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ORIGINAL ARTICLE

Impact of seizure-related injuries on quality of life

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Abstract

Objective Our aim is to assess the types and frequency of seizure-related injuries and to determine their effects on Quality of Life (QoL).

Methods Fifty-seven patients with epilepsy were included to our study. The demographic and clinical data of all the participants were recorded. All patients completed the Quality of Life in Epilepsy Inventory 89 (QOLIE-89). Injury types were classified as burns, head trauma, dental traumas, fractures, body injuries, penetrating traumas, road injuries, and drowning.

Results Forty-two patients had seizure-related physical injury history whereas 15 of them declared no history of injury. Lower education levels and more frequent seizures were associated with higher seizure-related injury rates ($p < 0.05$). The most common types of seizure-related injuries were head trauma (22%) and fractures (17%). Fifty-seven (64%)of the injuries took place at home. There was no difference in QOLIE-89 scores between patients with or without seizure-related injury. Multiple injuries, admission to emergency, older than 20 years of the first seizure-related injury, and shorter than 10 years after last seizure-related injury are negatively effective on the QoL scores.

Conclusion Patients with epilepsy are likely to have seizure-related injuries which may be severe but do not affect the patients' QoL. Seizure-related injuries most commonly occur at home and therefore simple precautions (supervised bathing, using microwave ovens instead of classical stoves, avoiding electric irons and electric heaters, and sleeping close to the floor to avoid falling) taken to reduce the incidence of seizure-related injuries will help reduce hospitalizations and will also be cost-effective.

Keywords Seizure-related injury · Quality of life · Multiple injury · Dental trauma · Burns · Fractures

Introduction

Quality of life (QoL) is defined as an individual's perception of physical health, psychological state and level of independence, social relationships, and personal beliefs [1]. Epilepsy is a common chronic neurological disease that causes limitations in everyday life and poorer QoL more than other chronic diseases [2–4]. The duration and frequency of epileptic seizures, the side effects of antiepileptic medications, lack of social support, and limited daily activities contribute to the poor QoL in these patients [5–8]. A greater number of people with epilepsy who do not have seizures are employed and have a better QoL compared to those with active epilepsy [8–10].

Epileptic seizures may often lead to injuries [11]. Seizure-related injuries are injuries that occur during a seizure. These injuries can decrease the QoL in patients with epilepsy, may require hospitalization, and cause disability [12]. The types of seizure-related injuries have been classified in previous studies and include burns, head trauma, dental traumas, fractures, major body injuries, penetrating traumas, road injuries, and drowning [13–15].

Although there are many studies investigating the QoL in patients with epilepsy, the effect of seizure-related injury in patients' QoL has not been studied before.

In our study, we aimed to assess the types and frequency of seizure-related injuries and to determine their effects on QoL.

Method

Fifty-seven patients with epilepsy were consecutively enrolled to participate in our study. We recorded the demographic and

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clinical data (age, gender, education, family and employment status, epilepsy type, seizure types (focal onset and generalized onset), frequency of seizure, age of onset of epilepsy, and the antiepileptic medications used) for each patient with face to face interview. We also interviewed the patients about seizure-related injuries since the beginning of their seizures using an injury questionnaire (modified from Buck et al. 1997 [16]). According to the state of injury, the patients were grouped as follows: group I, patients with seizure-related injury and group II, patients without seizure-related injury. If an injury is defined, we recorded the number and type of the seizure-related injuries, the age of the patient at the time of the injury, and the length of time after the last injury. We also assessed the severity of the seizure-related injury, referring to injuries needing emergency clinic admission as "severe injury."

Injury types were classified into categories of burns, head trauma, dental traumas, fractures, body injuries, penetrating traumas, road injuries, and drowning. A patient could have one or more injuries at different body locations during a seizure or multiple injuries at different seizures. We defined "multiple injuries" as having more than one injury during different seizures. Seizure types were classified according to ILAE 2017 Revised Classification of Seizures [17].

Each patient completed the QoL in Epilepsy Inventory 89 (QOLIE-89; Turkish version) and past injury survey. The QOLIE-89 is a widely adopted epilepsy-specific instrument for assessment of QoL [2]. It comprises of 86 items divided into 17 subscale domains: health perception (six items), overall QoL (two items), physical function (ten items), role limitations—physical (five items), role limitations—emotional (five items), pain (two items), work/driving/social function (11 items), energy/fatigue (four items), emotional well-being (five items), attention/concentration (nine items), health discouragement (two items), seizure worry (five items), memory (six items), language (five items), medication effects (three items), social support (four items), social isolation (two items). Each domain is scored by calculating the mean score of answers in the domain. The raw scores are adjusted to the "0–100" scaling. Total and subscale scores are calculated according to the QOLIE-89 scoring manual.

Written informed consents were obtained from all participants. Local ethics committee approval was received for the study.

Statistical analysis

SPSS 21.0 statistical software was used for statistical analysis. Continuous variables are expressed as the mean ± SD; categorical variables are presented as frequencies and percentages. The chi-square test was used to compare the differences in categorical variables between group I and group II. To compare QOLIE-89 scores between epilepsy patients with and without injury, we used independent sample t test. A value of $p < 0.05$ was considered statistically significant.

Results

We assessed a total of 57 patients in our study and 42 (73.6%) of these patients had seizure-related physical injury history whereas 15 of them declared no history of injury. There was no significant difference between group I and group II in terms of mean age, gender, occupation, marital status, epilepsy type, seizure types, duration of disease, and the antiepileptic medications used ($p > 0.05$). The lower education levels and more frequent seizures were associated with higher seizure-related injury rates, in a statistically significant value ($p < 0.05$) (Table 1).

The most common types of seizure-related injuries were head trauma (22%) and fractures (17%) (Table 2).

When we assessed the features of seizure-related injuries, 42 patients had a total of 89 injuries and 57 (64%) of these injuries took place at home. Sixty-four of these seizure-related injuries resulted in admission to emergency departments

Table 1 Clinical variables and social outcome of the patients

Variables	Group I N, 42 (%)	Group II N, 15 (%)	p value
Gender			
Male	16 (38.1)	8 (53.3)	0.305
Female	26 (61.9)	7 (46.7)	
Age	39.5 ± 15.7	35.6 ± 14.9	0.402
Profession			
Employed	37 (88.1)	14 (93.3)	0.570
Unemployed	5 (11.9)	1 (6.7)	
Family status			
Single	23 (54.8)	7 (46.7)	0.590
Married	19 (45.2)	8 (53.3)	
Educational stage			
Primary education	36 (85.7)	9 (60)	0.036*
Higher education	6 (14.3)	6 (40)	
Follow-up time (years)	10.1 ± 7.7	9.1 ± 5.2	0.628
Duration of epilepsy (years)	20.4 ± 12.5	17 ± 12.6	0.371
Type of epilepsy			
Focal	32 (76.2)	9 (60)	0.231
Generalized	10 (23.8)	6 (40)	
Frequency of seizures			
Less than 1/month	18 (42.9)	2 (13.3)	0.040*
More than 1/month	24 (57.1)	13 (86.7)	
Antiepileptic drugs			
Monotherapy	25 (59.5)	12 (80)	0.154
Polytherapy	17 (40.5)	3 (20)	

Group I: patients with seizure-related injury, group II: patients without seizure-related injury

*$p < 0.05$

Table 2 The frequency of seizure-related injury types

Injury types	*n*, 89	%
Head trauma	20	22
Fractures	15	17
Major body injury	14	16
Dental trauma	13	15
Burns	12	14
Penetrating trauma	8	9
Drowning	4	4
Road injury	3	3

(71.9%), while 6 (6.8%) of these patients were admitted to the hospital, 19 (21.3%) of them were treated at home. All of the burn injuries took place at home: two of them happened by falling onto the stove and 10 while cooking. There were three road injuries in two of which the driver was the patient himself. Two of near-drownings took place while taking a bath and interfered at home. All the dental and penetrating traumas happened at home, particularly in the kitchen (Figs. 1 and 2).

When we compared the patients in group I and group II to assess the effects of injury on QoL, we found no significant difference between their QOLIE-89 scores and subscores ($p > 0.05$) (Table 3).

When we assessed the relationship between the features of seizure-related injuries and QoL results in patients with injury, there was no difference in overall QoL between those patients with or without injury. However, in the patient group with seizure-related injury, there was a relationship between their seizure-related injuries and their QoL; patients with a history of multiple injuries and a more recent injury (< 10 years since last seizure-related injury) had a negative correlation with QoL scores. We also observed that the energy fatigue score in multiple seizure-related injuries, the physical function score at the home-treated injuries, role limitation—physical, and role limitation—emotional scores when the first injury happened older than the age of 20 and when the time interval since the injury was longer than 10 years was lower ($p < 0.05$) (Table 4).

Discussion

Patients with epilepsy are at a greater risk for injuries than normal population [13]. Most of the injuries are a result of seizures but there are also other risk factors like the side effects of antiepileptic drugs (such as ataxia related falls), cognitional, psychiatric, and behavioral problems which may lead to physical traumas [11]. Educational level and seizure frequency were effective on the patients' risk of having seizure-related injury in our study. Statistically significant prevalence of seizure-related injuries among patients with lower education level is remarkable and highlights the importance of awareness and attitude in the elimination of risks for injury. Higher seizure frequency is also positively correlated with seizure-related injury risk, understandably [14]. As in our study, seizure frequency was found to have a noteworthy impact on seizure-related injuries, with more frequent seizures as a significant risk factor for recurrent seizure-related injuries. In a recent study by Lagunju et al., 57 children (45.6%) had a seizure-related injury and 31 (24.8%) of them had multiple injuries. They reported higher seizure frequency as a risk factor for seizure-related injuries similar to our results [18]. We found no association between injury risk and other clinical features.

Similar to our study, head traumas followed by fractures were the most frequent injury types in previous studies [13, 15, 16, 19]. Head injuries usually result from falls during seizures. The patient can fully recover but persistent cognitive and psychological symptoms may be seen at follow-up [15]. The seizure-related fracture risk has been shown to increase in patients with epilepsy in various studies. Fracture risk of the extremities due to seizures is reported to be 2.4 times more frequent in patients with epilepsy while bone fractures have a rate of 19% [12, 20]. Moreover, due to the osteopenic effects of antiepileptic medications on the bone structure, patients become prone to having fractures [20].

Our study showed that most patients with epilepsy tend to have multiple injuries and most of these injuries occur during everyday activities at home. The most common seizure-

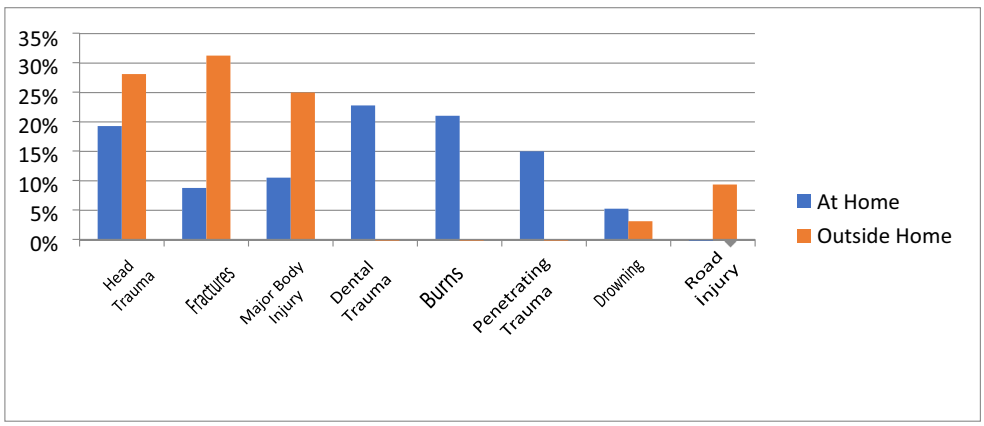

Fig. 1 Relationship of seizure-related injury type and injury location

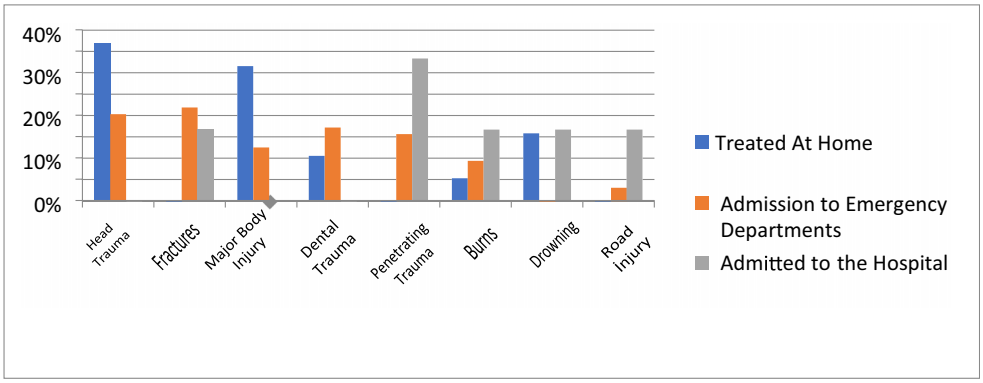

Fig. 2 Outcomes of seizure-related injuries

related injury type that happens at home was dental trauma followed by burns and head traumas, whereas the most common type outdoors was fractures, followed by head traumas and body traumas (lacerations, soft tissue injuries, etc.). The rates of dental injuries were found to be 58.6% and 62% in two separate studies [21, 22]. The rate of emergency admission according to seizure-related burns was found to be 1.6% and 4.9% in two separate studies [23, 24]. We found that all the burn injury patients had admission to emergency and some of them were hospitalized but none of the patients were treated at home. Burn injuries (14%) always took place at home either during house chores such as cooking (10 patients) or unintentionally such as by falling onto the stove (two patients). Our findings are compatible with other studies on burn injuries in literature [22, 25, 26]. We also observed that all the burn injuries end up with admission to emergency department and to the hospital, which indicates the severity of the risk. Furthermore, all eight of the penetrating traumas took place at home, in the kitchen. Similarly, in a multicenter prospective study, they reported a higher probability of seizure-related injuries to take place in home environment than on the street or at work [23]. These results may be attributed to decreased alertness and attention to safety at home and also patients' tendency to spend more time at home and isolate themselves at home because of their fear of having seizure in public. Furthermore, this finding highlights home as the locale of possible serious injuries and the need for taking preventive measures at home to minimize this risk. The fact that higher education is negatively correlated to the frequency of seizure-related injury may suggest the importance of being aware of risks and subsequent conscious avoidance of injuries.

Table 3 Quality of Life scores for patients with epilepsy from QOLIE-89

Scales	Group I *N*, 42	Group II *N*, 15	*p* value
Health perceptions	50.20 ± 18.47	53.33 ± 16.15	0.563
Overall Quality of Life	59.70 ± 14.54	58.17 ± 14.59	0.727
Physical function	82.19 ± 20.02	79.67 ± 25.25	0.697
Role limitations—physical	67.14 ± 35.29	72.00 ± 36.88	0.653
Role limitations—emotional	69.05 ± 41.01	76.00 ± 39.42	0.572
Pain	68.10 ± 25.58	59.17 ± 29.82	0.271
Work/driving/social function	60.92 ± 28.58	64.99 ± 30.87	0.644
Energy/fatigue	44.64 ± 21.13	44.67 ± 30.03	0.998
Emotional well-being	55.71 ± 20.76	56.93 ± 26.95	0.858
Attention/concentration	53.86 ± 23.80	57.17 ± 29.61	0.667
Health discouragement	59.52 ± 38.38	70.67 ± 32.83	0.322
Seizure worry	53.50 ± 32.86	69.27 ± 31.82	0.114
Memory	48.97 ± 22.02	53.54 ± 31.18	0.607
Language	68.64 ± 31.39	71.20 ± 32.57	0.790
Medication effects	52.78 ± 34.29	59.07 ± 37.04	0.552
Social support	58.33 ± 24.17	52.92 ± 29.77	0.487
Social isolation	67.38 ± 33.86	52.67 ± 38.45	0.169
Overall score	60.07 ± 17.57	62.55 ± 21.38	0.660

We also reported that admission to emergency departments was very high because of a seizure-related injury but hospitalization rates were low. Motor vehicle injuries always resulted in admission to emergency and sometimes hospitalization. It was reported that among all the road injuries in the USA between 1995 and 1997, the seizure-related injury ratio was 0.2% and these were mostly fatal [27]. In a prospective study from Turkey, road injury rates were found to be 3.8% [22]. We found the road injury rates to be 3%, similar to this study, and in two of these road injuries, the driver was the patient himself. Although prohibited in our country, patients with epilepsy still tend to drive causing risks for themselves and others. It is crucial to raise awareness about the risks of driving, and educate both patients and their caretakers to prevent this dangerous and illegal habit.

There are many studies in literature examining and using different QoLs in patients with epilepsy using different scale types. QOLIE-89 is a validated, multi-dimensional and detailed scale commonly used for determining the QoL in patients with epilepsy. In the current study, we showed that having injury during seizures had no significant effect on the total QOLIE-89 scores of patients with epilepsy. However, the assessment of the relationship between the features of seizure-related injuries

Table 4 Injuries' features and results of QOLIE-89 in patients with seizure-related injury

Injuries					
Scales	Location Home Outside	Number 1 Multiple	Interfered At home To emergency	Age of first injury < 20 years > 20 years	Time after last injury < 10 years > 10 years
Health perceptions	46.29 ± 21.66 58.92 ± 8.48	55.27 ± 13.03 47.37 ± 20.58	44.44 ± 27.47 50 ± 17.06	50.24 ± 18.36 50.16 ± 18.92	51.09 ± 18.37 41.66 ± 19.83
Overall Quality of Life	57.77 ± 16.75 65.71 ± 11.15	60.33 ± 12.24 59.35 ± 15.88	64.58 ± 12.39 56.3 ± 15.04	62.94 ± 12.47 57.5 ± 15.64	59.67 ± 14.66 60 ± 15.41
Physical function	79.16 ± 27.12 83.71 ± 15.38	87.66 ± 12.08 79.14 ± 22.94	63.33 ± 41.67 84.85 ± 12.41*	78.52 ± 28.71 84.68 ± 10.91	84.13 ± 16.81 63.75 ± 38.59
Role limitations—physical	74.44 ± 29.74 51.42 ± 38.04	65.33 ± 37.39 68.14 ± 34.75	73.33 ± 30.11 62.22 ± 36.93	54.11 ± 36.58 76 ± 32.14*	70 ± 34.71 40 ± 32.65*
Role limitations—emotional	72.22 ± 40.66 48.57 ± 47.40	64.00 ± 45.48 71.85 ± 38.93	66.67 ± 51.64 65.93 ± 42.18	51.76 ± 45.3 80.8 ± 33.9*	74.21 ± 38.87 20 ± 28.28*
Pain	60.13 ± 27.55 75.35 ± 21.81	71.16 ± 21.23 66.38 ± 27.93	58.33 ± 29.4 67.87 ± 26.06	71.47 ± 24.39 65.8 ± 26.59	67.96 ± 25.58 69.37 ± 29.46
Work/driving/social function	53.75 ± 30.11 72.70 ± 20.10	62.33 ± 25.54 60.12 ± 30.57	48.16 ± 32.11 63.49 ± 27.39	60.48 ± 32.76 61.21 ± 26.06	62.48 ± 27.44 45.98 ± 39.3
Energy/fatigue	40.55 ± 23.88 52.85 ± 14.96	54.67 ± 16.30 39.07 ± 26.16*	30.83 ± 22.45 45.37 ± 23.53	46.17 ± 24.97 43.60 ± 24	44.86 ± 24.45 42.5 ± 23.97
Emotional well-being	47.11 ± 23.66 63.42 ± 12.73	59.46 ± 10.88 53.62 ± 24.56	44.67 ± 32.83 56.74 ± 18.16	53.64 ± 22.89 57.12 ± 19.54	56.73 ± 20 46 ± 28.56
Attention/concentration	52.79 ± 27.38 45.63 ± 13.59	54.62 ± 23.31 53.43 ± 24.50	50.98 ± 24.61 55.88 ± 22.22	56.08 ± 19.99 52.34 ± 26.37	54.36 ± 24.52 49.11 ± 17.09
Health discouragement	46.66 ± 40.00 60.00 ± 38.29	53.33 ± 34.36 62.96 ± 40.64	36.67 ± 42.74 61.48 ± 37.59	67.05 ± 33.86 54.4 ± 41.03	60 ± 39.45 55 ± 30
Seizure worry	52.90 ± 34.74 49.18 ± 37.57	58.37 ± 32.06 50.80 ± 33.58	39.05 ± 34.02 55.68 ± 32.93	60.86 ± 32.83 48.5 ± 32.58	53.89 ± 32.72 49.83 ± 39.1
Memory	46.81 ± 24.87 49.16 ± 15.24	52.66 ± 21.40 46.91 ± 22.48	39.39 ± 16.82 50.67 ± 22.26	51.25 ± 21.89 47.4 ± 22.4	51.35 ± 21.72 26.31 ± 6.95
Language	67.33 ± 37.52 65.14 ± 31.04	77.60 ± 29.81 63.66 ± 31.67	59.33 ± 43.99 73.89 ± 29.49	63.05 ± 34.39 72.44 ± 29.28	71.44 ± 30.53 42 ± 30.37
Medication effects	51.69 ± 33.93 50.79 ± 31.69	57.03 ± 36.26 50.40 ± 33.61	42.13 ± 34.44 55.97 ± 33.62	46.72 ± 31.1 56.88 ± 36.33	53.21 ± 34.66 48.6 ± 35.02
Social support	56.59 ± 25.76 63.39 ± 29.18	63.75 ± 24.68 55.32 ± 23.81	67.71 ± 24.18 57.41 ± 24.52	65.8 ± 18.37 53.25 ± 26.58	59.7 ± 23.77 45.31 ± 27.65
Social isolation	57.78 ± 40.08 78.57 ± 22.67	74.66 ± 25.87 63.33 ± 37.41	60 ± 45.17 68.15 ± 29.49	74.7 ± 27.86 62.4 ± 37.11	67.89 ± 34.88 62.5 ± 25
Overall score	56.72 ± 21.24 60.53 ± 11.56	62.70 ± 12.32 58.60 ± 19.97	51.69 ± 25.03 60.82 ± 14.98	59.55 ± 18.21 60.41 ± 17.49	61.37 ± 17.23 47.65 ± 18.14

*$p < 0.05$

and subscores of QoL revealed that some factors were effective on the QOLIE-89 scores. Firstly, having multiple seizures decreases the energy of the patients causing lower energy fatigue score; therefore, seizure control is very important to increase the QoL in patients with epilepsy. In a recent study on a large cohort of 292 patients where 41 patients had seizure-related injuries and accidents, QOLIE-31 subscores of energy levels and emotional well-being were significantly decreased similar to our findings [28]. Secondly, the age at the first seizure-related injury is also important because having the first injury older than the age of 20 may affect the physical and emotional conditions of the patient negatively (e.g., having physical sequels and emotional trauma because of a seizure is more likely as the age increases), and therefore decrease the QoL subscores. Thirdly, the amount of time after the last seizure-related injury can also change the patients' QoL scores because the physical and emotional burden of the seizure-related injury fades in time. The patient may not remember or care about relatively minor seizure-related injuries and even may not inform the physician [14]. In addition, other factors like impairment in patients' perception of injury with time can be effective on QoL scores. Frequent admission to emergency is also negatively correlated

with QoL of the patient by affecting the patients' everyday routine. Therefore, reducing the admission to hospitals not only improves the QoL but is also cost-effective [29].

The strength of our study is being the first prospective study investigating the features of seizure-related injuries, the factors that affect these injuries and QoL changes in patients with seizure-related injuries by an epilepsy-specific instrument, QOLIE-89. An important limitation of this study is our small sample size taken from a single tertiary epilepsy referral center, which may have led to overestimation of injury frequency when compared to community-based samples (Lawn et al. 2004). Another limitation is that this study was based on the recall of the patients with seizure-related injuries; therefore, there may be a recall bias and missing information. Further prospective and more detailed studies with larger epilepsy cohorts are needed to support our findings and establish preventive measures.

Conclusion

We found that patients with epilepsy are prone to having seizure-related injuries which may be severe but these injuries do not have significant influence on the individuals' QoL. These injuries most commonly occur at home which may be explained in relation to the tendency of patients with epilepsy to isolate themselves to home for fear of having a seizure-related injury, which exacerbates the problem. It is therefore very important first to take seizures under control and then to take necessary precautions to prevent possible injuries at home. Multiple seizure-related injuries can change the individuals' perception of QoL and certain types of injuries can be more effective on this perception. Simple precautions such as supervised bathing, using microwave ovens instead of classical stoves, avoiding electric irons and electric heaters and sleeping close to the floor to avoid falling, when taken to reduce the incidence of seizure-related injuries, will contribute to the improvement of QoL in patients with epilepsy, help reduce hospitalizations, which is also cost-effective.

Compliance with ethical standards

Written informed consents were obtained from all participants. Local ethics committee approval was received for the study.

Highlights

- Seizure-related injuries have no effect on the individuals' Quality of Life (QoL).
- The main locale of these injuries is at home.
- The most common seizure-related injury at home is dental trauma; fractures outdoors.
- It is important to take precautions at home to minimize the risk.

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