Seizure-related injury in an adult tertiary epilepsy clinic

Objective. To assess the frequency, characteristics, and risk of injury during seizure attacks.

Design. Questionnaire survey.

Setting. Epilepsy out-patient clinic of the National Hospital for Neurology and Neurosurgery, Institute of Neurology, London.

Patients. One hundred consecutive epileptic patients and their caretakers or relatives, who attended the hospital between 1 May and 30 June 2000.

Main outcome measures. Details of epilepsy including the age of onset, causes, types, and number of seizures during the previous 12 months; injuries incurred as a result of seizures; and treatment required.

Results. The mean age of the 100 patients (38 male, 62 female) was 39 years (range, 16-78 years). Generalised tonic-clonic seizures occurred in 51% of patients and complex partial seizures in 40%. Hippocampal sclerosis was found in 12% of patients. Twenty-seven patients reported 222 seizure-related injuries. The total number of seizures per year was 4459 (mean, 45), of which 1094 (mean, 11) were with a fall (24.5%). Soft-tissue injury was the most common (61%), followed by burns (17%), head injury (14%), orthopaedic injury (5%), and injuries in water (3%). The most common site of soft-tissue injury and burns were to the face: 49% and 38% respectively. Burns occurred during cooking in 78% of cases. Two patients had skull fractures. Orthopaedic injuries usually occurred at home (73%). In cases of seizures in water, five of six occurred while swimming. Injury occurred once in every 20 seizures, every 11 generalised tonic-clonic seizures, and every five seizures with a fall. The significant risk factors for injury were generalised tonic-clonic seizures, high frequency of seizures, and seizures with a fall.

Conclusion. Soft-tissue injury was the most common seizure-related injury. Injury occurred once in every 20 seizures. The risk factors were generalised tonic-clonic seizures, high frequency of seizures, and seizures with a fall.

Key words: Soft tissue injuries, Seizures; Risk factors;
Introduction

Patients with epilepsy are generally encouraged to lead as normal a life as possible. Nonetheless, in doing so, some are at risk of injury to themselves and others during the peri-ictal period.\(^1\,^2\) Commonly recorded seizure-related incidents include traffic accidents, drowning, near drowning, burns, fractures, head injury, dental injury, and soft-tissue injury. The incidence and nature of seizure-related injuries differ from those that occur in the general population, and the associated risk is an important factor in guiding management decisions.\(^3\) The risk of injury in epilepsy has received less attention than the risk of death; there being relatively meagre data to aid decision-making. The aim of this study was to assess the frequency, nature, circumstances, and consequences of seizure-related injuries in patients attending a tertiary epilepsy clinic.

Methods

Between 1 May and 30 June 2000, a questionnaire on seizure-related injuries was administered to 100 consecutive epileptic patients and their caretakers or relatives. The patients attended the epilepsy out-patient clinic at the National Hospital for Neurology and Neurosurgery, Institute of Neurology, London. The clinic catered for tertiary referral patients, many of whom had severe epilepsy. Of the patients recruited, 24 were seizure-free, 31 reported seizure episodes 1 to 9 times per year, 15 reported 10 to 20 per year, and 30 experienced more than 20 annually. They were not representative of a general population of epileptic patients but did constitute an important subgroup.

Following informed consent, the questionnaire was administered face-to-face in a standardised fashion, by one of the authors. The questionnaire had been validated in a pilot phase involving 20 other patients. The total number of recorded seizures in the 12-month period was 4459. Of these, 1094 (25%) involved a fall. Fifty-one patients experiencing GTC seizures had 1965 seizures (AS), and seizures with a fall (FS) were 35 (0-1000), 45 (0-1100), and 11 (0-600), respectively. Generalised tonic-clonic (GTC) seizures occurred in 51, complex partial seizures in 40, secondary GTC seizures in 24, simple sensory seizures in 3, and myoclonic seizures in 3. Twenty had no seizures, two reported atypical absences. None had severe neurological deficit or mental abnormality.

Epilepsy was categorised as symptomatic (ie secondary) in 39 patients, cryptogenic/idiopathic in 56, and of uncertain origin in 5. The most common identified causes in the symptomatic category were: hippocampal sclerosis (12), stroke (5), central nervous system infection (4), post-traumatic events (3), related to brain tumours (3), and other conditions (14). The latter included arteriovenous malformation, brain atrophy, cortical dysplasia, haematoma, severe brain damage, tuberous sclerosis, and scarring of the temporal lobe.

In all, 94 patients were taking antiepileptic drugs when interviewed (28 received one, 38 two, 18 three, 6 four, 1 five, and 3 more than five). In addition to antiepileptic drugs, five of the patients had had neurosurgery; two of the latter discontinued drug therapy post-surgery. Four others in whom pharmacotherapy was ‘ineffective’ had ceased taking their medication.

In all, 222 seizure-related injuries were reported by 27 patients. The mean (range) of annual self-reported frequency of daytime seizures (DS), night-time seizures (NS), all seizures (AS), and seizures with a fall (FS) were 35 (0-1000), 9 (0-250), 45 (0-1100), and 11 (0-600), respectively. The types of injury were summarised in Table 1.

The total number of recorded seizures in the 12-month period was 4459. Of these, 1094 (25%) involved a fall. Fifty-one patients experiencing GTC seizures had 1965 seizures of which 953 (48%) were associated with a fall. Patients with GTC seizures reported 188 injury events; 121 involved soft tissues, 25 the head, and 25 burns, 11 events of an orthopaedic nature, and 6 entailed water. The mean number of seizures per injury event was approximately 20
and Shorvon

(4459/222) and 21.3% of these involved GTC with a fall. Patients with GTC seizures were at greater risk of injury. The average number of seizures per injury was 10.5 (9.6%). For every seizure, GTC seizure, and FS, the frequency of a skull fracture was one for every 2229.5 (0.04%), 982.5 (0.1%), and 476.5 (0.2%) seizures, respectively. By comparison, one orthopaedic injury occurred for every 178.6 (0.6%) GTC seizures and 86.6 (1.2%) GTC seizures with a fall (Table 2). Approximately 63% of injuries occurred at home, and 12% occurred while at work, although only 32% of the patients were employed when the seizure occurred.

The soft-tissue injuries involved the face (49%), arms (44%), legs (43%), chin (4%), head (2%), back (2%), hands (2%), lips (2%), buttocks (1%), and eyes (1%). Nearly all (96%) lesions healed within a week with only topical treatment. Suturing was undertaken for 12 events and one patient was hospitalised. At the time of the seizure, these patients were: travelling, sleeping, working, or at home walking or doing housework. However, for 91 of the soft-tissue injury events the activity could not be recalled.

Four patients reported 37 episodes of burns that involved the face (38%), hands (35%), arms (19%), and legs (8%). Burns occurred while cooking (78%), ironing (16%), drinking a hot beverage (3%), and from other causes (3%). One patient had skin grafting, and the remainder, were treated with topical ointments. In 60% healing occurred within a week.

Thirteen patients reported 32 episodes of head injury that included head laceration (the commonest injury), concussion, and rarely skull fracture (6%). Management comprised medication (44%), suturing (28%), observation, and one patient was hospitalised; 62% received medical attention. The activities undertaken at the time of the index seizure were: playing sports (30%), sleeping (30%), working (20%), walking at home (15%), and travelling. In 12 episodes, the circumstances could not be recalled. Generalised tonic-clonic seizures, DS, and FS were the significant risk factors.

In three patients, there were 11 self-reported orthopaedic injuries. One patient experienced 10 episodes resulting in fractures and shoulder dislocation. The fractures entailed: bones of the arm (2), hand (2), leg (1) and shoulder (1), as well as the ribs (1) and nose (1). Most of these injuries occurred at home; 10 were treated by application of a plaster cast and one by surgery.

One patient reported five seizure-related injuries while swimming and one while bathing; for five of these no treatment was given, while 24-hour observation was deemed necessary for one. This type of injury occurred once in every 743 (0.1%), 328 (0.3%), and 182 (0.5%) seizures of all types, GTC seizures, and seizures with falls (while showering), respectively (Table 2).

Patients who sustained a seizure-related injury were more likely to have GTC seizures or seizures that occurred

<table>
<thead>
<tr>
<th>Seizure category</th>
<th>No. of seizures</th>
<th>Type of injury event</th>
<th>No. of injury events</th>
<th>Mean seizure No. per event</th>
<th>% Risk of injury event</th>
</tr>
</thead>
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<tr>
<td>All</td>
<td>4459</td>
<td>All</td>
<td>222</td>
<td>20.1</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skull fracture</td>
<td>2</td>
<td>2229.5</td>
<td>0.0</td>
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<td></td>
<td>Head injury</td>
<td>32</td>
<td>139.3</td>
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<td></td>
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<td>11</td>
<td>405.4</td>
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<td></td>
<td></td>
<td>Soft tissue</td>
<td>136</td>
<td>32.8</td>
<td>3.1</td>
</tr>
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<td></td>
<td></td>
<td>Burn</td>
<td>37</td>
<td>120.5</td>
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<tr>
<td></td>
<td></td>
<td>Involving water</td>
<td>6</td>
<td>743.2</td>
<td>0.1</td>
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<tr>
<td>Generalised tonic-clonic seizure</td>
<td>1965</td>
<td>All</td>
<td>188</td>
<td>10.5</td>
<td>9.6</td>
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<td>982.5</td>
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<td></td>
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<td>25</td>
<td>78.6</td>
<td>1.3</td>
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<td>178.6</td>
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<td></td>
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<td>121</td>
<td>16.2</td>
<td>6.2</td>
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<tr>
<td></td>
<td></td>
<td>Burn</td>
<td>25</td>
<td>78.6</td>
<td>1.3</td>
</tr>
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<td>Involving water</td>
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<td>327.5</td>
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<tr>
<td>Generalised tonic-clonic seizure with a fall</td>
<td>953</td>
<td>All</td>
<td>188</td>
<td>5.1</td>
<td>19.7</td>
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<td>Head injury</td>
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<td>Soft tissue</td>
<td>121</td>
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<td>Burn</td>
<td>25</td>
<td>38.1</td>
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<td>Seizure with a fall</td>
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<td>All</td>
<td>222</td>
<td>4.9</td>
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<td>Head injury</td>
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<td>Soft tissue</td>
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<td>5.0</td>
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<td></td>
<td>Burn</td>
<td>37</td>
<td>29.6</td>
<td>3.4</td>
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<tr>
<td></td>
<td></td>
<td>Involving water</td>
<td>6</td>
<td>182.3</td>
<td>0.5</td>
</tr>
</tbody>
</table>

* Equivalent to No. needed to harm
Seizure-related injury
during the day. There were no differences between the
groups in terms of sex, age, age of onset, duration of disease,
staying alone, working, partial seizure type, seizures
without aura, neurological deficit, complex partial seizures,
absence seizures, secondary GTC seizures, and taking more
than two types of medication (data not shown in this report).

Discussion
In this study, the mean annual frequency of AS was 45, and
for FS it was 11. Half of the patients had GTC seizures,
and 48% of these were associated with a fall. As in other
studies, epilepsy duration, sex, and age were not significa-
tive risk factors, whereas the presence of GTC was a good
 predictor of injury, followed by DS, NS, AS, and FS.
However, a secondary GTC seizure was less likely to be
associated with injury, perhaps because of the warning
afforded by its focal onset.

Seizures with a fall had a 20% chance of injury. Com-
pared to our patients (Table 2), previous studies have reported
seizure-related injuries occur in 30 to 35% of patients per
year; most injuries (about 80%) were minor and healed with
minimal or no intervention. In our series too, most of the
injuries involved soft tissues of the face, arms, and legs.

Kinton and Duncan reported that hot water and rarely
cooking were the cause of most burns, which was unlike
our experience. This difference may have arisen because
the former patients were living in an epilepsy centre and
not exposed to the same risk of burns as in the community.
Spitz et al reported a linear relationship between the number
of seizures and associated burns; cooking on a stove was
the most influential factor and females were affected
more often than males in a ratio of 3:1. Contrary to other
studies, we did not find gender to be a significant risk
factor, which may be related to our small sample size.

Head injury accounted for 14% of all injury events; 45%
occurring at home. Playing sports and sleeping were the most
common pre-injury ‘activities’. Russell-Jones and Shorvon reported the occurrence of head injury once in every 37 (3%)
seizures and once in every 17 (6%) FS. Suturing was
required for one in every 82 seizures compared with one in
every 37 seizures with falls. The risk of injury in their
series may have been greater, because patients in their
series represented a high-risk group than our patients.

Having seizure with a fall was an important risk factor
for fractures (Table 2); about 1% were associated with
fractures compared to about 0.25% following all seizures.
Fractures to the humerus, acetabulum, and femur have also
been reported following seizures without falls. During
seizures, shoulder joint adduction, internal rotation and
flexion combined with contractions of the shoulder girdle
muscle forces the humeral head against the acromion and
glenoid fossa and causes posterior fracture dislocation. We
encountered only one such case.

In our series, seizure-related injury in water was the least
common; though one patient had six such injuries.

Guidelines for the prevention of seizure-related injury
advocate aggressive treatment of the epilepsy, minimising
drug-related ataxia, never swimming alone, and exercising
regularly to maintain bone mass. For high-risk patients:
avoiding unsupervised bathing, minimising risk of burns,
wearing a helmet, and avoiding high places is recommended.
Other preventative strategies include: minimising the use
of electric irons and hand-held hair dryers, using micro-
wave ovens rather than stovetop cookers, and installing
thermostats to control the water temperature in showers.
In addition, we would advise epileptic patients to avoid
unsupervised sports and to sleep on a thin mattress placed
directly on the floor and far from any heater.

Conclusion
Patients with epilepsy can lead normal lives but certain
precautions are needed to prevent seizure-related injury.
Soft-tissue injury was the most common, followed by burns,
head injury, orthopaedic injury, and events related to
seizures in water. Significant risk factors for injury were:
GTC seizures, frequent seizures, and FS. More than half
of all injuries occurred at home. The cost of excessive
dependency must be balanced against the benefits of
preventing injury.

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