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A study on the differences and influencing factors of sleep quality in epilepsy patients of different genders

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Abstract

This study aims to evaluate and analyze the differences in sleep quality among epilepsy patients of different genders to provide a reference for determining the influencing factors of sleep quality based on logistic multiple regression analysis. A retrospective analysis was conducted on the clinical data of 220 epilepsy patients admitted to our hospital from May 2022 to November 2023. The patients were divided into low-quality and high-quality sleep groups. Data were obtained using a general information questionnaire survey and the Pittsburgh Sleep Quality Index (PSQI). The average PSQI score for male patients was 12.89 ± 3.13, while for female patients, it was 9.26 ± 2.60. The PSQI score for male patients was significantly higher than that for female patients ($p < 0.05$). Moreover, the influencing factors for sleep quality in epilepsy patients included gender, annual income, medical insurance, frequency of epilepsy onset and medication use. Male epilepsy patients suffer from poorer sleep quality compared to female patients. Factors such as gender, annual income, medical insurance, seizure frequency and medication use significantly affect sleep quality in epilepsy patients. It could be recommended that patients adhere to medical advice for managing epilepsy and that healthcare authorities enhance awareness and policy support to reduce seizures and improve patients' quality of life.

Keywords

Gender; Epilepsy; Sleep quality; Differences; Influence factor

1. Introduction

Epilepsy is a neurological disorder characterized by symptoms such as limb convulsions, loss of consciousness, foaming at the mouth and clenched teeth during seizures [1]. It is generally associated with brain damage, genetic factors, infections and metabolic disorders.

In China, the prevalence of epilepsy has reached nearly 9 million, with an annual increase of 400,000 new cases. This rising trend will heighten the demand for medical resources, increase the socioeconomic burden, and exacerbate societal discrimination and misunderstandings about epilepsy. Consequently, the social status of epilepsy patients may decline, leading to increased psychological stress and reduced sleep quality [1].

Epileptic seizures are sudden, brief and recurrent events. Frequent seizures can disrupt patients' biological clocks, destroy normal sleep cycles, affect the balance of brain neurotransmitters and exacerbate sleep disorders [2]. According to related reports, epilepsy patients with sleep disorders have more difficulty controlling their condition compared to the general patient population. Factors such as gender, social responsibilities, education level, marital status and economic conditions further increase the psychological and physiological pressures on epilepsy patients, affecting their sleep quality [3]. The continuous worsening of sleep disorders, in turn, makes epilepsy harder to control, negatively impacting patients' quality of life. Therefore, researching the differences in sleep quality among epilepsy patients and the factors influencing these differences is crucial for improving sleep quality, managing disease progression, and enhancing quality of life [4].

At present, although clinical attention to sleep disorders in epilepsy patients has been increasing, there is still a lack of comprehensive understanding and recognition of the factors affecting sleep quality differences among epilepsy patients of different genders. Thus, we conducted this study using a general information questionnaire and the Pittsburgh Sleep Quality Index (PSQI) to survey and evaluate epilepsy patients admitted to our hospital by focusing on the differences in sleep quality and the influencing factors among epilepsy patients of different genders.

2. Materials and methods

2.1 General information

A retrospective analysis was conducted on the clinical data of 220 epilepsy patients admitted to our hospital from May 2022 to November 2023. The PSQI was utilized to assess the sleep

quality of the patients, and based on their PSQI scores, they were categorized into a low-quality sleep group and a high-quality sleep group.

The study inclusion criteria were (1) diagnosed with epilepsy by a neurologist and meeting the relevant diagnostic standards and guidelines, (2) aged 18 years or older, and (3) signed an informed consent form.

Patients were excluded if they had severe systemic diseases, were pregnant or breastfeeding females, or if their seizures were solely related to alcohol or medication reduction.

2.2 Sample size calculation

The sample size for the modeling group was estimated using the approximate sample size calculation formula for logistic regression analysis. It was preliminarily estimated that there would be 4 to 5 meaningful independent variables, each requiring 10 patients. According to the literature, the probability of epilepsy patients experiencing sleep disorders is 25%. It was considering a sample attrition rate of approximately 10%. Therefore, a sample size of 220 cases was selected to meet the research requirements.

2.3 Methods

The study participants were assessed through a questionnaire that primarily collected data on general patient demographics and sleep quality, and comparative analyses were conducted between the two patient groups to evaluate their basic characteristics, such as age, gender, marital status, and medication use.

2.4 General information survey questionnaire

The questionnaire was self-designed and developed by the researchers. This questionnaire gathered comprehensive information across several domains and collected general information such as their gender, age, marital status and education level. Additionally, it captured details from the patients' medical records, such as recent episodes of illness and types of medications taken. The questionnaire also assessed the patients' economic status by inquiring about their income level and sources of medical insurance. Furthermore, it examined lifestyle habits, including smoking history and alcohol consumption. The questionnaire was distributed electronically via a WeChat mini program specifically designed for the study subjects. To encourage active participation, the participants were informed about the research's importance, necessity and urgency. Throughout the survey process, confidentiality was strictly maintained to ensure privacy.

2.5 Survey questionnaire

The PSQI scale was used to assess the sleep quality of the research subjects. This scale evaluated eight aspects of sleep: overall sleep quality, sleep duration, sleep efficiency, frequency of sleep disturbances, incidence of nightmares, use of hypnotic medications, daytime dysfunction and subjective sleep quality. Each aspect was rated on a scale from 0 to 3, with the total score ranging from 0 to 24. If the total PSQI score was ≤ 5, $6 \leq \text{PSQI} \leq 10$ or > 10 points, it indicated good, moderate or poor sleep quality, respectively.

2.6 Statistical analysis

Data analysis was conducted using SPSS v27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were analyzed using t-tests, while categorical variables were examined with chi-square tests. A $p < 0.05$ was considered statistically significant. Logistic regression analysis was utilized to identify relevant influencing factors.

3. Results

3.1 Occurrence of poor sleep quality

Among the 220 epileptic patients, 141 patients scored greater than 10 points on the PSQI scale, which indicated poor sleep quality.

3.2 Current status of sleep quality in epileptic patients

Further analysis of the PSQI scale results revealed that the average score for the 132 male patients was 12.89 ± 3.13, while the average score for the 88 female patients was 9.26 ± 2.60, indicating that male patients had significantly higher PSQI scores compared to female patients ($t = 9.002$, $p < 0.001$).

3.3 Univariate analysis

Univariate analysis demonstrated significant differences between the two groups with respect to gender, annual income, medical insurance status, frequency of epileptic seizures and medication adherence ($p < 0.05$; Table 1).

3.4 Multivariable logistic regression analysis

A multivariate logistic regression analysis was performed using poor sleep quality in epilepsy patients as the dependent variable, as well as gender, annual income, medical insurance status, frequency of epileptic seizures and medication adherence as independent variables. The results revealed that gender, annual income, medical insurance status, frequency of epilepsy seizures, and medication adherence were significant factors influencing sleep quality in epilepsy patients ($p < 0.05$; Tables 2,3).

4. Discussion

In clinical settings, epilepsy patients may present with a range of symptoms, including convulsions, loss of consciousness, absence of seizures and foaming at the mouth. Frequent seizures can result in adverse outcomes such as physical injury, cognitive decline, and increased mortality risk [5, 6]. In recent years, the number of epilepsy patients in China has increased, potentially due to factors such as population aging, unhealthy lifestyles and both environmental and genetic factors. Current reports indicate that the growth rate of epilepsy patients in China is higher than the general level of societal awareness

TABLE 1. The results of univariate analysis.

Indicators	Low-quality Sleep Group (n = 141)	High-quality Sleep Group (n = 79)	χ^2/t	p value
Age (yr)	38.14 ± 4.19	37.83 ± 4.41	0.517	0.606
Gender (n, %)				
Male	95 (67.38)	37 (46.84)	8.901	0.003
Female	46 (32.62)	42 (53.16)		
Marital Status (n, %)				
Married	92 (65.25)	52 (65.82)	0.007	0.932
Unmarried	49 (34.75)	27 (34.18)		
Education (n, %)				
Bachelor's degree and above	44 (31.21)	24 (30.38)	0.016	0.899
Lower than a Bachelor's degree	97 (68.79)	55 (69.62)		
Annual Income (n, %)				
20,000 RMB and above	52 (36.88)	41 (51.90)	4.680	0.031
Lesser than 20,000 RMB	89 (63.12)	38 (48.10)		
Medical Insurance (n, %)				
Yes	37 (26.24)	64 (81.01)	61.166	<0.001
No	104 (73.76)	15 (18.99)		
Smoking (n, %)				
Yes	81 (57.45)	48 (60.76)	0.229	0.632
No	60 (42.55)	31 (39.24)		
Drinking (n, %)				
Yes	73 (51.77)	39 (49.37)	0.117	0.732
No	68 (48.23)	40 (50.63)		
Duration of Illness (n, %)				
3 years and above	79 (56.03)	44 (55.70)	0.002	0.962
Below 3 years	62 (43.97)	35 (44.30)		
Frequency of Seizures (n, %)				
4 times and above	83 (58.87)	31 (39.24)	7.810	0.005
Below 4 times	58 (41.13)	48 (60.76)		
Medication Status (n, %)				
2 or more	89 (63.12)	29 (36.71)	14.203	<0.001
Less than 2	52 (36.88)	50 (63.29)		

TABLE 2. Assignment of variable scores.

Factors	B	Assignment status
Occurrence of Low-Quality Sleep in Epileptic Patients	Y	Binary Variable: Occurred: Assigned 1; Not occurred: Assigned 0
Gender	X_1	Binary Variable: Male: Assigned 1; Female: Assigned 0
Annual Income Status	X_2	Binary Variable: Below 20,000: Assigned 1; 20,000 and above: Assigned 0
Medical Insurance	X_3	Binary Variable: None: Assigned 1; Available: Assigned 0
Frequency of Epileptic Seizures	X_4	Binary Variable: 4 times or more: Assigned 1; Less than 4 times: Assigned 0
Medication Status	X_5	Binary Variable: 2 or more types: Assigned 1; Less than 2 types: Assigned 0

TABLE 3. Regression analysis results.

Factors	β	Standard Error	Wald	p value	OR value	95% Confidence Interval for OR	
						Lower Bound	Upper Bound
Gender	0.890	0.378	5.551	0.018	2.434	1.161	5.102
Annual Income Status	0.780	0.370	4.447	0.035	2.181	1.057	4.501
Medical Insurance	2.669	0.391	46.651	<0.001	14.432	6.709	31.047
Frequency of Epileptic Seizures	1.047	0.376	7.739	0.005	2.850	1.363	5.961
Medication Status	0.881	0.360	5.981	0.014	2.413	1.191	4.887
Constant	−2.586	0.519	24.815	<0.001	0.075		

OR: Odds Ratio.

about the condition [7, 8]. As a result, the treatment of epilepsy patients may often be different due to their gender, education, employment status and marital status, which can create economic and psychological pressures that negatively affect their sleep quality [9]. Moreover, the episodic and recurrent nature of epilepsy can disrupt the circadian rhythm, further deteriorating sleep quality [10]. Clinical experience suggests that poor sleep quality can exacerbate the condition of epilepsy patients [11]. Therefore, addressing sleep quality among epilepsy patients is crucial for managing disease progression and improving quality of life. While some medical facilities have been providing psychological interventions to optimize treatments and adjust medications to alleviate sleep disturbances, there is still a lack of research on the differences in sleep quality and influencing factors between male and female epilepsy patients. To address this gap, our present study evaluated differences in sleep quality and its influencing factors across genders among epilepsy patients using general information surveys and the PSQI scale. The study results indicated that, among the 220 epilepsy patients surveyed, 141 had PSQI scores exceeding 10 points, which signifies poor sleep quality. The average PSQI score for male patients was 12.89 ± 3.13, while for female patients, it was 9.26 ± 2.60, and this difference was statistically significant ($t = 9.002$, $p < 0.001$), indicating that male epilepsy patients experienced poorer sleep quality compared to female epilepsy patients [12]. Additionally, significant differences were observed between the two groups with respect to gender, annual income, medical insurance, frequency of epilepsy episodes and medication status ($p < 0.05$).

According to our present research findings, male epilepsy patients exhibit significantly poorer sleep quality, reduced sleep efficiency and higher scores for common sleep disorders compared to female patients ($p < 0.05$). This disparity could be attributed to the greater responsibilities and obligations often shouldered by men, particularly in the context of family life and employment. In addition, men frequently face more substantial life pressures, such as the risk of job loss and increased economic burdens, which can adversely affect sleep quality [13]. Moreover, male patients often have narrower social networks, which limits their access to effective support channels and exacerbates life, work and psychological pressures, further compromising their sleep quality [14].

In this study, income level was also found to influence sleep disorders among epilepsy patients. This finding aligns with Wang Jinming's research on sleep quality and influencing factors in epilepsy patients. Specifically, an annual income below 20,000 RMB, which is marginally above the minimum living guarantee level, can increase economic pressure on male patients, leading to anxiety and depression that negatively impact sleep quality. For female patients, low income may affect living conditions and housing quality, making it challenging to address issues such as noise and lighting [15]. Furthermore, a limited and irregular diet can undermine disease management efforts and contribute to the development of sleep disorders. Lower incomes may confine epilepsy patients to substandard living conditions, where persistent issues like noise, inadequate lighting and irregular nutrition further impair disease control efforts and exacerbate sleep disorders [16].

Moreover, medical insurance is intended to mitigate economic losses associated with illness, share medical expenses, safeguard health and promote rational resource utilization. In this study, health insurance emerged as a significant factor influencing the sleep quality of epilepsy patients. The absence of health insurance may impose a greater economic burden on male epilepsy patients, who are often considered the primary earners in their families, and this economic strain can lead to negative emotions such as anxiety and worry over medical expenses, resulting in decreased sleep quality [17]. For female patients, the absence of health insurance can limit treatment options. Due to their increased sensitivity to health issues, this limitation often results in excessive psychological stress, leading to irregular, untimely and inconsistent medical consultations and treatment adjustments. Such delays in updating and adjusting the treatment plan can adversely affect disease management and, consequently, impair sleep quality. The lack of health insurance may also exacerbate economic burdens, increasing anxiety and worry, which further diminishes sleep quality.

In this study, recent seizure frequency was identified as a significant factor affecting the sleep quality of epilepsy patients. Domestic reports have indicated that the frequency of seizures is an independent risk factor for sleep problems in individuals with epilepsy. For male patients, seizures cause abnormal neuronal discharge in the brain, which impacts the neural centers responsible for sleep regulation and disrupts normal sleep patterns. Additionally, seizures can induce psychological stress, leading to excessive anxiety before bedtime.

Certain antiepileptic drugs may also have side effects that alter hormone levels, further exacerbating sleep disturbances [18]. In contrast, for female patients, hormonal fluctuations during the menstrual cycle can lead to increased seizure frequency. Women are also more susceptible to emotional and psychological factors, which can heighten anxiety and contribute to sleep disorders. Medication use is crucial for managing epilepsy; for example, phenytoin is used to treat tonic-clonic seizures, while lamotrigine controls various types of seizures [19]. Moreover, we found that taking two or more medications significantly influenced sleep quality in epilepsy patients. The reasons for this are multifaceted. The cumulative side effects of multiple medications may negatively impact sleep quality in both male and female patients. Antiepileptic drugs, which act on the nervous system to control seizures, can interact in ways that intensify their effects on the nervous system. Additionally, hormonal fluctuations in female patients related to the menstrual cycle may further contribute to sleep disturbances. The intake of various medications also increases the metabolic burden on the body, with drug residues and the overtaxed functions of the liver and kidneys potentially compromising normal physiological functions and reducing sleep quality [20].

This study had some limitations that should be acknowledged, such as the relatively small sample size, insufficient consideration of all influencing factors, and a lack of long-term follow-up research. Further research is required to address these issues and validate our findings.

5. Conclusions

In conclusion, male epilepsy patients were found to have poorer sleep quality compared to female patients. Factors influencing sleep quality among epilepsy patients include gender, annual income, health insurance, seizure frequency and medication adherence. For male patients, these factors primarily affect social functioning and secondarily impact hormonal fluctuations. In contrast, for female patients, these factors mainly influence psychological state and hormonal fluctuations, with secondary effects on social functioning and economic pressure. To improve sleep quality among epilepsy patients, personalized diagnosis and treatment plans should be developed based on gender differences. Encouraging timely and regular follow-up appointments, adherence to prescribed medications and appropriate psychological counseling can significantly enhance sleep quality. Additionally, it could be recommended that party committees, governments and medical institutions intensify efforts to raise awareness about epilepsy, implement relevant assistance policies, promote employment opportunities for epilepsy patients, safeguard their treatment rights, reduce seizure frequency and effectively manage the condition.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

WWH and HQX—designed the study and carried them out; prepared the manuscript for publication and reviewed the draft of the manuscript. WWH, HQX, YYC, ZQ and JZ—supervised the data collection. WWH, HQX, YYC and ZQ—analyzed the data. WWH, HQX, YYC and JS—interpreted the data. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of Xuzhou Central Hospital (Approval no. XZXY-LJ-20210303-026). Written informed consent was obtained from a legally authorized representative for anonymized patient information to be published in this article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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