Original Article
Analysis of depression and anxiety in patients with post-stroke epilepsy

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Abstract: Objective: The present study aimed to assess the depression and anxiety syndromes in patients with post-stroke epilepsy and explore the association of these disorders with epilepsy-related variables. Methods: 86 patients with brain stroke were collected in this study, including 46 post-stroke epilepsy patients in case group and 40 patients without epilepsy seizure as control group. The general data of the patients were recorded. Moreover, Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI) were used to measure the depression and anxiety state of the participators. What's more, numerical variables between two groups were compared with Chi-square and Fisher. Logistic regression was performed to assess the multivariate analysis. Results: Patients with post-stroke epilepsy showed high scores of depression and anxiety, and compared with the control group the difference of the two group were statistically significant ($P<0.05$). In the epilepsy group, 54.3% had depression and 43.5% had anxiety. Besides, a relationship was found between high scores of anxiety and depression and occurrence of epilepsy. In addition, factors associated with depression and anxiety were age, and duration of disease. Logistic regression analysis showed that both depression and anxiety were significantly associated with epilepsy ($P=0.003$, and $P=0.031$, respectively). Conclusion: Depression and anxiety could be useful syndromes for post-stroke epilepsy, and could be used to distinguish from patients without epilepsy. High scores of anxiety and depression were associated with occurrence of epilepsy in post-stroke.

Keywords: Post-stroke epilepsy, depression, anxiety, association

Introduction

Epilepsy is a common and complex neurological disease caused by multiple factors and is characterized by an excessive discharge of certain neurons system. Epilepsy affects approximately 0.5-0.7% of the population worldwide [1]. According to an epidemiological survey, there are about 9 million epileptics in China, and 2-14% of elderly patients with stroke will suffer from epilepsy [2]. What's more, many people with epilepsy suffer from moderate to severe depression and anxiety [3].

In patients with epilepsy depression and anxiety are the most prevalent psychiatric disorders, affecting about 55% of subjects [4]. The increased prevalence of affective disorders in children with epilepsy compared with the general population and children with nonneurolog-

ic disorders has been documented [5]. Adolescence is a particularly vulnerable period marked by profound developmental changes in the biological, social, and psychological domains. Coping with these changes may be especially challenging for adolescents with epilepsy [6]. Previous studies have assessed depression and anxiety in a population of 44 children and adolescents with epilepsy and found that 26% of patients had increased depression scores and 16% had anxiety symptomatology [7]. Dunn et al. [8] and Oguz et al. [9] all have reported adolescents with epilepsy aged less than 18 have higher scores of depression (using the CDI) and increased anxiety based on the State Trait Anxiety Inventory (STAI) when compared with the control group.

Depression and anxiety in children and adolescents with epilepsy requires further attention

Table 1. General characteristics of patients with epilepsy seizures or without epilepsy seizures

Features	With seizures (n=46)	Without seizures (n=40)	P value
Age at time of stroke			0.019
<18	30	16	
≥18	16	24	
Gender			0.952
Male	25	22	
Female	21	18	
Number of infarct foci			0.793.
<1	30	25	
≥1	16	15	
Stroke subtype			0.839
Partial anterior circulation infarct	9	6	
Posterior circulation infarct	11	11	
Lacunar anterior circulation infarct	11	12	
Total anterior circulation infarct	15	11	
Duration of disease			0.028
<5 years	19	26	
≥5 years	27	14	
Anxiety scores			0.022
≥8	36	22	
<8	10	18	
Depression scores			0.016
≥8	40	26	
<8	6	14	

criteria were a diagnosis of brain stroke, and literacy in Chinese. Those who had experienced a seizure within the previous 24 hours, with structural brain abnormalities, had surgery in the previous 4 weeks, or who had pseudo-seizures were excluded. The study was approved by the Ethics Committee of Qianfoshan Hospital Affiliated to Shandong University and written informed consent was obtained from all participants.

Basic information collection

The general features of patients were collected for both group including age, gender, number of infarct foci, stroke subtype, duration of disease, anxiety scores, and depression scores. Besides, for both group, the number of subjects in different degrees of anxiety and depression were collected respectively by the researchers at epilepsy clinic.

because it carries a risk of reduced quality of life and complications in life [10]. Whether children and adolescents patients with post-stroke epilepsy have a high level of depression and anxiety, it is possible to perceive differences among the numbers presented in these studies. In our study we aimed to assess the rates of anxiety and depression in adolescents with post-stroke epilepsy. Moreover, the relationship between affective symptoms and seizure related factors in the adolescents with epilepsy were also evaluated.

Materials and methods

Participants

The study sample consisted of 86 patients with brain stroke assessed from Qianfoshan Hospital Affiliated to Shandong University. Among the samples included 46 case participants with post-stroke epilepsy and 40 control participants without epilepsy. Inclusion

Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI)

The BDI [11] including a 21-item self-report was used to measure depression. Each of the items contains a 4-point severity rating scale. The scoring algorithm defines scores of 0-9 points as indicating minimum depression; 10-16 points as indicating low depression; 17-29 points as indicating moderate depression; and 30-63 points as indicating major depression. The BDI is being used as a standard reference and is one of the most common self-report scales used to assess depression including in adolescents [12, 13].

The STAI [14] test is divided in two sections I - presents 20 statements related to how the person feels most of the time (Trait); II - presents 20 statements related to how the person feels at the time of assessment (State). To assess the level of trait anxiety and/or state, it is necessary to first apply a correction to the scores

Table 2. Analysis of clinical factors related to HADS anxiety score ≥8 and depression score ≥8

Factors	Anxiety score ≥8			Depression score ≥8		
	Cases	Controls	P	Cases	Controls	P
Age at time of stroke	36	22	0.198	40	26	0.025
<18	21	9		28	11	
≥18	15	13		12	15	
Duration of disease			0.012			0.189
<5 years	14	16		18	16	
≥5 years	22	6		22	10	
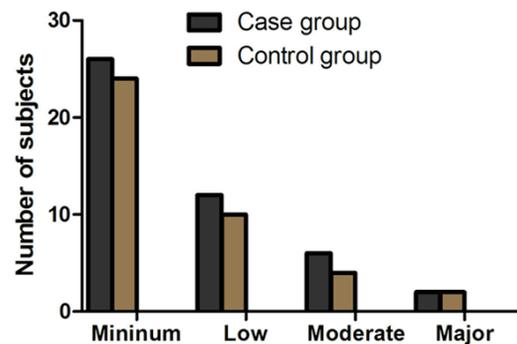
Figure 1. Patients distribution of depression scores in case group and control group.
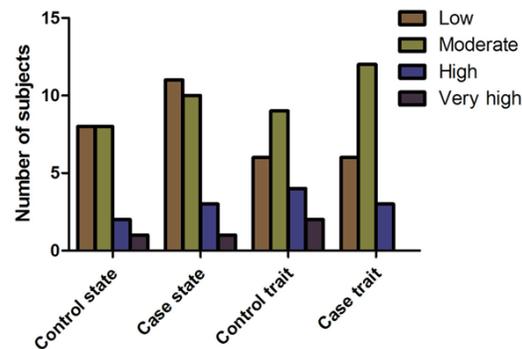
Figure 2. Anxiety in case group (state and trait domains) and control group (state and trait domains).

obtained on each item. After that, scores obtained on each item are summed up and classified accordingly, to assess the level of anxiety: low, scores between 20 and 34; moderate, scores between 35 and 49; high, scores between 50 and 64; and very high, between 65 and 80 [15]. STAI is widely used in monitoring anxiety states. And is also an instrument used to assess anxiety in children and adolescents [16, 17].

Statistical analysis

To compare numerical variables between two groups we used the Chi-square test and analysis of Covariance (ANCOVA) when needed to adjust for age and gender. Chi-square and Fisher tests were used to compare categorical variables. Odds ratios at a 95% confidence interval were calculated. Forward logistic regression was used for multivariate analysis. The level of significance for statistical test was 5% (P<0.05).

Results

General characteristic of the patients

The general information of the case and control groups was shown in **Table 1**. It was observed that age at the time of stroke and duration of disease differed among the study groups (P=0.019, and P=0.028 respectively). Moreover, we also found that anxiety scores and depression scores showed significant difference between patients with seizures and without seizures (P=0.022, and P=0.016 respectively). Other features like gender, number of infarct foci, and stroke subtype were similar in the two study groups (all, P>0.05).

Analysis of clinical factors related to HADS anxiety scores ≥8 and depression scores ≥8

In order to detect the relationship between clinical factors and anxiety and depression scores of ≥8 in patients with post-stroke epilepsy, we performed stratified analysis. As shown in **Table 2**, age at time of stroke was significantly associated with depression scores (P=0.025), meanwhile during of disease was significantly associated with anxiety scores (P=0.012). In addition, the number of patients in case group (56.5%) and control group (60%) was more in minimum depression subgroup of the BDI (**Figure 1**). While in the state anxiety analysis majority of the patients of both case group (45.6%) and control group (40%) scored for low and moderate anxiety. In the trait anxiety component, the majority of patients from case group scored for moderate anxiety (57.1%), and control group with moderate anxiety was 42.9% (**Figure 2**).

Table 3. Logistic regression analysis of the factors for patients with epilepsy

Factors	P value	OR	95% CI
Age	0.000	0.102	0.028-0.366
Duration of disease	0.006	4.985	1.588-15.655
Anxiety score	0.031	3.483	1.120-10.832
Depression score	0.003	5.748	1.819-18.164

Association of anxiety and depression with occurrence of epilepsy

Logistic regression analysis was performed to assess the association of anxiety and depression with occurrence of epilepsy in post-stroke patients. As shown in **Table 3**, the risk factors were duration of disease (P=0.006, OR=4.985, 95% CI=1.588-15.655), anxiety score (P= 0.031, OR=3.483, 95% CI=1.120-10.832), and depression score (P=0.003, OR=5.748, 95% CI=1.819-18.164).

Discussion

In recent decades there has been a great interest in the study of variables that control the impact of epilepsy, variables that may relate to the seizures. It has been noted that there are several predictors of the scores of items associated with emotion and cognition including anxiety and depression. First of all, our study showed that there were statistically significant differences between the group of adolescents with post-stroke epilepsy and control group when comparing depression scores and anxiety scores. These findings are particularly accordance with previous studies, because epilepsy was reported to correlate with high prevalence of depression and anxiety [18, 19]. However, Siqueira NF et al. [20] have reported that no difference was observed between epilepsy group and control group when comparing depression and anxiety scores. Therefore, one must consider the conditions that make difference to compare the studies already mentioned [21]. For example, the use of different instruments, different methodologies, different countries in which the research took place, characteristics of the population, form of assessment tests, or sub-categories analyzed may be factors of variability.

In the analysis of our study, several general factors were found to be significantly associated with seizures of epilepsy, including age at the time of stroke, duration of disease, depression and anxiety scores when comparing the case and control groups. In order to further explore the role of depression and anxiety, we analyzed the association of depression and anxiety with other factors of epilepsy patients. The results showed that the age at time of stroke was statistically significant related with depression scores. Moreover, duration of disease was found to be significantly related to anxiety scores. Ott et al. [22] have found that children of older age were more likely to have received mental health treatment. The access to treatment may be related to a better knowledge of the disease and, therefore, associated with better coping with the epilepsy leading to scores no different from the ones of the control group.

The present study highlights the association between anxiety and depression. Logistic regression analysis revealed that depression and anxiety were valuable syndromes for post-stroke epilepsy patients and might distinguish the epilepsy seizure patients from the control ones. Coexistence of anxiety and depression has been widely reported in people with or without epilepsy [23, 24]. In internalizing disorders, current depression has been reported to be associated with a 28-fold increase in current anxiety, according to a study of childhood psychiatric disorders [25]. A study by Alfstad et al. [26] reported that the presence of other chronic diseases along with epilepsy was an independent factor for developing overall psychiatric symptoms. Comorbid conditions have also been identified as a significant predictor of higher levels of anxiety in children and adolescents with epilepsy [27].

In this study we analyzed the relationship of post-stroke epilepsy with the related variables in adolescents. However, the small size of subjects in the different epilepsy subtypes might limit the interpretation. There is also a lack of compelling evidence regarding an association between subtypes of epilepsy and affective disorders in recent literature [24, 27]. In addition, the previous literature also reported that antiepileptic drugs can cause symptoms of anxiety and depression, but their mood-stabilizing properties mean that they are also used in the management of psychiatric disorders. Phar-

macoresistance has been reported to be associated with affective disorders in children with epilepsy [27, 28].

In summary, the present study revealed that adolescents with epilepsy have significantly higher rates of affective disorders than the control group. Moreover, seizure-related variables including depression and anxiety tended to make different contributions to mood disorders. Only few adolescents with epilepsy in the study received psychiatric services at the time of the study. Therefore, a comprehensive assessment including an assessment of mood disorders is required to improve the quality of life for children and adolescents with epilepsy.

Disclosure of conflict of interest

None.

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