



Accidents at work among people with epilepsy Results of a European prospective cohort study

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Summary Studies on accidents at work in people with epilepsy are scarce and the evidence that epilepsy carries an increased risk of accidents at work is mostly anecdotal. The present survey is a multicentre prospective cohort study of everyday life risks recently conducted in eight European countries (Estonia, Germany, Italy, the Netherlands, Portugal, Russia, Slovenia and United Kingdom) comparing referral children and adults with epilepsy to age- and sex-matched non-epileptic controls. In this context, every accident occurring during work over a 1–3 year follow-up was prospectively reported by patients and controls.

Six hundred and thirty-one adult patients with epilepsy and 592 controls from this cohort have been studied here. Each patient and his/her control received a diary to record any accident or illness, with severity, circumstances, causes, consequences (including days off-work) and (for the cases) the possible relation to a seizure. A slightly higher number of unskilled workers were present among patients with epilepsy than in controls.

Twenty-two patients with epilepsy and nine controls reported accidents during work ($p < 0.05$). Only two cases reported seizure-related accidents. In both groups the injuries were mild (only one requiring hospitalization) and caused abstention from work to the same extent. In patients with epilepsy, the risk of accidents was unaffected by seizure type and frequency. This study confirms that patients with epilepsy are at higher risk of accidents compared to the general population. However, injuries provoked by work accidents are generally mild and unrelated to seizures.

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¹ See Appendix A.

Introduction

Accidents and injuries are slightly more frequent in people with epilepsy than in the general population.^{1,2} This increased risk is probably predominant in patients with symptomatic epilepsy and frequent seizures and when seizures are associated with underlying handicaps. Epilepsy does not seem to carry a higher risk of accidents at work when people with intractable seizures or with associated neurological and psychiatric handicaps are excluded.³ However, the available reports provide conflicting evidence, which is mostly explained by the study sample (population-based versus referral), the definition of the disease (idiopathic, cryptogenic or symptomatic epilepsy), the accuracy of injury reports (types, circumstances and severity), the study design (retrospective versus prospective) and the length of the observation period.

For these reasons, the aim of this study was to investigate the incidence and characteristics of accidents at work in a cohort of patients with epilepsy and in matched non-epileptic controls. This was an international study in which accidents at work were investigated as part of a multicentre prospective screening of illnesses and accidents in several European countries.

Material and methods

These data refer to a multicentre prospective study aiming to assess the number and the type of illnesses and accidents occurring over a 1–3 year period in a cohort of children and adults with epilepsy and in an age- and sex-matched non-epileptic population.⁴ The aims of the original study were to assess the risk of illnesses and accidents in patients with epilepsy and to evaluate the proportion of those risks attributable

Table 1 General characteristics of the overall European cohort (631 patients, 592 controls)

	Patients with epilepsy		Controls	
	Number	(%)	Number	(%)
Sex				
M	327	51.8	292	49.3
F	304	48.2	300	50.7
Age (year)				
18–24	250	39.6	222	37.5
25–34	174	27.6	175	29.6
≥35	207	32.8	195	32.9
Education				
Basic	296	45.3	263	44.4
High school	254	40.3	224	37.8
University	65	10.3	91	15.4
Special school	18	2.9	11	1.9
None/Not specified	8	1.3	3	0.5
Marital status				
Single	348	55.2	302	51.0
Married	258	40.9	267	45.1
Divorced	15	2.4	18	3
Widowed	10	1.6	4	0.7
Not specified	0	0	1	0.2
Driving licence	296	46.9	393	66.4
Sports	180	28.5	224	37.8
Associated disabilities	78	12.4	15	2.5
Occupation				
Unemployed	84	13.3	57	9.6
Student	92	14.6	121	20.4
Housewife	58	9.2	47	7.9
Trainee	17	2.7	3	0.5
Pensioner	55	8.7	25	4.2
Unskilled worker	148	23.5	126	21.3
Skilled worker	172	27.3	195	32.9
Other	5	0.8	18	3

to epilepsy. The investigation was performed in eight European countries (Estonia, Germany, Italy, the Netherlands, Portugal, Russia, United Kingdom and Slovenia). The participating centres included university and general hospitals with adequate experience, technology and qualifications for the management of children and adults with epilepsy. Details of the study methods and design are given elsewhere⁴ and summarized here. For the purposes of the present study, only patients aged 18 years and older, mostly diagnosed in the recruiting centres in the previous 5 years, were included. Controls were matched for age (± 5 years), sex and social class (friends, relatives, work- or school-mates). The aim was to include subjects who were similar, except for epilepsy and who were a fairly representative sample of the general population.

To prevent inclusion of acute or progressing epileptogenic conditions, which might be indirect causes of illnesses or accidents, only patients with idiopathic or remote symptomatic epilepsy⁵ were enrolled. At entry, patients and controls were interviewed for the collection of the main demographic (education, occupation, marital status, driving and sports involvement) and clinical (associated disorder or disability) variables. Patients and controls were given daily diaries for recording details about any medical event occurring during the study period, including accidents. An accident at work was considered any event occurring at work and secondary to a sudden unexpected cause, which was not a disease, leading to physical damage requiring medical attention or resulting in financial obligation. For any accident, severity, circumstances, causes, possible relation to a seizure, consequences, medical interventions and actions taken were reported.

Employment was assessed by type and coded with reference to simplified categories (white-collar workers, blue-collar workers, trainees and unspecified workers). Patients and controls were invited to monthly telephone contacts and quarterly visits by the local investigators, to check compliance and improve the quality and completeness of the recordings.

Results

The sample comprised 631 patients and 592 controls (Germany, 79 and 64; the Netherlands, 97 and 84; United Kingdom, 15 and 14; Italy, 220 and 220; Portugal, 80 and 77; Russia, 136 and 126; Estonia, 1 and 5; Slovenia, 3 and 2). The general characteristics of the sample are depicted in Table 1.

At the time of enrolment, 342 cases (54.2%) and 342 controls (57.8%) were employed. The rate of

employment was similar in all countries. More specifically, 172 patients (50.3%) and 195 controls (57.0%) were middle/higher level white-collar, and 148 patients (43.3%) and 126 controls (36.8%) were blue-collar/lower level. The ratio between middle/higher level and lower level employment was similar across countries, except for the Netherlands, where middle/higher level employers were less frequent among the cases (51.0% versus 68.2%).

Partial epilepsies were more common than generalized epilepsies (58.2 versus 32.0%). Eighty-two percent of patients had seizures in the previous 2 years. In most cases (91%) seizure frequency was less than one per month. Epilepsy lasted 3 or more years in 75.2% of cases. Seizures occurred mostly during the day and both at day and night-time in fewer

Table 2 Disease characteristics in patients with epilepsy ($n = 631$)

	Number	(%)
Epileptic syndrome		
Partial		58.2
Idiopathic	32	5.4
Symptomatic	124	20.9
Cryptogenic	145	24.5
Undetermined	44	7.4
Generalized		32.0
Idiopathic	142	23.9
Symptomatic	12	2.0
Cryptogenic	4	0.7
Undetermined	32	5.4
Undetermined	44	7.4
Special	10	1.7
Unclassifiable	4	0.7
Not specified	38	
Disease duration (year)		
≤ 1	84	13.4
1–2	72	11.5
3–5	217	34.6
> 5	255	40.6
Not specified	3	
Seizure in the last 2 years	512	81.5
Seizure frequency		
None	111	17.6
< 1 per 6 month	191	30.3
< 1 per month	154	24.4
< 1 per week	109	17.3
< 1 per day	48	7.6
Daily	18	2.9
Timing		
Day	402	65.6
Night	82	13.4
Both	129	21.0
Not specified	18	

Table 3a Characteristics of accidents at work in patients with epilepsy

N	Sex	Age	Occupation	Accident circumstances	Type of injury	Medical attention	Hospital admission	Off-work	Seizure-related
1	M	21	Joiner	Hand hit with hammer	Contusion	+	—	+ (10)	—
				Glass splinter in the eye	Abrasion	+	—	—	—
2	M	54	Electrician	Falling at working place	Knee haematoma	+	—	+ (8)	—
3	M	18	Trainee farmer	Hand hit by shelves	Contusion	+	—	+ (7)	—
4	M	28	Skilled worker	Misplaced foot	Contusion	+	—	+ (2)	—
5	M	41	Disability pensioner	Using a knife	Wound	—	—	—	—
6	M	33	Incinerator checker	Closing a door	Wound	+	—	+ (5)	—
7	M	44	Window cleaner	Lifting heavy object	Groin strain	+	—	+ (4)	—
8	M	24	Unskilled worker	Finger cut	Wound	+	—	+ (7)	—
9	M	19	Joiner	Wounded eyebrow	Wound	+	—	+ (5)	—
10	M	18	Blacksmith	Glass splinter in the eye	Abrasion	+	—	—	—
11	F	19	Welder	Incandescent spark on skin	Burn	—	—	—	—
				Incandescent spark on skin	Burn	—	—	—	—
				Incandescent spark on skin	Burn	—	—	—	—
				Incandescent spark on skin	Burn	—	—	—	—
				Incandescent spark on skin	Burn	—	—	—	—
				Incandescent spark on skin	Burn	—	—	—	—
12	F	24	Sanitarian	Handling materials	Wound	—	—	—	—
13	M	22	Electrician	Sudden movement	Muscle strain	+	—	—	—
14	M	44	Mechanic	Finger cut	Wound	+	+ (0)	+ (10)	—
15	M	22	Unskilled worker	Using metallic blade	Wound	+	—	+ (5)	—
				Using metallic blade	Wound	—	—	—	—
16	M	25	Waiter	Cleaning a table	Abrasion	—	—	—	—
17	M	49	Gardener	Falling from stairs	Wound	+	—	—	+
				Falling from stairs	Wound	+	—	—	+
18	M	32	Officially unemployed	Object dropped on foot	Contusion	+	—	+ (2)	—
19	F	19	Clerk	Hand hurt at the workplace	Contusion	—	—	—	—
20	M	22	Joiner	Cheek hurt	Contusion	—	—	—	—
21	M	44	Yard keeper	Falling on ground	Head trauma	+	—	+ (10)	+
				Falling on ground	Head trauma	—	—	—	+
22	M	21	Mechanic	Forehead stroke	Wound	+	—	—	—

Number of days in parenthesis.

Table 3b Characteristics of accidents at work in controls

N	Sex	Age	Occupation	Accident circumstances	Type of injury	Medical attention	Hospital admission	Off-work
1	F	22	Barman	Scalded by coffee machine	Burn	–	–	
2	M	32	Blacksmith	Handling defective materials	Wound	+	–	–
3	M	31	Painter	Lifted heavy objects	Strained back	+	–	+ (5)
4	M	54	Unskilled worker	Hit leg on pedal	Thrombophlebitis	+	–	+ (30)
				Dust in eyes	Conjunctivitis	+	–	+ (11)
				Split in eyes	Conjunctivitis	+	–	+ (11)
5	M	29	Confectioner	Frying food	Burn	–	–	–
				Preparing cakes	Wound	+	–	–
6	M	29	Unskilled worker	Falling	Serious wound	+	–	+ (1)
7	M	28	Electrician	Moving staircase	Pain in foot (Contusion)	+	–	+ (7)
8	M	26	Water supplies worker	Carelessness	Contusion in eyebrow	+	–	+ (1)
9	M	30	Welder	Finger squashed	Contusion	+	–	+ (8)

cases. The main disease characteristics in patients with epilepsy are illustrated in Table 2.

Thirty work accidents (8.8%) were referred by 22 cases (6.4%) compared to 12 accidents (3.5%) referred by nine controls (2.6%) ($\chi^2 = 4.8$, $p < 0.05$). One patient had six accidents, four patients had two accidents, and two controls had three and two accidents, respectively.

The type of injury and the circumstances and consequences of each accident are reported in Tables 3a and 3b Table 3 for patients and controls separately. The sequelae of most accidents were mild. In one case, only hospitalization was required for a finger cut. Days off-work after the accident were reported by 12 cases and eight controls. The total number of days off-work was 75 for the cases

Table 4 Clinical characteristics of disease in patients with epilepsy reporting accidents at work

N	Epileptic syndrome	Seizure frequency	Tonic–clonic seizures	N drugs	Adverse drug reactions
1	Generalized idiopathic	<1/Month	+	1	–
2	Generalized idiopathic	None	–	1	–
3	Partial cryptogenic	<1/Month	+	1	–
4	Partial idiopathic	<1/6 months	–	1	+
5	Partial symptomatic	None	–	1	+
6	Partial symptomatic	<1/6 months	–	2+	–
7	Partial (unspecified)	<1/6 months	–	1	–
8	Generalized (unspecified)	None	–	1	–
9	Generalized idiopathic	<1/6 months	–	1	–
10	Partial cryptogenic	<1/6 months	+	1	–
11	Juvenile myoclonic	<1/6 months	–	1	+
12	Myoclonic	<1/6 months	–	1	+
13	Partial cryptogenic	<1/6 months	–	1	+
14	Partial (unspecified)	<1/6 months	–	1	–
15	Partial cryptogenic	<1/Month	+	1	–
16	Partial (unspecified)	<1/Month	+	1	–
17	Partial cryptogenic	<1/Week	–	2+	–
18	Partial symptomatic	<1/Day	+	2+	–
19	Generalized idiopathic	None	–	1	–
20	Undetermined	<1/6 months	–	1	–
21	Undetermined	<1/Day	–	1	–
22	Generalized symptomatic	<1/Month	–	2+	–

(3.4 per patient) and 75 (8.3 per patient) for the controls.

The disease characteristics in patients with accidents at work are reported in Table 4. Partial epilepsies (12 cases) were the commonest syndromic patterns, followed by generalized epilepsies (8 cases) and undetermined epilepsies (3 cases). Tonic–clonic seizures were present in six cases. Most individuals had no or very rare seizures. Seizure-related accidents were four (13.3%) and were referred by two patients (9.1%). Eighteen patients (81.8%) were on monotherapy. Adverse drug reactions were recorded in five cases (22.7%).

Discussion

In our study, the rate of employment in people with epilepsy was fairly similar to that of the general population, in keeping with one report⁶ and at variance with others,^{7–10} which showed a lower level of occupation in people with epilepsy compared to people without epilepsy.

Good employability has been found to be related to the perception that epilepsy has little or no effects on job prospects, good experience with work colleagues and management, low seizures severity and good seizure control.¹¹ By contrast, underemployment in patients with epilepsy may be linked to a variety of factors, including frequency and severity of seizures, associated neurological and psychological problems, overall disease severity, psychosocial adjustment, attitudes towards absenteeism, and the risk of accidents.^{10,11} The apparent contrast between our and others' findings may be explained by the different population and study design. We enrolled only patients in whom epilepsy had been mostly diagnosed in the preceding 5 years and we did not include patients with progressive epileptogenic conditions. Thus, our sample tends to represent mostly firstly diagnosed idiopathic, cryptogenic or remote symptomatic epilepsy, which is inherently less severe than in other series.^{6,12}

The risk of accidents was about two times as high among people with epileptic seizures compared to the general population. However, injuries were mostly mild and, with few exceptions, unrelated to seizures. This finding supports the concept that patients with early idiopathic, cryptogenic or remote symptomatic epilepsy are not at risk of severe injuries at work. The difference in the reports between cases and controls may be also explained by an increased propensity of reporting even minor complaints in people with a chronic clinical condition. As most accidents might be

related to lack of attention, the possibility of drug-related impairment of vigilance should be also considered.

Our findings have important social implications because they speak against stigma and isolation in people with epilepsy. In fact, according to some reports, patients believe that they have been treated unfairly at work or when trying to get a job.^{6,10}

We were unable to find specific job categories or, in people with epilepsy, disease characteristics which could predict an increased risk of accidents. This may depend on the small sample size and the limited number of accidents (and injuries) reported by the study population. For this reason, our conclusions should be considered only speculative.

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Appendix A

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References

1. Tomson T, Beghi E, Sundqvist A, Johannessen SI. Medical risks in epilepsy: a review with focus on physical injuries, mortality, traffic accidents and their prevention. *Epilepsy Res* 2004;**60**:1–16.
2. Cornaggia CM, Gianetti S. Epilepsy, risks, and insurance: general considerations. In: Cornaggia CM, Beghi E, Hauser A, Loeber J, Sonnen AEH, Thorbekce R, editors. *Epilepsy and risks. A first-step evaluation*. Heemstede: IBE; 1994. p. 7–14.
3. Beghi E, Brown S, Capurro D, Chadwick D, Cornaggia C M., De Boer H, et al. Second Workshop on "Epilepsy, Risks, and Insurance". *Epilepsia* 2000;**41**:110–2.
4. Beghi E, Cornaggia CM. Epilepsy and everyday life risks. A case-referent study: rationale, study design, and preliminary results. Risk in epilepsy study group. *Neuroepidemiology* 1997;**16**:207–16.
5. Commission on Epidemiology and Prognosis, ILAE. Guidelines for epidemiologic studies on epilepsy. *Epilepsia* 1993;**34**:592–6.
6. Ratsepp M, Oun A, Haldre S, Kaasik AE. Felt stigma and impact of epilepsy on employment status among Estonian people: exploratory study. *Seizure* 2000;**9**:394–401.
7. Hart YM, Shorvon SD. The nature of epilepsy in the general population. I. Characteristics of patients receiving medication for epilepsy. *Epilepsy Res* 1995;**21**:43–9.
8. Van Hout B, Gagnon D, Souetre E, Ried S, Remy C, Baker G, et al. Relationship between seizure frequency and cost and quality of life of outpatients with partial epilepsy in France, Germany and the United Kingdom. *Epilepsia* 1997;**38**:1221–6.
9. Jacoby A, Buck D. Uptake and cost of care for epilepsy: findings from a U.K. regional study. *Epilepsia* 1998;**39**:776–86.
10. Lee SA. What we confront with employment of people with epilepsy in Korea. *Epilepsia* 2005;**46**(Suppl. 1):57–8.
11. Collings JA, Chappell B. Correlates of employment history and employability in a British epilepsy sample. *Seizure* 1994;**3**:255–62.
12. Moran NF, Poole K, Bell G, Solomon J, Kendall S, McCarthy M, et al. Epilepsy in the United Kingdom: seizure frequency and severity, anti-epileptic drug utilization and impact on life in 1652 people with epilepsy. *Seizure* 2004;**13**:425–33.