Factors associated with social anxiety in South Korean adults with epilepsy

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ABSTRACT

Purpose: The aim of this study was to examine social anxiety in South Korean adults with epilepsy and to identify associated factors.

Method: This was a cross-sectional, multicenter study in South Korea. Social anxiety was assessed using short forms of the Social Phobia Scale (SPS-6) and Social Interaction Anxiety Scale (SIAS-6). The SPS-6 scores ≥9 and SIAS-6 scores ≥12 were considered indicative of social phobia and social interaction anxiety, respectively. The Patient Health Questionnaire-9 (PHQ-9); Stigma Scale-Revised (SS-R); Disclosure Management Scale; Family Adaptation, Partnership, Growth, Affection, Resolve (F-APGAR) scale; and a questionnaire assessing knowledge about epilepsy were also used.

Results: Of a total of 219 patients with epilepsy, 21% and 11% had SPS-6 scores ≥9 and SIAS-6 scores ≥12, respectively. In logistic regression analysis, SPS-6 scores ≥9 were independently associated with SS-R scores of 4–9 (odds ratio [OR]: 8.626, 95% confidence interval [CI]: 2.515–29.587, p = .001), SS-R scores 1–3 (OR: 5.496, 95% CI: 1.757–17.197, p = .003), and PHQ-9 scores ≥10 (OR: 4.092, 95% CI: 1.823–9.185, p = .001). In contrast, SIAS-6 scores ≥12 were related only to PHQ-9 scores ≥10 (OR: 8.740, 95% CI: 3.237–23.599, p < .001). Belonging to a dysfunctional family and lack of knowledge about epilepsy tended to be associated with social phobia (p = .071) and social interaction anxiety (p = .090), respectively. Epilepsy-related variables were not related to social anxiety.

Conclusion: Social anxiety is not rare in patients with epilepsy. In this study, social phobia was associated with perceived stigma and depressive symptoms, whereas social interaction anxiety was related only to depressive symptoms in patients with epilepsy.

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1. Introduction

Epilepsy, characterized by recurrent and unprovoked seizures, is one of the most common chronic neurological disorders [1]. Epidemiological studies have demonstrated that the prevalence of psychiatric comorbidities in people with epilepsy is 19–80% [1]. The most common

psychiatric comorbidities are mood disorders (24–74%), with depression responsible for 30%, followed by anxiety disorders (10–25%) [2]. The importance of identifying and treating anxiety in people with epilepsy is increasingly recognized [3].

Social anxiety, defined as a "marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others," accounts for a high proportion of anxiety disorders [4]. Owing to the unpredictability of seizures and negative public attitudes toward epilepsy, people with epilepsy may develop social anxiety [1]. In a recent study in England, logistic regression analysis comparing the prevalence of social phobia between patients with epilepsy and the general population indicated strong relationships between epilepsy and social phobia [5]. One study indicated that people with epilepsy had significantly higher Liebowitz Social Anxiety Scale scores compared with healthy subjects [6]. In another study, social anxiety was found to correlate with perceived seizure severity, impact of epilepsy, fear of negative evaluation, experiential avoidance, epilepsy knowledge, and degree of disclosure of the condition [7]. There was also an incidental finding suggesting the association between lower levels of epilepsy knowledge and increased levels of social anxiety symptoms [8]. Diagnosing and treating social anxiety disorders may be important because they are associated with social function in patients with epilepsy. However, the literature on social anxiety in South Korean adults with epilepsy is limited.

Therefore, the purpose of this study was to examine the prevalence of social anxiety in South Korean adults with epilepsy and to identify associated factors. Referring to the literature regarding general or social anxiety in patients with epilepsy [3,7,9,10], it was expected that social anxiety symptoms would be correlated with various psychological and epilepsy-related variables such as seizure severity, depressive symptoms, perceived stigma, epilepsy disclosure, and family functioning.

2. Methods

2.1. Participants

This was a cross-sectional multicenter study involving 14 university hospitals in South Korea. Individuals over 18 years of age who had been diagnosed with epilepsy and had been treated for over a year were allowed to participate. A revised 2014 International League Against Epilepsy (ILAE) definition of epilepsy was used in this study: 1) two unprovoked seizures more than 24 h apart or 2) one unprovoked seizure and an at least 60% possibility of another one in the next 10 years [11]. As there was limited information about recurrence risk after a single seizure in particular clinical circumstances, diagnosis of epilepsy after a single seizure was made on the basis of electroencephalography or magnetic resonance imaging findings [11]. The new ILAE classification of seizures and epilepsy was used [12]. The participants were asked to fill out questionnaires on the day they visited their neurologist at the outpatient clinic. Demographic and clinical data were collected by interviews and reviewing medical files. Patients were excluded if they had experienced a seizure in the 48 h before the request to fill out the questionnaire, if type or dosage of prescribed antiepileptic drugs (AEDs) were changed in a month, or if they were unable to read or understand the questionnaire.

2.2. Measures

The Social Interaction Anxiety Scale (SIAS) and Social Phobia Scale (SPS) are companion measures that assess two distinct aspects of social anxiety: anxiety related to social interaction in dyads or groups (e.g., attending a social gathering, making small talk) and fear of being scrutinized in specific performance situations (e.g., public speaking and eating, drinking, and writing in the presence of others), respectively. Instead of the original scales consisting of 20 items, we used the six-item versions (SIAS-6 and SPS-6) created by Peters et al. [13], in which each item is scored on a five-point Likert-type scale ranging

from 0 (not at all) to 4 (extremely). The Korean versions of the SIAS-6 and SPS-6 have been validated [14]. A total SIAS-6 score ≥12 and a total SPS-6 score ≥9 are considered indicative of social interaction anxiety and social phobia, respectively [14].

Perceived stigma was measured using the Stigma Scale-Revised (SS-R) for epilepsy, which consists of three items rated on a four-point Likert-type scale (0 = not at all, 1 = maybe, 2 = probably, 3 = definitely) [15]. Participants are asked to respond to questions regarding to what degree they feel other people are uncomfortable with them, treat them as inferior, or prefer to avoid them because of their condition. The SS-R scores range from 0 to 9, on the basis of which participants are categorized as experiencing no stigma (a score of 0), mild stigma (scores of 1–3), and moderate-to-severe stigma (scores of 4–9) [15].

Disclosure management strategies were assessed using the Disclosure Management Scale (DMS), developed by Westbrook et al. [16], which consists of four items. These are rated on a four-point Likert-type scale, ranging from 0 (no concealment of epilepsy) to 3 (full concealment of epilepsy). The score is summed across all items to produce a total score ranging from 0 to 12. Higher scores indicate greater concealment of an epilepsy diagnosis from others.

The Patient Health Questionnaire-9 (PHQ-9) is a nine-item self-report scale used to assess and grade depression severity. The PHQ-9 covers the nine diagnostic criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, on which clinical diagnoses of depressive disorder are based [17]. Participants are asked to respond to questions regarding experiences bothering them in the last two weeks such as anhedonia, feeling sad or depressed, trouble falling asleep or sleeping too much, feeling tired or having little energy, eating problems, feelings of worthlessness or guilt, concentration problems, psychomotor retardation or agitation, and suicidal thoughts. Each item is rated on a four-point Likert scale ranging from 0 (absence of symptoms) to 3 (presence of symptoms nearly every day). The PHQ-9 total score ranges from 0 to 27; higher scores indicate greater risk of depression. The Korean version of the PHQ-9 has been validated [17]. A PHQ-9 score ≥10 is considered indicative of depression [17].

Family function constructs were assessed using the Family Adaptation, Partnership, Growth, Affection, Resolve (F-APGAR) questionnaire [18], in which participants are asked to respond to five questions. Each item is rated on a three-point scale (0–2). The sum of the scores ranges from 0 to 10. We used the validated Korean version of the F-APGAR [18]. Scores ≤6 represent abnormal family functioning [18].

Knowledge about epilepsy was assessed by seven questions, each requiring a simple true/false response, including knowledge of features, etiology, and treatment of epilepsy (organic brain disease, mental illness, inheritable disease, transmissible disease, occurring at any age, incurable disease, and curable by surgery). Participants receive 1 point for each item they answer correctly, and their overall score is the sum of their correct responses, ranging from 0 to 7. Higher scores indicate greater knowledge of epilepsy.

2.3. Statistical analysis

Data were presented as means and standard deviations (SD) for numeric variables and numbers and percentages for nominal variables. The potential factors independently associated with social anxiety in patients with epilepsy were assessed with multivariate logistic regression analyses. The dependent variables were the presence or absence of social interaction anxiety and social phobia, as defined by SIAS-6 scores ≥12 and SPS-6 scores ≥9, respectively. The independent variables included age, sex, epilepsy-related variables, and psychological variables. Epilepsy-related variables were age at seizure onset, duration of epilepsy, type of epilepsy and seizures, seizure frequency in the last year, recurrence of generalized or focal to bilateral tonic–clonic seizures in the last year, and number of AEDs. Psychological variables were depressive symptoms (PHQ-9 scores ≥10), abnormal family functioning

(F-APGAR scores <7), DMS scores, epilepsy knowledge scores, and the level of perceived stigma. On the basis of SS-R scores, participants were categorized as experiencing no stigma (a score of 0), mild stigma (scores of 1–3), or moderate-to-severe stigma (scores of 4–9). Univariate analyses were conducted using an unpaired t-test or a chi-squared test depending on the types of independent variables. Variables with p < .1 in the univariate analysis were then entered into multivariate logistic regression models to assess their association with social anxiety. The backward elimination method for variable selection was used with an exit criterion of p > .1 and an entry criterion of p < .05. In the current study, the calibration power of the logistic regression model was assessed by using the Hosmer–Lemeshow goodness of fit test, and p > .05 indicated a well-calibrated model. All statistical tests were two-tailed, and p < .05 was considered statistically significant. Data were analyzed using SPSS version 21.0 (IBM Corp., Armonk, NY, USA). Written informed consent was obtained from all participants. The study was reviewed and approved by the Institutional Review Board of Asan Medical Center.

3. Results

3.1. Participant characteristics

Of a total of 258 participants, 39 were excluded owing to incomplete data. The study group, therefore, comprised 219 patients with epilepsy, of whom 122 (55.7%) were men. The mean age was 35.5 years (SD: 11.9), and the mean duration of epilepsy was 14.3 years (SD: 11.7) (Table 1). Social phobia (SPS-6 scores ≥9) and social interaction anxiety (SIAS-6 scores ≥12) were identified in 46 (21.0%) and 24 participants (11.0%), respectively. Depressive symptoms (PHQ-9 score ≥ 10) were

identified in 44 participants (20.1%) and family dysfunction (F-APGAR score < 7) in 71 (32.4%) participants. About 35% of the participants had no perceived stigma, about 45% had mild perceived stigma, and about 20% had moderate-to-severe perceived stigma (Table 1).

The SIAS-6 scores ≥12 were related to only PHQ-9 scores ≥10 (odds ratio [OR]: 8.740, 95% confidence interval [CI]: 3.237–23.599, p < .001). Belonging to a dysfunctional family and lack of knowledge about epilepsy tended to be associated with social phobia (p = .071) and social interaction anxiety (p = .090), respectively. Epilepsy-related variables were not related to social anxiety.

3.2. Factors associated with social phobia

Univariate analyses showed that SPS-6 scores ≥9 were significantly associated with more frequent seizures (p < .01), AED polytherapy (p < .01), PHQ-9 scores ≥10 (p < .001), higher SS-R scores (p < .001), DMS scores (p < .05), epilepsy knowledge scores (p < .01), and F-APGAR scores <7 (p < .01) (Tables 2 and 3). There were no significant associations of SPS-6 scores ≥9 with age, sex, age at seizure onset, duration of epilepsy, generalized or focal to bilateral tonic–clonic seizures in the last year, and types of epilepsy and seizure. In the multivariate logistic regression analysis, SS-R scores of 4–9 (OR: 8.626, 95% CI: 2.515–29.587, p = .001), SS-R scores of 1–3 (OR: 5.496, 95% CI: 1.757–17.197, p = .003), and PHQ-9 scores ≥10 (OR: 4.092, 95% CI: 1.823–9.185, p = .001) remained significant (Table 4). Belonging to a

Table 1
Subject characteristics (n = 219).

Men, n (%)	122 (55.7)
Age, years, mean (SD)	35.5 (11.9)
Unemployed, n (%)	49 (23.1)
Married, n (%)	122 (55.7)
Education 12-year or less, n (%)	72 (32.9)
Psychiatric comorbidities, n (%)	9 (4.1)
Medical comorbidities, n (%)	25 (11.4)
Age at seizure onset, years, mean (SD)	21.1 (12.0)
Duration of epilepsy, years, mean (SD)	14.3 (11.7)
Epilepsy type, n (%)	
Generalized, idiopathic	41 (18.7)
Focal	144 (65.7)
Unknown	34 (15.5)
Seizure type, n (%)	
Focal aware	35 (16.0)
Focal impaired awareness	56 (25.6)
Generalized or focal to bilateral TCS	127 (58.0)
Seizure frequency in the last year, n (%)	
Seizure-free	89 (40.6)
1–11 per year	102 (46.6)
1 or more per month	27 (12.3)
Generalized or focal to bilateral TCS in the last year, n (%)	71 (33.0)
Antiepileptic drug polytherapy, n (%)	125 (57.1)
SIAS-6 score ≥12, n (%)	24 (11.0)
SPS-6 score ≥9, n (%)	46 (21.0)
Knowledge about Epilepsy score, mean (SD)	4.91 (1.53)
Disclosure Management Scale score, mean (SD)	6.26 (2.67)
Stigma Scale-Revised, n (%)	
Score = 0	77 (35.2)
Score 1–3	99 (45.2)
Score ≥ 4	42 (19.6)
F-APGAR score < 7, n (%)	71 (32.4)
PHQ-9 score ≥ 10, n (%)	44 (20.1)

F-APGAR, Family Adaptation, Partnership, Growth, Affection, Resolve; PHQ-9, Patient Health Questionnaire-9; SIAS-6, Social Interaction Anxiety Scale-6; SPS-6, Social Phobia Scale-6; SD, standard deviation; TCS, tonic–clonic seizures.
The range of possible scores of the measures: the Disclosure Management Scale 0–12, F-APGAR 0–10, Knowledge about Epilepsy 0–7, Stigma Scale-Revised 0–9, PHQ-9 0–27, SIAS-6 0–24, and the SPS-6 0–24.

Table 2
Differences in the percentage of social anxiety depending on the characteristics of the nominal independent variables.

	SPS-6		SIAS-6	
	Scores ≥9, n (%)	p value	Scores ≥12, n (%)	p value
Sex		.587		.302
Men (n = 122)	24 (19.7)		11 (9.0)	
Women (n = 97)	22 (22.7)		13 (13.4)	
Epilepsy type		.516		.342
Idiopathic generalized (n = 41)	6 (14.6)		2 (4.9)	
Focal (n = 144)	33 (22.9)		17 (11.8)	
Unknown (n = 34)	7 (20.6)		5 (14.7)	
Seizure type		.275		.165
Focal aware (n = 35)	7 (20.0)		3 (8.6)	
Focal impaired awareness (n = 56)	16 (28.6)		10 (17.9)	
Generalized or focal to bilateral TCS (n = 127)	23 (18.1)		11 (8.7)	
Seizure frequency in the last year		.001		.02
Seizure-free (n = 89)	11 (12.4)		6 (6.7)	
1–11 per year (n = 102)	23 (22.5)		11 (10.8)	
1 or more per month (n = 27)	12 (44.4)		7 (25.9)	
Generalized or focal to bilateral TCS in the last year		.685		.51
No (n = 144)	29 (20.1)		14 (9.7)	
Yes (n = 71)	16 (22.5)		9 (12.7)	
AED treatment		.003		.149
Monotherapy (n = 94)	11 (11.7)		7 (7.4)	
Polytherapy (n = 125)	35 (28.0)		17 (13.6)	
Stigma Scale-Revised		<.001		<.001
Score = 0 (n = 77)	4 (5.2)		4 (5.2)	
Score 1–3 (n = 99)	23 (23.2)		8 (8.1)	
Score ≥ 4 (n = 43)	19 (44.2)		12 (27.9)	
F-APGAR		.001		.004
Score ≥ 7 (n = 148)	22 (14.9)		10 (6.8)	
Score < 7 (n = 71)	24 (33.8)		14 (19.7)	
PHQ-9		<.001		<.001
Score < 10 (n = 175)	24 (13.7)		8 (4.6)	
Score ≥ 10 (n = 44)	22 (50.0)		16 (36.4)	

AED, antiepileptic drug; F-APGAR, Family Adaptation, Partnership, Growth, Affection, Resolve; n, number; PHQ-9, Patient Health Questionnaire-9; SIAS-6, Social Interaction Anxiety Scale-6; SPS-6, Social Phobia Scale-6; TCS, tonic–clonic seizures.
The range of possible scores of the measures: the Stigma Scale-Revised 0–9, F-APGAR 0–10, PHQ-9 0–27, SIAS-6 0–24, and the SPS-6 0–24.

Table 3
Comparisons of the numeric variables between patients with epilepsy with and without social interaction anxiety or social phobia.

	Social Phobia Scale-6			Social Interaction Anxiety Scale-6		
	Scores ≥9 (n = 46)	Scores <9 (n = 173)	p value	Scores ≥12 (n = 24)	Scores <12 (n = 195)	p value
Age, years, mean (SD)	35.5 (12.3)	35.4 (11.8)	.984	34.9 (11.5)	35.5 (11.9)	.817
Age at seizure onset, years, mean (SD)	18.7 (9.3)	21.8 (12.5)	.59	17.5 (10.1)	21.6 (12.1)	.112
Duration of epilepsy, years, mean (SD)	16.4 (13.3)	13.8 (11.2)	.171	17.5 (12.0)	13.9 (11.6)	.163
Knowledge about Epilepsy score, mean (SD)	4.39 (1.67)	5.05 (1.46)	.009	3.88 (1.57)	5.04 (1.47)	<.001
Disclosure Management Scale score, mean (SD)	7.02 (2.46)	6.05 (2.69)	.028	6.75 (2.36)	6.19 (2.70)	.337

F-APGAR, Family Adaptation, Partnership, Growth, Affection, Resolve; PHQ-9, Patient Health Questionnaire-9; SD, standard deviation; TCS, tonic–clonic seizures.
The range of possible scores of the measures: the Disclosure Management Scale 0–12, Knowledge about Epilepsy 0–7, SIAS-6 0–24, and the SPS-6 0–24.

dysfunctional family did not reach statistical significance (p = .071). The Hosmer–Lemeshow test revealed that the model had a good fit (p = .806).

3.3. Factors associated with social interaction anxiety

Univariate analyses demonstrated that SIAS-6 scores ≥12 were significantly associated with more frequent seizures (p < .05), PHQ-9 scores ≥10 (p < .001), higher SS-R scores (p < .001), epilepsy knowledge scores (p < .001), and F-APGAR scores <7 (p = .04) (Tables 2 and 3). Multivariate logistic regression analysis demonstrated that only PHQ-9 scores ≥10 (OR: 8.740, 95% CI: 3.237–23.599, p < .001) remained significant (Table 4). Knowledge about epilepsy did not reach statistical significance (p = .09). The Hosmer–Lemeshow test revealed that the model had a good fit (p = .688).

4. Discussion

We found that 21% and 11% of South Korean adults with epilepsy had social phobia and social interaction anxiety, respectively. Social phobia was independently associated with depressive symptoms and perceived stigma, and social interaction anxiety was significantly related to depressive symptoms. Demographic and seizure-related variables were not related to social interaction anxiety and social phobia in this study.

Previous clinical studies using a fully structured diagnostic interview to identify social phobia have reported a prevalence rate of 6–13% in people with epilepsy [5,19–21]. The lifetime prevalence of social phobia in Dutch inpatients with epilepsy was 13% [19]. The point prevalence of social phobia in people with epilepsy was 6.0% and 7.2% in population-based studies in England and Germany, respectively [5,20]. The prevalence of social phobia during the last year was 6.1% in patients with temporal lobe epilepsy and 10.9% in those with extratemporal lobe epilepsy [21]. However, in the present study, through the use of self-report scales, it was determined that 11% and 21.0% of patients with epilepsy had social interaction anxiety and social phobia, respectively. It is difficult to directly compare our results regarding the prevalence of social anxiety with those of previous studies because of

methodological variability. According to studies in the general population, the prevalence of social anxiety is culture-specific, with variations between Asian and Western cultures [22]. Therefore, the prevalence of social anxiety disorder in South Korean patients with epilepsy may also be different from the Western population. However, there has not yet been a study on the prevalence of social anxiety disorder in people with epilepsy in South Korea. Further interview-based investigations of the prevalence of social anxiety disorder in patients with epilepsy from various sociocultural backgrounds are needed.

In the current study, 65% of the participants presented epilepsy-related perceived stigma, which was independently associated with social phobia. It is speculated that those with social phobia tend to interpret others' attitudes toward themselves negatively, which may make them feel as if they are being stigmatized. People with epilepsy often experience stigma, and its association with psychological distress has been reported [23]. In South Korean people with epilepsy, perceived stigma has been reported to be related to various psychosocial variables including anxiety [9], personality, and individual problem-solving styles [24]. Previously, anxiety has been reported to predict stigma among patients with epilepsy [8], and the converse has also been reported [25]. Similarly, the direction of the association between social anxiety and stigma may also be ambiguous. In our study, perceived stigma was an independent contributor to social phobia after controlling for depression, knowledge about epilepsy, and family functioning. In contrast, in Heersink et al.'s study [7], the hierarchical regression analysis demonstrated that social anxiety was significantly associated with the variance in stigma beyond that explained by anxiety, age, seizure frequency, depression, and impact of epilepsy. Of course, inferences regarding causality are limited because of the cross-sectional design of these two studies.

In the present study, 32.4% of the participants belonged to dysfunctional families, a situation that tended to be associated with social phobia (p = .071). Epilepsy can affect not only people with epilepsy but also their families. There is evidence of caregiver burden in epilepsy [26] and familial dysfunction in people with epilepsy [27]. The association between family factors and psychological variables in epilepsy has been mostly reported in the context of children and adolescents [28–30]. In one previous study, children's satisfaction with their family

Table 4
Logistic regression models for the factors associated with social interaction anxiety and social phobia in patients with epilepsy.

	SPS-6 scores ≥9			SIAS-6 scores ≥12		
	OR	95% CI	p value	OR	95% CI	p value
PHQ-9 score ≥ 10	4.092	1.823–9.185	.001	8.740	3.237–23.599	<.001
Stigma Scale-Revised score 1 - 3[a]	5.496	1.757–17.197	.003	–	–	–
Stigma Scale-Revised score ≥ 4[a]	8.626	2.515–29.587	.001	–	–	–
F-APGAR score < 7	1.993	0.943–4.214	.071	–	–	–
Knowledge about Epilepsy score	1.546	0.612–3.906	.357	0.765	0.561–1.042	.090

CI, confidence interval; F-APGAR, Family Adaptation, Partnership, Growth, Affection, Resolve; OR, odds ratio; PHQ-9, Patient Health Questionnaire-9; SIAS-6, Social Interaction Anxiety Scale-6; SPS-6, Social Phobia Scale-6.
The range of possible scores of the measures: the F-APGAR 0–10, Knowledge about Epilepsy 0–7, Stigma Scale-Revised 0–9, PHQ-9 0–27, SIAS-6 0–24, and the SPS-6 0–24.
[a] Reference: Stigma Scale-Revised score 0.

relationships was associated with their depression levels [28], while in another, family conflicts were correlated with depression among children [29]. Another study suggested that enhancing family function may play a role in decreasing anxiety in patients with epilepsy [10]. This finding was in line with our results, according to which belonging to a dysfunctional family tended to be associated with social phobia. In contrast, extremely protective behavior from the family may play a role in the development of anxiety disorders [2]. Overprotective parental behavior could also delay the psychosocial maturation of ill children [30].

In our investigation, we identified that both social interaction anxiety and social phobia were related to depressive symptoms. Anxiety and depression are common comorbid conditions in people with epilepsy [2]. It is well known that anxiety and depression are closely associated with each other and that they coexist in many people with epilepsy [31]. Similar to our study, Heersink et al. [7] found a significant correlation between social anxiety and depression. Even in general medical clinic settings [32] and in the general population [33], social anxiety is highly comorbid with depression. Amelioration of the symptoms of depression or anxiety is quite likely to reduce the symptoms of the other condition [31].

In this study, knowledge of epilepsy tended to be associated with social interaction anxiety ($p = .090$). Knowledge of epilepsy is important in successfully coping with the disease and also in minimizing the impact on patients' psychological and social functioning [8]. Improving knowledge about epilepsy can reduce a variety of manifestations of psychological distress, including perceived anxiety [8]. A recent Canadian study [7] found that patients who knew more about their epilepsy were less likely to experience social anxiety, as measured by the Social Phobia Inventory. A previous study also reported an incidental finding regarding the association between lower levels of epilepsy knowledge and increased levels of social anxiety symptoms, as measured by the Social Avoidance and Distress Scale [8].

The degree of epilepsy disclosure was not related to social anxiety. However, Heersink et al. [7] have suggested that social anxiety is significantly negatively related to epilepsy disclosure. In a study on South Korean patients, the degree of epilepsy disclosure was not associated with anxiety symptoms [34]. Seizure-related factors including seizure frequency may play a role in the development of anxiety, but they were not identified as independent factors associated with social anxiety in the present study. Similarly, in a recent study, the types of epileptic seizures were not associated with the level of social anxiety measured using the Liebowitz Social Anxiety Scale [35]. Heersink et al. [7] found that perceived seizure severity measured by the Liverpool Seizure Severity Scale was associated with social anxiety assessed using the Social Phobia Inventory after controlling for only depression, but they did not control for perceived stigma. In addition, an Australian study of 147 adults with epilepsy showed that anxiety assessed by Hospital Anxiety Depression Scale was not associated with epilepsy factors, but with unemployment status [36]. In contrast, Kimiskidis et al. [37] reported in 201 adults with epilepsy that symptomatic focal epilepsy was an only independent determinant of state anxiety, whereas high seizure frequency (>1 per month), polypharmacy with 3 AEDs, symptomatic focal epilepsy, and female gender were positively correlated with trait anxiety measured using State–Trait Anxiety Inventory. The reasons for these discrepancies are unclear, but sociocultural differences could be significant in this regard.

Our study had several limitations. First, our findings were based on a cross-sectional design, which limited inferences regarding causality. Second, the use of self-report scales, which can allow for response bias, may also be a limiting factor. Third, we did not consider details such as type of medications used, ictal onset zone, and neuroimaging findings. In particular, since certain AEDs such as pregabalin have been used for the treatment of social anxiety disorder [38], it is considered as a limitation not to include individual AEDs as a confounding factor. We recognize the need for controlling for the details of AEDs

used in future research on the subject. Finally, social anxiety may differ considerably among countries with different traditions. Therefore, caution must be exercised in attempts to generalize our results to different cultural environments.

5. Conclusion

Social anxiety was significantly related to various psychosocial variables including depression and perceived stigma in South Korean adults with epilepsy. Demographic and seizure-related variables were not related to social anxiety. Our results provide a basis for the management and treatment of social anxiety in patients with epilepsy. There is a need for the formulation of management and treatment strategies derived from evidence-based treatments for social anxiety disorder.

Role of the funding source

Declaration of competing interest

None.

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