, would provide a helpful guide for clinical management and daily-life planning of patients[1]. It is known that the periictal period present the greatest risk for injury among epileptics[2]; thus, patients' activities need only be limited when there is serious risk of injuring themselves or others[3]. When injuries do occur, they include traffic accidents, drowning, near-drowning, burns, fractures, and injuries to the head, teeth or soft tissues. The clinical features for each type of seizure-related injury differ from the general population because the risk and extent of injury depends upon the number and type of seizure and the concomitant activity.

The authors' objective was to assess the risks associated with injury among Thai epileptic patients.

Correspondence to : Tiamkao S, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.

Material and Method

Between January and March 2004, a questionnaire on seizure-related injuries was administered by physicians attending 300 consecutive epileptic

patients at the Epilepsy Out-Patient Clinics at Srinagarind, Surin and Maharaj Nakhon Ratchasima Hospitals.

The data collected comprised demographics, age of onset and the type, apparent causes, treatment, number of medications, number of seizures and association of a fall during the last 12 months. Patients were asked whether they had any injuries during seizures in the past and about the specific features of these events, such as the body part involved, the type and place of injury and its treatment. The types of injuries included soft tissue, head, burns, bone fracture or dislocation and drowning.

Patients with a history of seizure-related injuries were compared with those without reported injury using, as appropriate, the SPSS PC student *t test*, ^{2} and Mann-Whitney U tests with $p < 0.05$ was considered significant.

Results

The 300 patients (154 males; 146 females) ranged between 13 and 91 years of age (mean, 36 $\pm$ 14). The age at onset was between 0 and 90 years (mean, 25 $\pm$ 17).

Fifty patients (16.7%) reported being seizure-free during the last 12 months, and 67% of these patients had been treated with antiepileptic drugs (*i.e.* 1, 2, 3 or 4 types of medication in 69, 23.7, 3.3, 1 percent of patients, respectively). Anti-epileptic drugs and surgery were used in 1% of patients of whom 29% (86) were able to stop taking medications after surgery (*i.e.* in the case of head trauma and brain tumors). The data was not complete for 3%, as this was a retrospective study.

Partial seizures occurred in 38.3% of patients, including 52.8% generalised seizures and 11.3% unclassified. Fourteen patients had two types of seizures. The types of seizures were: Generalised Tonic-Clonic (GTC) (26%), 2nd GTC (21%), Complex Partial Seizure (CPS) (19%), atypical absence (15%), absence (9%), tonic seizures (2%), simple motor seizures (1.7%), simple sensory seizures (0.7%), atonic seizures (0.3%), clonic seizures (0.3%) and no data (5%).

The annual mean Frequency of Daytime seizures (FD) was 18.45 $\pm$ 62.92 (range, 0-750), Frequency of Night-time seizures (FN) was 9.96 $\pm$ 55.07 (range, 0-750), Frequency of Seizures (FS) was 28.37 $\pm$ 106.25 (range, 0-1500) and Seizures with a Fall (SF) was 24.35 $\pm$ 104.58 (range, 0-1500).

The causes of seizure were primary (65.3%), secondary (33.6%) or not discernible (1.0%). The most common secondary causes were stroke (25.5%), head trauma (24.5%), birth trauma (13.6%), brain tumour (11%), metabolic (4.5%) and others (21%).

The type of injuries and their frequency are presented in Table 1: 70.3% soft tissue, 21.5% head injury, 2.9% near-drowning, 2.6% burns and 1.4% fractures or dislocations joint. Fourteen patients reported two types of injury and five patients reported three.

Soft tissue injury was the most common injury, as it was reported by 57 patients for a total of 294 events. The common sites were head (61.6%), face (28.9%), arm (26.9%), leg (13.3%), chin (11.6%), back (5.1%) and hand (1.7%). Nearly all of the injuries (96.2%) healed within 1 week with topical ointment, while sutures (3.1%) were needed for nine wounds. Only one patient had to be admitted.

The activity when injury occurred included sleeping (12%), working (8%) and traveling (7%). The precise details of what was occurring during 211 of the events could not be recalled.

Nine patients reported burns of the: arm (28.6%), head (21.4%), face (14.3%), hand (14.3%) and leg (14.3%). Burns usually occurred while cooking

Table 1. Types of injury

Injury	Number of patients (%)	Number of events (%)
1. Soft tissue injury	57/88 (64.8)	294 (70.3)
2. Head injury	23/88 (26.1)	90 (21.5)
3. Burns	9/88 (10.2)	11 (2.6)
4. Orthopaedics	4/88 (4.5)	6 (1.4)
5. Seizures in water	4/88 (4.5)	12 (2.9)
6. Other	5/88 (5.8)	5 (1.2)
Total	102*	418 (100.0)

* Some patients had more than one type of injury

(37.5%) or ironing (25.0%) and were treated with topical ointment. The burns healed in 1 week in 11.1% of cases, 2 weeks in 11.1% of cases and > 3 weeks in 66.7% of cases.

Twenty-three patients reported 90 events of head injury: 66.7% laceration, 8.9% cerebral concussion and 30.0% skull fracture. These were treated with medication in 45.3% of the events, hospitalisation in 37.2% of the events, sutures in 12.8% of the events or observation in 4.7% of events. The most common activities were: working (55.1%), sleeping (2.2%) and traveling (1.1%), while the associated activity during 37 events could not be recalled.

Orthopaedic injuries occurred in 6 events including fracture (2) and shoulder dislocation (1). The sites of the fractures included vertebra (50%), arm (16.7%), hand (16.7%), teeth (16.7%), which occurred while working (16.7%) or travelling (16.7%). The details of concomitant activities were not reported and the type of fracture or dislocation was not reported for 3 events. Splints were used to treat four injuries (80%) and surgery the others.

Twelve seizure events occurred in water; six while bathing. Nine of the events needed no treatment. This injury occurred once in every 710 seizures, and more particularly once in every 137 GTC seizures, indicating a critical differentiation for physicians and their families caring for GTC sufferers.

Discussion

The present study included only outpatients. The accuracy of data and the completeness of the questionnaire depended on the memory of patients and their relatives. Thus, the precise number of seizures and details of injuries may be incomplete. The annual number of seizures among the 300 patients was 8,525. The number of seizure with a fall were 7,306. The total number of seizures recorded among epileptic patients with GTC was 1,648, and of these 1,647 involved a fall. The authors compared the total number of seizures in all patients that included a fall with GTC patients. The mean frequency of remembered seizures per year was 28.4 and a seizure with a fall 24.4. Eighty-eight patients (29.3%) reported seizure-related injury and the total number of injury events was 418 of which 272 (65.1%) were reported by GTC patients.

The patients with GTC seizures reported 272 injury events and soft tissue injuries were most common (221/272), namely: head injury (38), burns (3), orthopaedics (5) and seizures in water (5). The number of seizures per injury was 20.4, and for 17.5 of these it was the fall that caused the injury. GTC patients had a high risk of injury and the total number of seizures per injury was 3.94. Of every 94.7 seizures, 18.3 were GTC seizures and 81.2 involved a fall with a head injury. Orthopaedic injury occurred once in every 274.7 GTC seizures. Table 2 presents the risk of injury per type of seizure for all patients *vs.* the GTC patient group alone.

The significant risks for seizure-related injury were GTC seizures and a 2nd GTC. Sex, age, age of onset, duration of disease, staying alone, working, partial seizures type, seizures without aura, neurological deficit, CPS, absence seizures, FN, FD, FS, and taking more than two medications were not significant risk factors. In the subgroup of patients by type of injuries, GTC seizures and 2nd GTC were significant risk factors in the soft tissue injury group. In the group with head injury, 2nd GTC seizures were a significant risk factor. Among orthopaedic patients, the significant risk factors were the same as for any other head injury patient. No significant risk factor was found for the burn patient group.

Table 2. Risk of injury per seizure

	Number of seizure per injury			% total seizure resulting in injury		
	All	SF	GTC	All	SF	GTC
1. Soft tissue injury	29.0	24.8	5.6	3.4	4.0	17.8
2. Head injury	94.7	81.2	18.3	1.1	1.2	5.5
3. Burns	775.0	664.2	149.8	0.1	0.2	0.7
4. Orthopedic injury	1420.8	1217.7	274.7	0.1	0.1	0.4
5. Seizures in water	710.4	608.8	137.3	0.1	0.2	0.7
Total	20.4	17.5	3.9	4.9	5.7	24.9

Note; All = all types of seizure, SF = seizure with a fall, GTC = generalized tonic-clonic seizure

Fifty-seven patients reported soft tissue injury, accounting for 64.7% of patients who suffered from seizure-related injuries followed by head injury (26.1%), burns (10.2%), orthopaedic injury (4.5%) and seizures in water (4.5%). The significant risk factors for injury were GTC seizures and a 2nd GTC. GTC seizures were therefore a good predictor of injury as in most other studies[1,4,5].

The mean duration of the epileptic seizure, sex and age were non-significant risk factors, which concurs with Buck et al[4] who found that seizure-related injuries occurred once in every 20.4 seizures (specifically 3.9 GTCs) and 17.5 seizures with a fall, of which 4.9% resulted in injury. The GTC seizures with a fall had a higher chance of injury, as 24.9% of seizures with a fall had resulted in injury.

Neufeld[1] and Buck et al[4] found between 30 and 35% of patients had seizure-related injuries. In the present study and others[1,4-6], most patients experienced minor injuries and were treated with only medication and completely healed within 1 week, such that neither suturing, hospitalisation nor surgery were required.

Soft tissue injury was the most common type of injury as 57 patients reported 294 injury events. Most patients had one event per week while one patient experienced events twice a week. The common sites of injury were to the head, face or arms. Twenty percent of injuries occurred while sleeping or working. Frequently details of associated activities were not recorded. Nearly all reported injuries were mild, while sutures were needed in 9 events. GTC seizures and 2nd GTC were risk factors of injury. Soft tissue injury occurred once in every 29 seizures, 5.6 GTC seizures, and 24.9 seizures with a fall.

Burn injuries - commonly to the arm or head - were a significant (37.5%) problem for epileptic patients in the present study, compared to 25% while dressing. By comparison, Kinton and Duncan's[7] found burns while cooking at the Chalfont Center were rare and mostly when boiling water; suggesting persons in the centre were not exposed to the same risks as those (like the presented subjects) living in rural communities in a developing nation. Spitz et al showed that the greater the number of seizures, the more likely the patient is to experience seizure-associated burns when cooking on a stove[8]. Burn injuries occurred once in every 775 seizures, including 150 GTCs and 664 seizures with a fall.

Ironing was the second most common concomitant activity and all of the ironing injury events occurred at home. All of the patients required topical ointment and 66.7% of the burns healed within 3 weeks. The risk factors for injury were not clear.

Twenty-three patients and 90 events reported head injury, which accounted for 21.5% of all traumatic events and 62% needed medical attention. Twenty-seven patients had skull fractures; 55% outside the home and 2.2% at home (sleeping). Playing sports and sleeping were the most common activities when seizures occurred. Persons having a 2nd GTC seizure were at greater risk of injury as every 94.7 (1.1%) seizures (*i.e.* 18.3 GTC seizures and 81.2 seizures with a fall) produced a head injury.

Russell-Jones and Shorvon[9] reported that head injury occurred once in every 36.5 (2.7%) seizures and once in every 16.5 (6.1%) seizures with a fall. The risk of injury was higher compared to the present study perhaps because patients at the Chalfont Centre for Epilepsy (UK) for temporary residents at immediate risk of a further epileptic attack represented a high-risk group.

The authors had 6 orthopaedic injury events and a 2nd GTC seizure was the only significant risk factor, since only 0.36% of GTC seizures with a fall (per year) resulted in a fracture (*i.e.* every 1 420 seizures produced a fracture). Evidently, the primary mechanism of fracture was trauma while the remainder was from shoulder adduction and internal rotation forcing the humeral head against the acromion and glenoid fossa, resulting in a posterior fracture-dislocation as per Finelli and Cardi, who reported fracture following seizure without trauma, and fracture sites were the humerus, acetabulum and femur[10]. The authors encountered one such case of fracture-dislocation of the shoulder joint. In the trauma group, most fracture sites were of the nasal bone, clavicle or skull. Most of the fracture sites the authors observed were at the vertebra, arm or hand.

According to Spitz's suggestion, guidelines for preventing injuries for all patients are: 1) treat epilepsy aggressively, 2) minimise drug-related ataxia, 3) never swim alone, and, 4) exercise regularly to maintain bone mass. Guidelines for patients at higher risk include: 1) avoid unsupervised bathing, cooking or ironing, and 2) wear a helmet and avoid high places[11]. General protective strategies should include: 1) minimise the use of electric irons and hand-held hair dryers; 2) use microwave ovens rather than a stove; and, 3) install thermostats to control water temperature in showers[8]. GTC patients and those experiencing a high number of seizures should avoid cooking with an oven, swimming in unsupervised settings. They should

sleep on a mattress placed directly on the floor and far from fire.

Conclusion

People with epilepsy should be encouraged to live as normal a life as possible. However, special precautions should be taken because of the potential for seizure-related injuries. The authors found that soft tissue injury was the most common injury followed by head injury, seizures in water, burns and orthopaedics injury. The significant risk of injuries was GTC seizures, which occurred once in every 20.4 (4.9%) seizures, 3.9 GTC seizures, and 17.48 seizures with a fall. The need for restricting activity must be balanced with the potential for damaging consequences and excessive dependency. Detailed information about the precise causes of accidents would ensure better-focused advice for patients, so that the risk of injury can be minimised.

Acknowledgments

The authors wish to thank Mr. Bryan Roderick Hamman for his assistance with the English-language presentation of the manuscript. The authors wish to thank Sanofi-Aventis Thailand for their grant.

References

1. Neufeld MY, Vishne T, Chistik V, Korezyn AD. Life-long history of injuries related to seizures. Epilepsy Res 1999; 34: 123-7.
2. Josty IC, Narayanan V, Dickson WA. Burns in patients with epilepsy: changes in epidemiology and implications for burn treatment and prevention. Epilepsia 2000; 41: 453-6.
3. Spitz MC. Severe burns as a consequence of seizures in patients with epilepsy. Epilepsia 1992; 33: 103-7.
4. Buck D, Baker GA, Jacobey A, Smith DF, Chadwick DW. Patients' experiences of injury as a result of epilepsy. Epilepsia 1997; 38: 439-44.
5. Nakken KO, Lossius R. Seizure-related injuries in multihandicapped patients with therapy-resistant epilepsy. Epilepsia 1993; 34: 836-40.
6. Kirby S, Sadler RM. Injury and death as a result of seizures. Epilepsia 1995; 36: 25-8.
7. Kinton L, Duncan JS. Frequency, causes, and consequences of burns in patients with epilepsy. J Neurol Neurosurg Psychiatry 1988; 65: 404-5.
8. Spitz MC, Towbin JA, Shantz D, Adler LE. Risk factors for burns as a consequence of seizures in persons with epilepsy. Epilepsia 1994; 35: 764-7.
9. Russell-Jones DL, Shorvon SD. The frequency and consequences of head injury in epileptic seizures. J Neurol Neurosurg Psychiatry 1989; 52: 659-62.
10. Finelli PF, Cardi JK. Seizure as a cause of fracture. Neorology 1989; 39: 858-60.
11. Spitz MC. Injuries and death as a consequence of seizures in people with epilepsy. Epilepsia 1998; 39: 904-7.

อุบัติเหตุสัมพันธ์กับการชักในภาคตะวันออกเฉียงเหนือประเทศไทย

สมศักดิ์ เทียมเก่า, อรวรรณ อมรสิน, ฉัตรเลิศ พงษ์ไชยกุล, ธนินทร์ อัศววิเชียรจินดา, ประพันธ์ ยอดนพเกล้า, สุทธิพันธ์ จิตพิมลมาศ, สุวรรณา อรุณพงศ์ไพศาล, วรินทร์ธร พุทธรักษ์, ณรงค์ เอื้อวิชญาแพทย์, สุดา วรรณประสาท, ศิริพร เทียมเก่า, คัชรินทร์ ภูนิคม, อาภรณี ไชยาคำ, เจียมจิต แสงสุวรรณ, สุรินทร์ แซ่ตัง

วัตถุประสงค์: *ศึกษาความถี่, ลักษณะ และปัจจัยเสี่ยงของการเกิดอุบัติเหตุในผู้ป่วยโรคลมชัก ซึ่งประกอบด้วย อุบัติเหตุทางการจราจร จมน้ำ ไฟไหม้น้ำร้อนลวก กระดูกหัก อุบัติเหตุที่ศีรษะ และการฟกช้ำ*

วัสดุและวิธีการ: *ผู้ป่วยจำนวน 300 คน ตอบคำถามโดยแพทย์ผู้รักษาช่วยแนะนำในแบบสอบถาม ศึกษาถึงชนิดการชัก ความถี่ของอุบัติเหตุที่เกิดขณะชักและนำเสนอความสัมพันธ์ระหว่างชนิดของการชักและกิจกรรมขณะที่เกิดอุบัติเหตุ*

ผลการศึกษา: *ผู้ป่วยชาย 154 คน ผู้ป่วยหญิง 146 คน อายุระหว่าง 13-19 ปี (ค่าเฉลี่ย 36.27 $\pm$ 14.55) การชักชนิด generalized tonic-clonic (GTC) พบร้อยละ 26 ชนิด secondary GTC ร้อยละ 21 และชนิด complex partial seizures ร้อยละ 19 พบการชักที่มีสาเหตุร้อยละ 34 โดยพบสาเหตุจากโรคหลอดเลือดสมองบ่อยที่สุด (ร้อยละ 25.5) จำนวนการชักต่อปี 8,525 ครั้ง และเป็นการชักแล้วล้มลงกับพื้น 7,306 ครั้ง อุบัติเหตุที่พบ ได้แก่ การฟกช้ำ ร้อยละ 70 อุบัติเหตุที่ศีรษะร้อยละ 22 จมน้ำร้อยละ 3 ไฟไหม้น้ำร้อนลวกร้อยละ 3 และกระดูกหักหรือข้อเลื่อนหลุดร้อยละ 1 ปัจจัยเสี่ยงของการเกิดอุบัติเหตุคือ การชักชนิด GTC การชักชนิดล้มลงกับพื้น และจำนวนครั้งของการชัก*

สรุป: *อุบัติเหตุที่สัมพันธ์กับการชักพบบ่อยในผู้ป่วยโรคลมชัก การป้องกันได้แก่ การรักษาที่ดีและให้ความรู้เกี่ยวกับปัจจัยเสี่ยงของการเกิดอุบัติเหตุ*