

Seasonal clustering in epilepsy

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Abstract

Objective: There are few studies in the literature suggesting that epileptic attacks can cluster especially in winter. We aimed to confirm the most frequent month and season in which our patients with epilepsy visited the emergency room because we had similar observations in our clinical experience.

Material and Methods: Patients admitted to the emergency room due to convulsive epileptic seizures between January 2017 and December 2019 were included in the study. The month of seizures was recorded.

Results: In our study, epileptic seizures clustered significantly in winter.

Conclusion: Although more detailed data should be collected on this subject, we think this is an indirect result of the change in vitamin D metabolism, as suggested in other studies.

Keywords: epileptic cluster; seasonality; human seasonality

Introduction

Seasonal clustering can be seen in many systemic diseases. Although in infectious diseases, the reason of seasonality is easily understood, various reasons are speculated when it comes to psychiatric diseases, coronary artery diseases, ischemic and hemorrhagic stroke, and even for some oncologic diseases (1-5). There are few studies in the literature suggesting that epileptic attacks can cluster, especially in winter (6,7). Studies on seasons and epilepsy are not just about seasonal clustering; there are several studies emphasizing etiologic implications of epilepsy in terms of season of birth, and circadian and seasonal variation of the first febrile seizure and infantile spasm (8-12).

In our own clinical experience, we observed that the number of epileptic attacks was higher in the winter season. We aimed to achieve significant results by converting our observation to quantitative values.

Material and methods

Demographic and medical information of patients

This is a descriptive single-center study conducted in our adult neurology and emergency departments. Patients who were admitted to the emergency room for convulsive epileptic seizures between January 2017 and December 2019 were included in the study. In the retrospective design of the study, the medical history of all patients was investigated, and whether they used antiepileptic drugs and vitamin D supplements, epilepsy follow-up years, and demographic information were recorded.

All patients were using antiepileptic drugs. None of the patients were receiving vitamin D supplements.

Patients aged under 18 years, and patients with suspected pseudo-seizures and incomplete medical data were not included in the study. The month in which the patients had a seizure was noted. The annual data were divided into four seasonal periods (December to February, March to May, June to August, and September to November).

Statistical analysis

The data are expressed in the form of mean, standard deviation, minimum and maximum values and percentages. One-way analysis of variance (ANOVA) was used to show the difference of the number of epileptic seizures according to the seasons statistically.

Results

In the 36-month period between January 2017 and December 2019, a total of 194 seizures of 82 patients who were admitted to the emergency department with convulsive epileptic seizures were distributed by months.

Forty-five female and 37 male patients were included in the study. The ages of the patients were between 18-90 years and the mean age was 47.52 years. The mean follow-up for epilepsy was 9.7 (range, 1-45) years. The most visited month due to epileptic seizures was December (n=25), and the least visited month was July (n=10) (Graph 1).

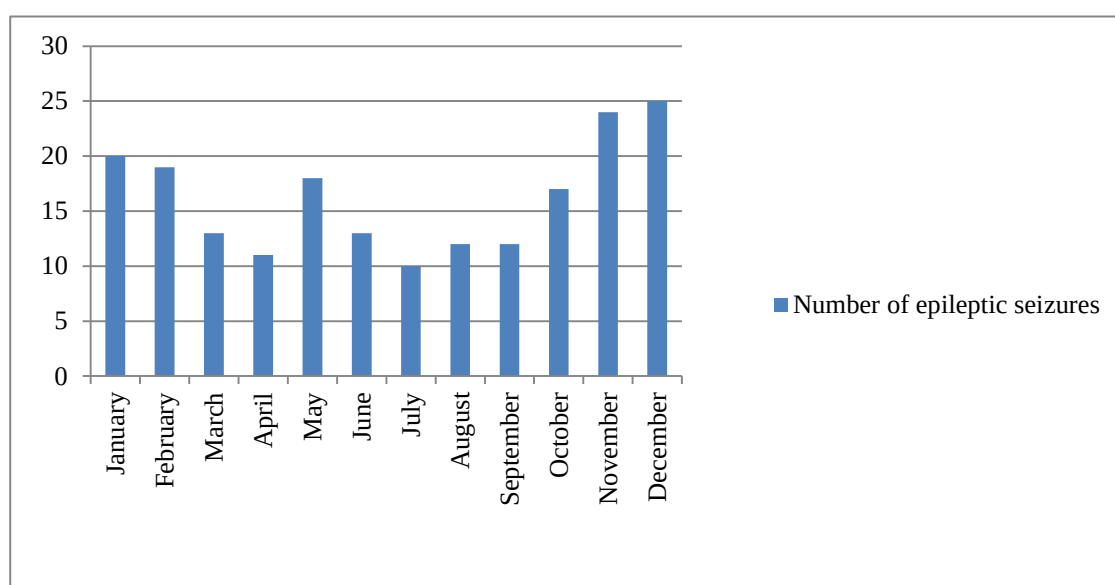


When seizures were analyzed according to seasonal distribution, the least frequent season in which epileptic seizures were seen was summer (n=35), followed by spring (n=42) and autumn (n=53). The most frequent season in which epileptic seizures were seen was winter (n=64). The comparison of the number of seizures experienced by patients with epilepsy during the 36-month period by season was statistically interpreted. Accordingly, the average number of seizures of the patients according to the seasons in this period was as following; 12.67 ± 1.5 in the spring, 10.33 ± 2.1 in the summer, 17.67 ± 6 in the autumn, and 21.67 ± 3.8 in the winter (Table 1).

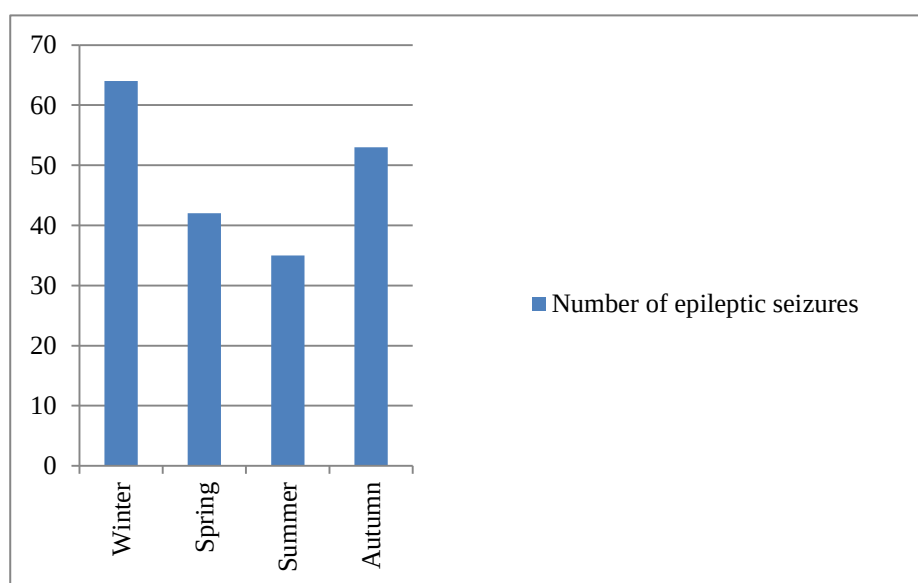
The number of epileptic seizures experienced by the patients showed a statistically significant difference according to the seasons (one-way ANOVA; $p < 0.05$). This distinctness arises from the difference in number of epileptic seizures between summer and winter ($p = 0.026$; Tukey arrangement). As can be clearly assessed in Graph 2, the number of epileptic seizures experienced in the winter season was considerably higher than in the summer season, both numerically and statistically.

Table 1: Average number of seizures of the patients according to the seasons.

	Spring	Summer	Autumn	Winter	P Value
Seizure frequency Mean $\pm$ SD	12.67 ± 1.5	10.33 ± 2.1	17.67 ± 6	21.67 ± 3.8	Winter-Summer $p = 0.026$
One-way ANOVA; $p < 0.05$					



Graph 1. Distribution of epileptic seizures by months



Graph 2. Distribution of epileptic seizures by seasons (winter: December to February, spring: March to May, summer: June to August, autumn: September to November).

There are quite a few studies examining the relationship of epilepsy with seasons. In our study, similar to previous studies, it was found that epileptic seizures were more common in winter season.

While the seizure numbers showed a significant peak in December and a nadir in June in our study, similar results were obtained in January and August in the study of Clemens et al. (6). Procapia et al. presented a number of studies suggesting differences in the seasonality of birth between patients with epilepsy and the general population, which confirmed that births in summer and winter months were related with high incidence of epilepsy. All three studies seemed to confirm the existence of an etiological factor for epilepsy with a seasonal presence in the environment causing disruption of neurodevelopment in the perinatal period (8-10). In 1988, Danesi showed a higher incidence of photo paroxysmal discharges in winter compared to other seasons, suggesting higher cerebral neuronal excitability (13). In the studies of Scorza and Bell, sudden unexpected death due to epilepsy was more common in winter (14-16).

While many studies confirm the relationship between low vitamin D and epilepsy patients, there are possible theories regarding the role of vitamin D deficiency in the etiopathogenesis of epilepsy (17). Vitamin D directly reduces neuronal hyperexcitability, interacts with GABA-A receptors in the brain and maintains the expression of the neuromediator genes involved in neurotransmission (18,19)

In our study, the difference in the number of epileptic seizures between July and December (10 vs 25), and the difference between summer and winter (35 vs 64, $p = 0.026$) are very significant. According to our results, the accumulation of epileptic seizures in the winter season compatible with the literature.

As our study is a retrospective study and there is no definite record of other factors that may affect the frequency of seizures in our study. Fever, bacterial and viral infections, multiple antiviral and antibiotic drug use are other factors that may increase the frequency of epileptic seizures in winter. This is the most obvious limitation of our study.

Conclusion

In conclusion, epileptic seizures are significantly cumulating in winter in our study. Although more detailed data should be collected on this subject, we think that this is an indirect result of the change in vitamin D metabolism, as suggested in other studies.

Conflict of Interest: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors have no independent disclosures or conflicts of interest.

Author's Contributions: MAU: concept, design, literature search, data analysis, manuscript preparation, manuscript editing and manuscript review; MMA: manuscript review, statistical analysis, YO: data acquisition, data analysis

References

1. Lukmanji A, Williams JVA, Bulloch AGM, Patten SB. Seasonal variation in specific depressive symptoms: A population-based study. *J Affect Disord.* 2019; 261: 153-159.
2. Levin RK, Katz M, Saldiva PHN, Caixeta A, Franken M, Pereira C, et al. Increased hospitalizations for decompensated heart failure and acute myocardial infarction during mild winters: A seven-year experience in the public health system of the largest city in Latin America. *PLoS ONE* 2018;13(1)
3. Sipilä JO, Ruuskanen JO, Kauko T, Rautava P, Kytö V. Seasonality of stroke in Finland *Ann Med.* 2017; Jun;49(4):310-318.
4. Telman G, Sviri GE, Sprecher E, Amsalem Y, Avizov R. Seasonal variation in spontaneous intracerebral hemorrhage in northern Israel. *Chronobiol Int.* 2017;34(5):563-570.
5. Calip GS, McDougall JA, Wheldon MC, Li CI, De Roos AJ. Evaluation of seasonality in the diagnosis of acute myeloid leukaemia among adults in the United States, 1992-2008. *Br J Haematol.* 2013;160(3):343-350.
6. Clemens Z, Holló A, Kelemen A, Rásonyi G, Fabó D, Halasz Peter, et al. Seasonality in Epileptic Seizures. *J Neurol Transl Neurosci* 2013; 1: 1016
7. Baxendale S. Seeing the light? Seizures and sunlight. *Epilepsy Res.*2009; 84: 72-76.
8. Procopio M, Marriott PK, Williams P. Season of birth: aetiological implications for epilepsy. *Seizure.* 1997; 6: 99-105.
9. Procopio M, Marriott PK. Seasonality of birth in epilepsy: a Danish study. *Acta Neurol Scand.* 1998; 98: 297-301.
10. Procopio M, Marriott PK, Davies RJ. Seasonality of birth in epilepsy: a Southern Hemisphere study. *Seizure.* 2006; 15: 17-21.
11. Manfredini R, Vergine G, Boari B, Faggioli R, Borgna-Pignatti C. Circadian and seasonal variation of first febrile seizures. *J Pediatr.*2004; 145: 838-839.
12. Cortez MA, Burnham WM, Hwang PA. Infantile spasms: seasonal onset differences and zeitgebers. *Pediatr Neurol.* 1997; 16: 220-224.
13. Danesi MA. Seasonal variation in the incidence of photoparoxysmal discharges among patients investigated after a single seizure. *J Neurol Neurosurg Psychiatry.* 1989; 52: 799.
14. Scorza FA, de Albuquerque M, Arida RM, Cavalheiro EA. Sudden unexpected death in epilepsy: are winter temperatures a new potential risk factor? *Epilepsy Behav* 2007;10: 509– 510.
15. Scorza FA, Terra VC, Arida RM, Scorza CA, Cavalheiro EA. Sudden unexpected death in epilepsy and winter temperatures: it's important to know that it's c-c-c-c-cold outside. *Epilepsy Behav* 2009; 14: 707.
16. Bell GS, Peacock JL, Sander JW. Seasonality as a risk factor for sudden unexpected death in epilepsy: a study in a large cohort. *Epilepsia.*2010; 51: 773-776.
17. Samaniego EA, Sheth RD. Bone consequences of epilepsy and antiepileptic medications. *Semin Pediatr Neurol* 2007; 14:196-200.
18. DeLuca GC, Kimball SM, Kolasinski J, et al. Review: the role of vitamin D in nervous system health and disease. *Neuropathol Appl Neurobiol* 2013; 39:458-484.
19. Sonmez FM, Donmez A, Namuslu M, et al. Vitamin D Deficiency in children with newly diagnosed idiopathic epilepsy. *J Child Neurol* 2015; 30:1428-1432.