Seizure 27 (2015) 80–83

Contents lists available at ScienceDirect

Seizure

journal homepage: www.elsevier.com/locate/yseiz

Injuries from seizures are a serious, persistent problem in childhood onset epilepsy: A population-based study

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ARTICLE INFO

Article history:
Received 12 December 2014
Received in revised form 3 February 2015
Accepted 27 February 2015

Keywords:
Childhood
Epilepsy
Injury
Accidents
Population-based

ABSTRACT

Purpose: Document the frequency, types and risk factors for injuries caused by seizures for people with childhood onset epilepsy.
Method: We contacted patients with all types of epilepsy except childhood absence from the Nova Scotia Childhood Epilepsy population-based cohort. Seizure onset was between 1977 and 1985. Patients and parents were asked about serious injuries resulting from a seizure, defined as severe enough for an urgent physician or dentist visit.
Results: Of 595 eligible patients, we contacted 472 (79%). During an average follow up of 23.9 ± 8 years, 52 (11%) experienced ≥1 serious injury for a total of 81 injuries. Of all injuries, 24 (30%) were lacerations requiring sutures, 15 (19%) fractures, 11 (14%) broken teeth, 8 (10%) concussions, 4 (5%) burns, and 20 (25%) other. "Other" included 1 fatal drowning, 2 near-drownings, 3 shoulder dislocations and 1 severe eye injury. Four injuries occurred with the first seizure; all others after a long gap from seizure onset (range 1.5–30 years). Injuries occurred in all epilepsy syndromes, most commonly with symptomatic generalized epilepsy (17% vs. 11% $p = 0.03$) and intractable epilepsy (28% vs. 8% $p < 0.0001$). Most injuries occurred during normal daily activities and were judged not to be easily preventable.
Conclusions: During ~24 years of follow up 1 out of 10 patients with childhood onset epilepsy had a serious injury as the result of a seizure. Most injuries occurred years after the initial diagnosis and were more common when seizures were more frequent. The only practical solution to injury prevention is better seizure control.

1. Introduction

Children with epilepsy may be injured during seizures. Any seizure that alters consciousness or leads to loss of motor control may lead to a variety of accidental injuries including falls, drowning, driving accidents or being struck by a vehicle, crashes with others or equipment during sporting events. Additional injuries from seizures may be the result of the seizure itself such as shoulder dislocation from severe muscle contraction during a generalized tonic-clonic seizure or tongue biting from tonic masseter contraction [1]. Children with epilepsy may have other neurological or behavioral problems that might increase the risk of an accident such as ataxia or ADHD (attention deficit and hyperactivity disorder). Physicians, parents and patients may be very concerned about the risk of seizure related accidents and limit activities in an effort to prevent them [2].

In this study we have attempted to document how often seizures result in injuries during many years of follow up of a population-based cohort of children with new onset epilepsy. We have focused exclusively on injuries which occurred as the direct result of a seizure.

2. Methods

Patients were selected from the Nova Scotia population-based childhood epilepsy cohort. The cohort includes only incident (newly diagnosed) cases. The methods for the case finding of this cohort have been published previously [3,4]. Patients included all those in the Province of Nova Scotia between 1 month and 16 years of age who developed epilepsy (≥2 unprovoked seizures) between 1977 and 1985. Excluded were patients with progressive brain disorders such as a malignant brain tumor, neurodegenerative disease or metabolic disease. The entire cohort includes 692 patients

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http://dx.doi.org/10.1016/j.seizure.2015.02.031
1059-1311/

with the complete array of epileptic disorders; however, for the current study those with epilepsy primarily characterized by absence seizures were excluded, because we have already published details about their seizure-related injuries [5].

The authors personally contacted parents and patients for a semi-structured telephone interview several times over their clinical course with a final interview for most patients at 20–30 years after the initial diagnosis of epilepsy. The interview lasted about 45 min and consisted of a series of questions including several about accidents that occurred during a seizure. Data from the last available interview are reported in this paper. We included only those accidents that were sufficiently concerning that they lead to an emergency room visit or a visit with a family physician or a dentist. We accepted the parent or patient's impression that the accidents occurred during an actual seizure.

To show the time between onset of epilepsy and time of injury, follow up was divided into intervals of 0–5 years, >5–10, >10–15, >15–20, >20. The number of patients with active epilepsy (i.e. those not beginning a terminal remission) was estimated for each interval.

Statistical analysis used SPSS version 15. Comparisons are Chi-squared and *t*-tests. "Multivariate analysis was not performed, given that correlates of injuries would be expected to be only variables related to seizure frequency/control."

This study was approved by the IWK Health Center Research Ethics Board.

3. Results

3.1. Sample description (Table 1)

Of 595 eligible patients, 472 (79%) answered questions about injury resulting from a seizure. Information came from parents + patient in 55%, patient alone in 18.3% and parents alone in 26.8%. No patient or parent refused participation. Ninety percent of patients were followed for ≥10 years. Follow up was <10 years in 10%, 10–20 years in 13%, 20–30 years in 58% and >30 years in 19%. The average age at seizure onset was 6.1 ± 4.6 years and at final follow up was 30 ± 9.7 years. Duration of follow up averaged 23.9 ± 8 years. Intellectual disability was present in 124 (26%) and 87 (18%) had a severe neurological deficit that interfered with activities of daily living.

Epilepsy syndromes were: focal 274 (58%), rolandic 39 (8%), juvenile myoclonic 26 (5.5%), generalized tonic-clonic only 40 (8.4%), symptomatic generalized epilepsies 65 (13.8%) and other 28 (5.9%). We used the 1989 ILAE Classification [6] rather than the 2010 ILAE suggestion of organization [7] in order to group patients, as fewer than 50% of patients with epilepsy have a syndrome accepted by the 2010 schema [8].

There were 125 (26.5%) individuals who experienced ≥1 seizure in the last year of follow up. Over the course of follow up, 62% had remission of their seizures (seizure-free and no longer receiving AED treatment) with an average terminal remission from seizures of 19.5 ± 9 years.

Table 1
Description of sample *n* = 472.

	Injury with seizure	No injury with seizure	*P*
Sex			
Female	27 (12.3%)	192	NS
Male	25 (11%)	228	
Epilepsy syndrome			SGE vs. all others
Focal[a]	29 (10.6%)	245	*P* = 0.03
Rolandic	2 (5.4%)	37	
JME[a]	6 (23%)	20	JME vs GTC only
GTC only[a]	3 (7.5%)	37	*P* = 0.07
SGE[a]	11 (16.9%)	54	
Other and unclassified	1 (3.6%)	25	
Intellectual disability	21(16.9%)	103	0.02
Normal intelligence	31(8.9%)	316	
No terminal remission	38 (21.3%)	140	0.0000001
Terminal remission	14 (4.8%)	280	
Intractable	23 (27.7%)	63	0.0000003
Not intractable	29 (7.6%)	355	

JME, juvenile myoclonic epilepsy; GTC only, epilepsy with generalized tonic clonic seizures only; SGE, symptomatic generalized epilepsy.

[a] Well defined self-limited epilepsy syndromes of childhood with focal features were considered separately.

4. Injuries

Overall, 52 (11%) patients had ≥1 injury as the result of a seizure; 34 had 1 injury, 7 had 2 injuries and 11 had ≥3. The total number of injuries was 81. The types of injury are outlined in Table 2. About 70% of the injuries consisted of lacerations requiring sutures, bone fractures, broken teeth or concussion. There was one fatality – a 35-year-old woman with Juvenile Myoclonic Epilepsy (JME) who drowned during a seizure in a supervised swimming pool. None of the accidents were the result of falls from bicycles and none occurred during sporting activities. In our judgment, all of the accidents occurred during normal daily activities and none was easily preventable. Others have noted that helmet use is not particularly effective in preventing facial or dental injuries, although we did not document the frequency of their use [9].

Not surprisingly, patients with more frequent seizures were more likely to sustain an injury. Those with persistent epilepsy (no remission) were significantly more likely to be injured than those with remission (21.3% vs. 4.8%, $p < 0.0001$) (Table 1). Likewise, people with intractable epilepsy had significantly more injuries than those without intractable seizures (27.7% vs. 7.6%, $p < 0.0001$) (Table 2). Children with "symptomatic generalized epilepsy" had more injuries than those with all other syndromes (16.9% vs. 11.3%, $p = 0.03$). Children with intellectual disability were more likely to be injured (Table 1), but this is likely the result of the strong association of intellectual disability with symptomatic generalized epilepsy and intractability [10].

For 47 of the 52 patients with injury, the age at the first injury was well documented. Injuries occurred throughout the clinical course (Fig. 1) and only ~5% of injuries occurred with the first seizure. Of first injuries, 70% occurred more than 5 years after the onset of epilepsy.

5. Discussion

The main findings of our study are that significant injuries occur as the result of seizures throughout the clinical course and, not surprisingly, are more likely to occur in those with more frequent

Table 2
Types of injuries *N* = 81.

24 (30%)	Lacerations requiring sutures
15 (19%)	Bone fractures
11 (14%)	Broken teeth
8 (10%)	Concussions
4 (5%)	Burns
3 (4%)	Shoulder dislocations
16 (20%)	Other including 1 fatal drowning, 2 near drownings, 1 severe eye injury with permanent loss of vision, 1 cervical disk herniation