

Relationship of epileptic seizures with lunar cycle and seasons

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Abstract

Background and objectives: Various factors facilitate seizures in patients with epilepsy. The relationship between the phases of the moon and neuropsychiatric conditions has been a matter of curiosity. The present study investigated whether patient presentations to the emergency department with epileptic seizures vary according to the phases of the moon, seasons, and daily air temperature.

Materials and method: The study retrospectively included patients who presented to the emergency department with epileptic seizures over a one-year period. Patients with provoked seizures (head trauma, intracranial hemorrhage, etc.), pregnant women, and patients aged under 18 years were excluded. Patients' age, gender, date and time of presentation to the emergency department were recorded. The effects of the phases of the moon and seasons on these presentations were investigated.

Results: Total 255 patients (176 male, 79 female) met the inclusion criteria of the study. The majority of patients (67.1%) were aged 18-44 years. Majority of the patients (41.2%) did not previously used epileptic medication. The laboratory tests showed that the mean blood pH and lactate values were 7.31 ± 0.11 and 4.59 ± 4.12 mmol/L respectively. No statistically significant ($p > 0.05$) relationship was observed regarding frequency of presentations of epileptic seizures and the season and phases of the moon.

Conclusion: The results of this study showed that the phases of the moon, air temperature, and seasons did not affect the frequency of epileptic seizures.

Introduction

Epilepsy is a dysfunction in the brain's neuronal activity that can develop abnormally, suddenly, and synchronously. Depending on the underlying cause, epileptic seizures are divided into two groups: primary and secondary. Additionally, epileptic seizures are classified as generalized or partial according to the nature of the seizure [1]. Epileptic seizures constitute a significant portion of patient presentations to the emergency department. It has been reported that 5% of emergency calls are due to epileptic seizures [2].

Sleep deprivation, alcohol intake, not taking prescribed medication, and bright lights have previously been reported as factors that facilitate seizures in patients with epilepsy [3]. However, there are different views concerning the increase in the frequency of seizures according to the phases of the moon [4,5]. In addition, the relationship between the phases of the moon and neuropsychiatric conditions has been a matter of curiosity for every society [6]. The relationship between the phases of the moon and various diseases, including psychiatric disorders, cardiac

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disorders, epileptic seizures, and stroke, has been examined. Nevertheless, there is not yet a definitive consensus on the effect of the phases of the moon on occurrence of epileptic seizures [7,8]. There are patients claiming that their seizures are predictably triggered or exacerbated by the full moon, which is supported by previous studies in the literature [5]. In contrast, several researchers have found no relationship between the phases of the moon and epileptic seizures [4,9,10].

This study evaluated the demographic characteristics of patients who presented to the emergency department with primary generalized epileptic seizures and investigated whether frequency of epileptic seizures varied according to the phases of the moon.

Materials and methods

The study was approved by the local Ethics Committee (Number: 2022/9-10). Patients who presented to the emergency department with epileptic seizures over a one-year period from January 1, 2021, through December 31, 2021, were retrospectively identified from the hospital registry system using the diagnostic codes G.40 (epilepsy), G.40.8 (Other epilepsy and recurrent seizures), and G40.9 (Epilepsy, unspecified) [11]. Patients with reactive seizures due to head trauma, intracranial hemorrhage and other causes, pregnant women, and patients under 18 years of age were excluded from the study. The patients' presentation dates and times were recorded. Based on the date and time information, the phase of the moon during which each patient presented to the emergency department was determined using a website [12]. The presentations were grouped according to the phases of the moon: the new moon, the first quarter moon, the full moon, and the third quarter moon. The maximum and minimum values of air temperature for each presentation were obtained and recorded using a website [13]. The patients' demographic characteristics, presentation season, age, laboratory values, and medication used were recorded from the patient files.

Statistical analysis: The conformity of continuous data to the normal distribution was determined by the Kolmogorov-Smirnov test. Normally distributed data were analyzed by Student's t-test, and non-

normally distributed data were analyzed by the Mann-Whitney U test. The chi-square test was used to compare qualitative data. The Kruskal-Wallis test was performed to compare the data between the groups. P values of less than 0.05 were regarded as statistically significant. Analyses were performed on SPSS v. 21.0 software (IBM Corp. NY, USA)

Results

The study included a total of 255 patients of which 176 and 79 were men and women respectively. The majority of the patients (67.1%) were aged 18-44 years. Evaluation of the frequency of presentations with epileptic seizures according to the phases of the moon revealed that most patients (27.5%) presented to the emergency department during the full moon. According to seasons, the most frequent presentations were observed in winter (30.2%). Out of 255 cases, 41.2% patients did not use any epileptic medication previously (Table-1).

Table-1: Demographic characteristics and time of presentation of cases at the emergency department

Variables	Number	%
Gender		
Male	176	69
Female	79	31
Age (years)		
18-44	171	67.1
45-65	60	23.5
Over 65	24	9.4
Presented with epileptic seizures during:		
New moon	60	23.5
1st quarter moon	62	24.3
Full moon	70	27.5
3rd quarter moon	63	24.7
Presented with epileptic seizures during:		
Spring	55	21.6
Summer	57	22.4
Autumn	66	25.9
Winter	77	30.2
Epileptic drug use		
None	105	41.2
Single	96	37.6
Multiple	54	21.2

The laboratory parameters of the patients evaluated at the time of presentation to the emergency department showed that the mean blood pH, lactate and glucose values were 7.3 ± 0.1 , 4.6 ± 4.1 mmol/L and 138 ± 68.3 mg/dl respectively. The other laboratory parameters were within the normal ranges (Table-2).

No significant difference was found in the frequency of epileptic presentations among the age groups ($p > 0.05$). Concerning the gender evaluation, the highest rate of female patient presentations was seen during the new moon phase (30.4%), and the highest rate of male patient presentations occurred during the full moon phase (27.3%). No statistically significant difference ($p > 0.05$) was observed. The evaluation of presentations with epileptic seizures according to seasons revealed the highest frequency for winter, with a higher number of presentations being made during the new moon and full moon phases in this seasons, albeit with no statistically significant difference ($p > 0.05$). The lactate level was > 2 mmol/L in 74.3% (133/179) of the cases and did not significantly differ according to the phases of the moon ($p > 0.05$). The use of multiple epileptic drugs

was highest during the new moon phase, and that of single medication was highest during the third quarter of moon. Epileptic drug use did not exhibit a statistically significant difference according to the phases of the moon ($p > 0.05$) (Table-3).

Table-2: Laboratory parameters and air temperature at the time of presentation of cases to the emergency department

Variables	Mean \pm SD
Lactate (mmol/L)	4.6 ± 4.1
pH	7.3 ± 0.1
pCO ₂	44.2 ± 11.1
WBC count ($\times 10^9$ /L)	9.6 ± 4
Hemoglobin (g/dL)	13.4 ± 2.2
Platelet count ($\times 10^9$ /L)	251 ± 87
Glucose (mg/dl)	138 ± 68.3
CK (U/L)	142.4 ± 118.7
Temperature (°C)	
Maximum	22.9 ± 11.1
Minimum	11.4 ± 8.8

Note: pCO₂: partial pressure of carbon dioxide, WBC: white blood cell, CK: creatine kinase

Table-3: Evaluation of variables of study cases according to the phases of the moon

Variables	Total n	New moon n (%)	1st quarter moon n (%)	Full moon n (%)	3rd quarter moon n (%)	p-value
Age (years)						
18-44	171	44 (25.7)	43 (25.1)	47 (27.5)	37 (21.6)	ns
45-65	60	12 (20)	15 (25)	17 (28.3)	16 (26.7)	
>65	24	4 (16.7)	4 (16.7)	6 (25)	10 (41.7)	
Gender						
Female	79	24 (30.4)	17 (21.5)	22 (27.8)	16 (20.3)	ns
Male	176	36 (20.5)	45 (25.6)	48 (27.3)	47 (26.7)	
Presented during:						
Winter	77	21 (27.3)	20 (26)	21 (27.3)	15 (19.5)	ns
Spring	55	14 (25.5)	12 (21.8)	16 (29.1)	13 (23.6)	
Summer	57	12 (21.1)	13 (22.8)	11 (19.3)	21 (36.8)	
Autumn	66	13 (19.7)	17 (25.8)	22 (33.3)	14 (21.2)	
Epileptic drug use						
None	105	23 (21.9)	25 (23.8)	32 (30.5)	25 (23.8)	ns
Single	96	21 (21.9)	23 (24)	25 (26)	27 (28.1)	
Multiple	54	16 (29.6)	14 (25.9)	13 (24.1)	11 (20.4)	
Lactate level (mmol/L) *						
≤ 2	46	9 (19.6)	10 (21.7)	15 (32.6)	12 (26.1)	ns
> 2	133	32 (24.1)	35 (26.3)	31 (23.3)	35 (26.3)	

Note: *Lactate was measured in 179 cases; ns = not significant ($p > 0.05$)

Discussion

Neuropsychiatric interactions with the phases of the moon have been a subject of curiosity for many years. A review of the studies on neurological and psychiatric conditions reveals no relationship between the phases of the moon and aggressive behavior [9] or psychiatric admissions [10]. Similar to our study, Wang et al. [4] did not find a relationship between the phases of the moon and epileptic seizures. In contrast, Polychronopoulos et al. [5] reported an increase in emergency department presentations due to seizures during the full moon phase. In our study, no relationship was found between the phases of the moon and epileptic seizures.

There are many causes for high lactate levels. Lactate is produced by most tissues in the human body, with the highest production level found in muscles [14]. The relationship between the lactate level and epileptic seizures has not previously been examined. It is possible that the lactate level increases due to contraction and hypo-oxygenation of tissues during an epileptic seizure. The blood lactate levels of our patients were found to be high.

Concerning the relationship between seasons and epileptic seizures, it has been reported that a multifactorial mechanism may be involved and that seasons do not have a direct effect on occurrence of epileptic seizures. However, it has also been stated that body temperature is directly related to brain damage and seizures [15]. Although we observed a higher rate of presentations to the emergency department with epileptic seizures during the winter months, this did not reach a statistically significant level.

The results of this study showed that the phases of the moon, air temperature, and seasons did not affect the frequency of epileptic seizures.

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