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Seizure-Precipitating Factors in Relation to medical Recommendations: Especially Those Limiting Physical Activity

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Abstract

Identification of factors precipitating epileptic seizures should always have practical implications and should always result in special recommendations given to patients. The purpose of our study is to analyze the relation between seizure-triggering factors and restrictive recommendations involving limitation of physical activity in particular. The research group consisted of 407 children hospitalized due to seizures. Their precipitants were identified in 27.5% of the patients. The most common included infection/fever, stress, and flashing lights. Although sport was documented as a precipitant in only 3.4% of all children, 8.1% of the investigated group were recommended to limit physical activity. As some episodes of epileptic seizures are reported to be provoked by sport, multiple restrictions are imposed on children. In the light of the worldwide academic literature and the present study, the recommendation of limiting sports activity is no longer supported.

Keywords

epilepsy in children, sport limitation in epilepsy, seizures in children, precipitation of seizures

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Epilepsy is a chronic disease characterized by unprovoked seizures. Nevertheless, it is widely known that some seizures may be provoked.[1] According to Aird, more than 40 endogenous and environmental precipitating factors have been reported in academic literature.[2] When identified, they may have practical implications in special recommendations given to patients. But in most cases, it is not the presence of seizure precipitants, but excessive concern about the patient's safety that is the main reason to formulate such suggestions. As a result, patients, and children in particular, may be limited in their everyday activity not only because of the seizures but also because of restrictive recommendations given by their doctors.

The aim of the study was to explore the frequency and nature of seizure-provoking factors in patients with epileptic seizures hospitalized in our department. We were particularly interested in whether doing sports triggers convulsions. Our study also highlighted the aspect of reasonable formulation of medical recommendations, especially those limiting physical activity.

Materials and Methods

Over a 2-year period (from 2009 to 2010), 407 children were hospitalized at the Chair of Children and Adolescents' Neurology of the Jagiellonian University Medical College due to single or recurrent epileptic seizures. All patients were analyzed retrospectively. The data collected from hospital records included age, sex, diagnosis, result of neurologic examination, prescribed medications, factors triggering convulsions, and medical recommendations. Information on factors triggering convulsions was obtained from the patients or their relatives. Subsequently, it was recorded in the medical history by the doctor admitting the patient to the hospital. A question about seizure precipitants was a standard part of the protocol. To distinguish seizure triggers, the definition of Pierre Loiseau was used. Loiseau defined precipitant as circumstances that precede the beginning of an epileptic seizure and are considered by both the patient and the doctor to be a possible explanation as to why the seizure occurred.[3] Statistica 10.0 (Pearson χ^2 test) and Microsoft Excel 2010 were used for statistical analyses. $P < .05$ was considered statistically significant.

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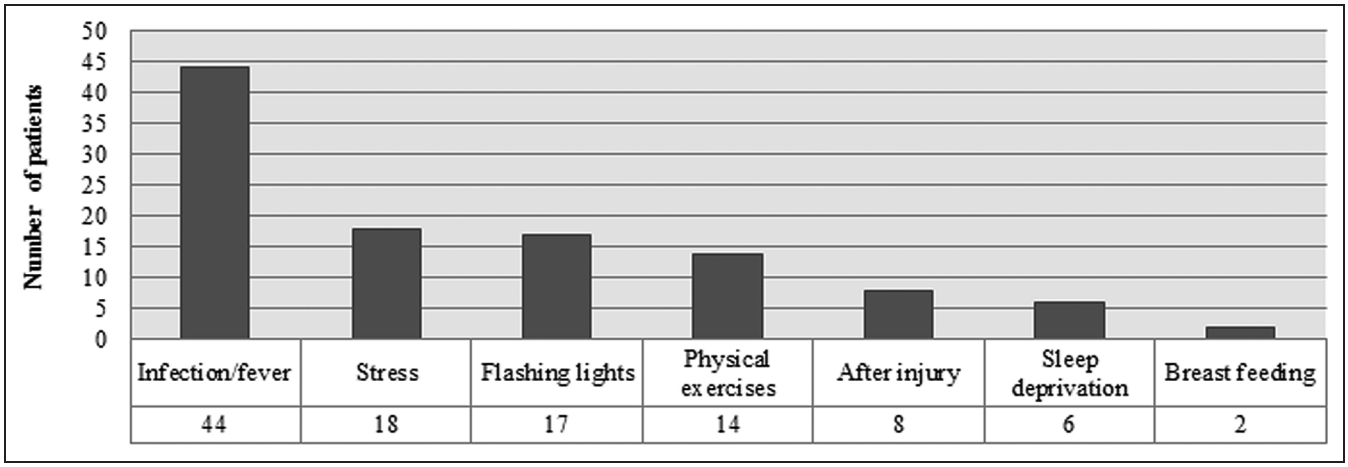

Figure 1. Distribution of seizure precipitants among children hospitalized in our department. As some subjects mentioned multiple precipitants, the total number of triggers exceeds the number of patients.

Results

Participants

A total of 407 patients aged between 1 month and 18 years (mean age = 7.3 years) were investigated. A slight female predominance was noticed, with 212 girls (52.1%) and 195 boys (47.9%) in the study group. A total of 253 children (62.2%) experienced a single seizure. Another 154 patients (37.8%) had a history of recurrent seizures. Fourteen participants (3.4%) were diagnosed with intractable epilepsy. None of the children in the study group had previous diagnosis of febrile seizures.

Seizure Precipitants and Special Recommendations

A total of 112 out of 407 children (27.5%) experienced at least 1 triggered seizure. The sample may be representative of the pediatric population in our region (approximately 5 500 000 inhabitants), as the first episode of seizure is a strong indication for hospital admission. In 76 children that experienced a single seizure (30%), a precipitant was named. In the group with recurrent seizures, 36 patients (23.3%) mentioned a provocative factor. The precipitants occurred statistically more often in patients aged 3 to 10 when compared to groups aged 1 to 2 and 11 to 18 ($P < .02$). There was no statistical difference for either gender ($P = .9$) or the number of seizures experienced (single or multiple) ($P = .14$). Figure 1 presents the distribution of precipitants in the study group. The most common were infection and fever (39%). Less common precipitants included psychological stress (16%) and flashing lights, for example, when using a computer, at a discotheque, or while motoring (15%). In 8 patients, seizure was noticed after trauma (most frequently after a head injury) and in another 6, it was associated with sleep deprivation.

Specific recommendations were given to 288 patients (70.1%). Continuous neurologic care was suggested most frequently, followed by pharmacological antiepileptic therapy and further diagnostic tests (Figure 2). Regular lifestyle recommended to some children included proper hours of sleep, regular meals, and limited exposure to stress.

Epilepsy and Physical Activity

In 14 of 407 patients (3.4%), physical activity was reported as a seizure-triggering factor. 33 patients (8.1%) were documented to have received a specific recommendation to avoid sport and other physical activities (Table 1). Only patients old enough to perform physical activity were included in the aforementioned groups, with the youngest child being 7 years old. None of those patients suffered from drug-resistant epilepsy. The maximal frequency of seizures was 4 per week in 1 child only. Of the 33 patients who were counseled to avoid sport and training permanently (even during physical education classes at school), it was only in 6 children that previous physical effort was believed to have triggered seizure ($P < .001$). Twenty-seven other patients (81.8%) received similar recommendation in spite of having seizures caused by other or undisclosed factors. In 2 of them, another reason for limiting physical activity could be identified (spasticity, limited neck movements). Permanent excuse from physical education was statistically more frequent over the age of 10 than in the group aged 3 to 10 ($P < .001$). It was recommended in both groups, both with single and recurrent seizures ($P = .8$). Gender differences were not significant ($P = .5$). In our group, there was no documented trauma resulting from seizure. According to doctors, recommendations were given in order to improve patients' safety.

Discussion

Seizure Precipitants

A seizure-precipitating factor is defined as a phenomenon preceding the onset of an epileptic attack, which is considered by both the patient and the physician to be an acceptable explanation for the seizure occurrence.[3] Although a high prevalence rate of precipitants in children with epilepsy is widely

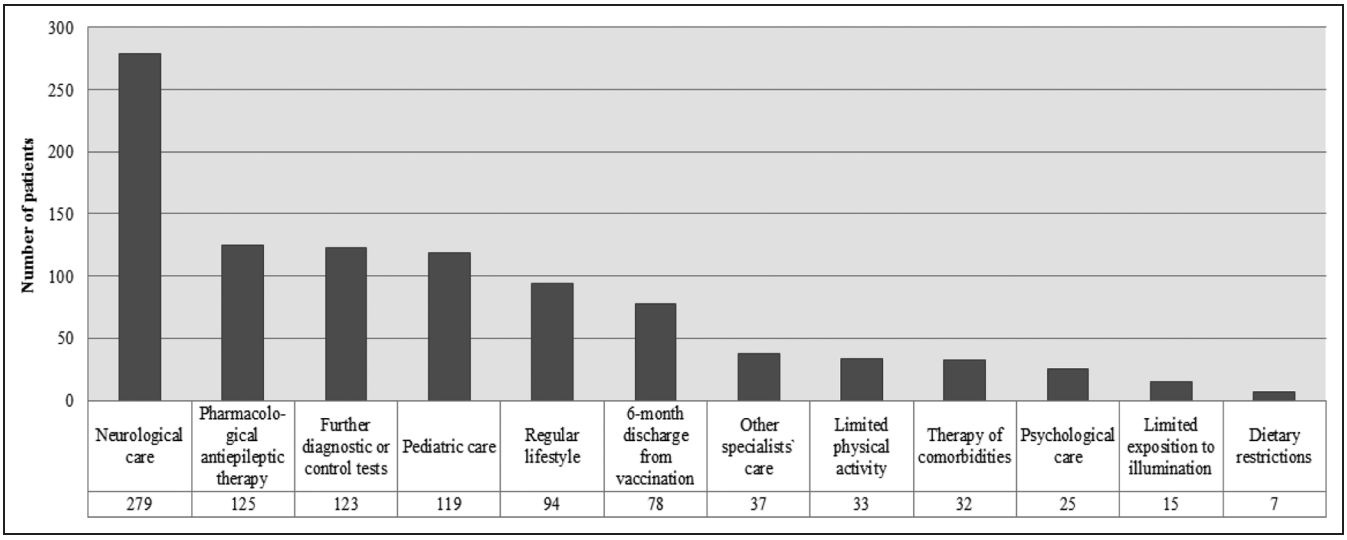

Figure 2. Distribution of medical recommendations among investigated patients. As some subjects were given multiple recommendations, their total number exceeds the number of patients. Regular lifestyle advised to some children included proper hours of sleep, regular meals, and diminished exposure to stress. Limited exposure to illumination meant avoidance of flashing lights, especially during excessive usage of a computer or in a discotheque.

Table 1. Relation Between Physical Activity as a Seizure Precipitant and Specific Recommendation to Avoid Sport Even During Physical Education at School.

	Seizures claimed to be precipitated by physical activity	Permanent excuse from physical education
Patients with recurrent seizures (n = 154; 100%)	5 (3.5%)	13 (8.4%)
Patients with a single seizure (n = 253; 100%)	9 (3.5%)	20 (7.9%)
Total	14	33

described in academic literature,[4-6] our series documented a relatively low occurrence of seizure precipitants (23.3%). The aforementioned difference may be attributed to various methodologies used in particular studies. Further, our results were similar to those published by Fang et al,[4] with illness or fever being the leading precipitant in the children examined. On the grounds of our experience, stress was the second most common factor followed by photostimulation and physical activity. Although the results are in line with those of Fang et al,[4] other authors associate stress rather with epilepsy in adults than in children.[7-10] This may be explained by a greater exposure to those factors in the grown-up population.

Epilepsy and Physical Activity

Our results correspond with academic literature reporting that sport may trigger seizures in as many as 3.1% of patients, as investigated in the multicenter study conducted by Nakken et al.[7] Papers by Frucht et al[10] and Pinikahana[11] reveal physical exertion as accountable for seizures in 0.5% and 16% of participants respectively. This disparity may be explained by the fact that Frucht et al and Pinikahana investigated groups of young adults only. Further data confirming the prevalence of physical exercise as a factor triggering seizures are limited.

The reason for seizures emerging in correspondence with physical exercise is metabolic acidosis.[1] Such seizures occur shortly after the exercise, not in the middle of it. Moreover, hyperventilation in response to exercise differs from the one in a resting patient, so epileptiform abnormality during hyperventilation in electroencephalography (EEG) may not predict the occurrence of seizure while exercising.[1] By contrast, some studies even suggest an elevation of the seizure threshold during aerobic exercises.[12] A recent article by Arida et al[13] discusses neuroprotective and antiepileptogenic effects of exercise on epilepsy. Interestingly, 7% of patients investigated by Spector et al[14] declared activity (eg, running or jumping) as a method of aborting seizures.

In view of aforementioned data, recommendations to avoid sports activity or to excuse children from physical education classes should be reconsidered. The attitude of health professionals toward patients with epilepsy and their participation in sports has been changing throughout history. It evolved from discouragement to participate in sports and physical education in 1968,[15] through permission to taking part in contact sports in 1974,[16] to permission to sport involvement if seizures well-controlled in 1983.[17] Up until now, only high-risk sports, such as scuba-diving, hang-gliding, and free climbing, are not recommended.[18] Unfortunately, as myth and stigma still enfold epilepsy, multiple restrictions are formulated because of fears of either injury during seizures or the possibility of exercise-induced seizure and subsequent injury. Our data and other studies indicate that this problem is still pressing.[19-26]

Only several studies on injury rates in pediatric population have been conducted so far. Nevertheless, on the basis of investigation performed on a group of pediatric epileptic patients, Kirsch et al[19] denied increased rates of injury in pediatric population with epilepsy. Those observations are confirmed by Appleton,[20] who reported that although 12.5% of the children examined experienced injury due to seizure, only 2% of them required medical help. Sports activities with proven increased risk of injury are swimming and bathing, but almost all deaths result from performing those sports without supervision.[21,22] Data provided by Wirrell[23] show that injuries result in only minor soft tissue wounds and bruises unrelated to physical activity itself. What is more, according to Van den Brock et al,[24] a great majority of injuries due to seizures are reported to occur at home, at work or in the street, not while exercising. In our group, only 18.2% of the children excused from physical education by a doctor reported physical activity to precipitate seizures. None of them reported any serious injury. This leads to the question of whether sports activity should be so strictly prohibited. A sibling-controlled study by Wong et al[25] found teens with epilepsy to be less active and less involved both in individual and team sports than their controls. Those children were also more likely to be potentially or actually overweight. It is documented in literature that physical fitness is significantly poorer in adult patients with childhood onset of epilepsy than in their controls. One third of patients do not exercise at all.[26] Although there are studies proving equal or even higher sport activity in the population of patients with epilepsy, they originate from highly developed countries and concern mostly adults. [27,28]

Despite evidence in favor of physical activity in children with epilepsy, limiting their physical fitness is still practiced. According to Carpay et al,[29] 83% of children with active epilepsy reported disability due to restrictions they received. Therefore, the risk of injury must be weighed against compelling evidence showing that the fewer restrictions are given to patients, the more independent and fitter they are and less stigmatized they feel. To propagate the idea, the International League Against Epilepsy Executive Committee has defined priorities. Their purpose is to educate health professionals, health authorities, social workers, and sports instructors about the benefits of physical activity for people with epilepsy.[30]

There are still no data on doing professional sport while suffering from epilepsy. All of the above information and our observations concern recreational and amateur sport only.

The data on which this study is based have several limitations. As it is a retrospective study, some of the data were unavailable or incomplete, which resulted in the exclusion of a few patients. Data concerning seizure precipitants were obtained from the patients' parents or from the patients themselves, which means it is subjective in nature. This resulted in limitations in the evaluation of the results. Furthermore, the sample was heterogeneous, comprising single and recurrent seizures. The latter may admittedly diminish the value of the study, but it was decided that the results could in any case be of great value for practicing pediatricians.

Conclusions

In line with much more tolerant recommendations of the American Medical Association, the American Academy of Pediatrics, and the International League Against Epilepsy, as supported by the results of our study, children should not be excused from physical education classes only because of having epilepsy. Furthermore, they should be permitted and encouraged to be physically active, in order to avoid isolation and stigma, as well as to prevent them from obesity and other consequences of a sedentary lifestyle.

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Author Contributions

Preparation of the manuscript was completed by (in order of contribution) AS, EW, EK, and KK. Mentors who contributed equally to this work are AG and MK.

Declaration of Conflicting Interests

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Ethical Approval

This being a retrospective analysis, it requires no agreement of bioethical community. Material used in the study came from medical documentation.

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