A MINIREVIEW ABOUT SPORTING PRACTICE IN EPILEPTIC CHILDREN

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ABSTRACT

Movement is important for neuropsycho-physical development, ensuring the correct growth and giving many benefits from childhood to adulthood. Motor activity plays a pivotal role in psychological, educational and social terms: sport practice induces harmonious physical development with common important benefits independently from sport type and each sport imposes rules respect that children learns to know and respect step by step improving the social skills and cognitive abilities. Sport has a very important role in the growth of children and adolescents. Sport and physical activity work as a moral laboratory to practice decision-making and problem-solving skills, as well as teamwork and cooperation. In many pathological conditions, the sport practice is strongly discouraged, as in epileptic patients for the negative consequences on their physical condition and psychic. In general, several studies reported that physical activity has positive influence on seizure frequency and severity. As a result, attitudes regarding sports and epilepsy have changed considerably in the last decades and presently, the risk of convulsive seizures during sports practice is minimal in case of well-managed epilepsy. Evaluating the control of convulsive disease is therefore a key point to allow sports in the children and adolescents.

Keywords*: exercise, synaptic-plasticity, hippocampus, epilepsy.*

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Introduction

Movement is important for neuropsycho-physical development, ensuring the correct growth and giving many benefits from childhood to adulthood. In general, motor activity plays a pivotal role in psychological, educational and social terms. Certainly, sport practice induces harmonious physical development with common important benefits independently from sport type. On the other hand, each sport imposes rules respect that children learns to know and respect step by step improving the social skills and cognitive abilities, because regular physical exercise has been demonstrated to beneficially effect neural health and function and reduce the risk of various neurological diseases.

Rodent studies demonstrate that exercise improved spatial learning and memory co-occurring with changes in hippocampal plasticity, including increased neurogenesis, enhanced long-term potentiation (LTP), and elevated expression of brain-derived neurotrophic factors (BDNF). BDNF seems to play a prominent role in the survival, growth, and maintenance of neurons during development and modulation of synaptic-plasticity in the adult brain. Also reelin, an extracellular glycoprotein, seems to be crucially important in the developmental organization of neurons in the brain, mainly expressed in interneurons residing primarily in the hilar region of dentate gyrus, and in the molecular stratum lacunosum- layer of hippocampus[1-25].

Epilepsy is a common and prevalent neurologic disease found in 2% of the population, affecting people of all ages and characterized by a predisposition to promote seizures as well as neurobiological, psychological, cognitive, and social consequences. Due to their condition, patients with epilepsy may develop other medical problems such as heart disease, cognitive decline or dementia, insulin resistance, obesity, atherosclerosis, internalizing problems such as anxiety and depression. Commonly, individuals with epilepsy tend to have a sedentary lifestyle which leads to poor physical fitness.

Consequently, individuals with epilepsy have low levels of maximal oxygen uptake and cardiorespiratory fitness and poor levels of strength and flexibility. The lower aerobic fitness observed in people with epilepsy may be associated with their sedentary habits. Physical activity should be encouraged in this group, as previous studies have reported a number of positive effects of physical exercise in people with epilepsy. However, the correct management and prescription of physical exercise programs in epilepsy patients depends on health professionals' knowledge[26-30].

Regular physical exercise, when prescribed at the correct dose and type, can promote quality of life and well-being, improve cardiovascular fitness and strength, increase maximal aerobic capacity, elevate work capacity, promote weight and body fat reduction, and help in the management of seizure frequency. Taken together, this broad body of evidence indicates that patients with epilepsy should be encouraged to practice regular physical exercise, as this is beneficial for their health and does not exacerbate seizure frequency.

In this light, sporting activities can be the right time for the child development, while training and working-out allows the child to mature skills and social abilities[31-35]. Sport practice means also understanding the importance of training and constancy: even the most troublesome children or those who feel less wary than their comrades will be able to achieve brilliant results thanks to their training. This will help them understand that they can achieve goals that they would not have imagined at first, even in other contexts. Furthermore, team sports do not allow children to be selfish, enhancing mainly the social skills. Sport has a very important role in the growth of children and adolescents. Sport and physical activity work as a moral laboratory to practice decision-making and problem-solving skills, as well as teamwork and cooperation. In fact, many studies explored the possibility of teaching life skills in the contest of sport and physical activity programs[33-37].

Particularly, sporting can improve four areas of life skills:

• playing well, referring to skills that deal with being more physically active, improving levels of sport skills and enjoying physical activities and sport;

• connecting well, referring to work with and for other people, learning the importance of caring for others;

• coping well that refers to the life skill required to deal with stress, problems or conflicts in a constructive way, -dreaming well, that refers to skill related to exploring future lives and setting specific goals to achieve a future dreams.

Despite of all these advantages and benefits derived by regular physical activity, in many pathological conditions, the sport practice is strongly discouraged, as in epileptic patients. The relationship between epilepsy and physical exercise is debated. In the past the epileptic children was discouraged by sporting activities with negative consequences on their physical condition (less stress resistance, Increased body mass index, Increased cardiovascular risk) and psychic (isolation, reduced self- But, anxiety, depression)[38-43].

On the other hand, we have to consider the presence of many precipitating factors in children and adolescents affected by epilepsy during the sport practice. Potentially, many seizure precipitating factors exist in relation to physical exercise, fatigue, stress, repeated head injury during contact sports, excessive aerobic exercise, hyperventilation,

changes in the metabolism of antiepileptic drugs (AEDs), and ionic/metabolic disturbances[44-50]. In general, seizures seem to rarely be triggered by physical activity. In a study encompassing 400 PWE, only two were able to identify physical activity as a precipitant. No link has been established between post exercise fatigue and increased seizure frequency. Stress has been identified as a seizure trigger in a considerable number of patients, suggesting that intense athletic activity may increase seizures. In addition, physical stress and neurosteroids appear to be linked in epilepsy. In response to stress induced by physical exercise, it has been demonstrated, both in human and animal models, that the activation of the hypothalamic-pituitary-adrenal axis affects adrenal steroids and neurosteroids and increases the seizure susceptibility. However, the same stress may also activate hypothalamic corticotrophin-releasing hormone, which in turn stimulates deoxycorticosterone production in the adrenal gland. Increased levels of allotetrahydrodeoxycorticosterone synthesized in the liver and brain by circulating deoxycorticoster- one activates GABAA receptors in certain brain regions, with decreased seizure susceptibility[51-60].

Further studies are needed to elucidate the exact role of the physical stress in the control of seizures. It is well known that hyperventilation at rest triggers absence seizures; therefore one might assume that the same would apply during exercise. However during exercise, hyperventilation is a physiological response to an increased metabolic demand, a compensatory response to prevent hypercapnia. On the other hand, resting hyperventilation leads to hypocapnia and vasocon-striction. Furthermore, exercise-induced hyperventilation, as an adaptive reaction to acidosis, may even produce suppression of interictal abnormalities[61-65].

Therefore, hyperventilation during exercise appears to deter seizure onset. Exercise is thought to increase liver-enzyme metabolism and so could also increase the metabolism of several AEDs, particularly the ''old generation'' ones. Greater drug clearance and competi-tion for protein (albumin) binding sites are factors that may account for a decrease in their serum levels. A prospective study on the effect of physical training on serum levels of AEDs, however, failed to show any correspondent decrease or abnormality of the metabolism rate[63-64].

Another study showed only slight variations in serum levels, especially for phenytoin (small decrease) and valproic acid and phenobarbital (small increase) between the exercise and pre-exercise periods, not statistically relevant and with no repercussion on seizure frequency, as it was a small sample conclusions must be drawn with caution[65-68].

Despite this contradictory evidence, we would only recommend checking serum levels of AEDs in PWE practicing sports when clinically indicated. Finally, hypoxia (mainly altitude-related), hyperhydration, hyperthermia, hypoglycemia and hyponatremia are all distur-bances linked to physical activity and known to trigger seizures, although, at least some of them, may correspond to acute symptomatic seizures. There are no studies showing a link between these metabolic disturbances and the increase of true epileptic seizures, nor that PWE are more susceptible to them than athletes without epilepsy.8 However, it is also true that robust studies have not yet been carried out[69-71].

The reasons that more were frequently adduced to justify the contraindication to the Physical exercise in the epileptic babies were numerous: for example, it was hypothesized that recurrent minor cranial traumas, induced by contact sports or collision, could worse generalized epilepsy.

Tonic-clonic seizures can cause unexpected falls and subjects suffering from epilepsy-absence, can have difficulties in mantaining balance, losing the ability to protect themselves while practicing contact sports (i.e. box, hockey and basket)[69-71].

Discussion

In general, several studies reported that physical activity has positive influence on seizure frequency and severity. As a result, attitudes regarding sports and epilepsy have changed considerably in the last decades and presently, the risk of convulsive seizures during sports practice is minimal in case of well-managed epilepsy. Evaluating the control of convulsive disease is therefore a key point to allow sports in the children and adolescents. In case of well-controlled epilepsy both team sports and contact or collision sports are allowed, with an appropriate equipment, educating both parents and coaches. These data are not applicable in subjects with epileptic encephalopathies or in case or not controlled seizures or pharmacoresistant epilepsy[72-75].

Patients with epilepsy who wish to participate in sports represent a challenging population to

counsel and manage because their condition puts them at risk for possibly life-threatening events; however, most of these risks are manageable. High-risk activities for this population include water sports and any water-related activity. The athlete with epilepsy who participates in such activities should have constant supervision by a responsible adult or a ''buddy'' who can provide immediate assistance and maximally reduce the risk of drowning, which is never negligible. The athlete's frequency of seizures is also a factor in determining whether his or her participation in high-risk activities is advisable. Patients with frequent seizures should be guided toward activities in which loss of consciousness or bodily control is not life threatening. Athletes with known seizure disorders have not been reported to exhibit a higher incidence of seizures in comparison with their baseline frequencies when they play contact sports.

Collision sports associated with a greater number of and more forceful impacts resulting in a higher rate of concussions may place the brain at risk of seizures secondary to the increase in excitatory neurotransmitters during the acute phase of the injury, as has been described in animal models of brain injury. Clinical experience to date demonstrates that low-impact injuries typically seen in most competitive sports do not put athletes with epilepsy at increased risk for seizures[76-81].

About the effects of AEDs in sporting practice by children affected by epilepsy, in general AEDs can slow mental processing, trigger physiologic changes, and cause imbalance and fatigue with reduced endurance, all of which negatively affect competitive performance. Consequently, athletes who notice these drops in performance may limit their compliance with these medications. Appetite can also be affected by the use of medications, with anorexia causing a diminution of adequate nutrition that affects strength and endurance and increases risk of seizures.

Carbamazepine and oxcarbazepine have been noted to cause hyponatremia, which may be compounded by excessive perspiration. 25Y28 careful monitoring is strongly encouraged when initiating medications and during increased physical training. Participation in organized sports provides many physical and psychological benefits for patients with epilepsy and can be safely incorporated into their lives. By providing appropriate education and encouragement, a neurologist can ensure that patients are properly equipped to make the right choices and manage any complications that occur while they are participating in activities.

In conclusion, physical exercise has a positive effect on epilepsy and is associated with reduced epileptiform discharges and increased seizure threshold, and seizures are unlikely to occur during incremental physical effort to exhaustion. These findings are strengthened by studies in animal models of seizures and epilepsy, in which aerobic exercise training was found to retard the epileptogenic process, to reduce seizure frequency, and to promote favorable plastic changes in the hippocampus[82-100].

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