Effects of Exercise on Hippocampus-entorhinal Cortex and EpilePsy After TBI

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Abstract:

Traumatic brain injury can lead to a series of cognitive deficits and dyskinesias, including hippocampal memory dysfunction and dyskinesia of the contralateral limb. Theta oscillation has been recognized to be involved in the memory storage and processing functions of people. Epilepsy is a neurological disorder characterized by frequent seizures and is believed to originate from abnormal electrical activity in the brain. Studies have found that moderate exercise has a protective effect on the brain and can promote recovery after brain injury. The protective effects of exercise include reducing the frequency of epileptic seizures and reducing the behavioral disorders of animals after brain injury. Exercise is related to the decrease of EEG epileptiform discharge and the increase of seizure threshold. In the study of epilepsy and epilepsy animal models, it is found that aerobic exercise training can delay the occurrence of epilepsy, reduce the frequency of seizures, and promote good plastic changes in the hippocampus. Therefore, this review focuses on the effects of exercise on the hippocampus-entorhinal cortex and seizures after brain injury, and provides a new perspective to clarify the neuroprotective effects of exercise.

Keywords:

TBI; Epilepsy; Exercise

Introduction:

Traumatic brain injury (TBI) is a major global health problem. The morbidity rate in developed countries is at least 200 per 100,000, and the mortality rate for severe TBI is 20-30%[1]. Many long-term cognitive, sensory, motor, and memory deficits after TBI are exacerbated by sensory processing defects. This hypothesis is put forward in the context of accumulated evidence in humans and animals. These evidences indicate that long-term recognition after traumatic brain injury Cognitive, sensory, motor and memory deficits may be caused by sensory processing defects[2]. People with epilepsy are often advised not to participate in sports and sports, mainly because of fear, overprotection, and ignorance of the specific benefits and risks associated with these activities. International Anti-Epilepsy League research has shown that physical exercise and active participation in physical activities, in addition to producing broader health and psychosocial benefits, may also have a beneficial effect on the control of epilepsy[3, 4].

1. The impact of the interaction between the hippocampus and the entorhinal cortex on brain function

Neural circuits in the hippocampus, the hippocampus area firings, and theta oscillations have been recognized as participating in human learning, memory, emotion, and social functions [5]. The entorhinal cortex (EC) is a ventromedial border area that receives a lot of information and edges. Direct input from the cortex, which in turn sends a wide range of output information to the same part of the cerebral cortex. It is a unique location that provides input to the hippocampus and then propagates the hippocampus output to the cortex[6].

1.1 Changes in local field potentials in the hippocampus and entorhinal cortex after TBI

Craniocerebral trauma can reduce theta frequency trigger, which is a neural trigger frequency, which is known to trigger in the rat hippocampus CA1 and in other frequency ranges, and plays an important role in memory[7-9].

Trimper et al. study showed that in rodent hippocampus, theta local potential (LFP) in the frequency range of θ (6-10 Hz), slow gamma (30-55 Hz) and fast gamma (65-90 Hz)) Oscillation is related to memory performance. Gamma intensity and coherence between regions differ between exploring novel, repetitive, and repositioned objects, and during exploration of novel objects, this correlates with whether the rat will subsequently show a good object position Memory is related[10].

1.2 The significance of exercise for improving brain function after TBI

Exercise is an important part of a healthy life. Evidence accumulated over the years has shown that low-to-moderate-intensity exercise for a certain period of time has a variety of beneficial effects on the body, including improving cardiovascular function[11],Regular exercise can promote a variety of brain fu nctions, and has preventive and therapeutic effects on oxidative st ress-related diseases[12].

2. Epilepsy

Epilepsy is a neurological disorder characterized by frequent seizures and is believed to originate from abnormal electrical activity in the brain. Although the etiology is unknown in most cases, epilepsy can be caused by genetic factors, head trauma, stroke, or infection within the nervous system[13].

Compared with the general population, patients with epilepsy have less physical activity. These include prejudice, overprotection, lack of awareness, fear of seizures, and lack of knowledge of health professionals. However, physical education (PA) has certain benefits in controlling epileptic seizures. Regular physical exercise may have a moderate effect on preventing epilepsy in 30-40% of patients, and in about 10% of patients, strenuous exercise may cause seizures. Among those who are prone to seizures caused by exercise, patients with poor physical health and symptomatic epilepsy account for the majority[14].

Experimental studies have shown that PA provides neuronal protection mechanisms, which are related to biochemical and structural changes, including the release of θ -endorphins and steroids, which may inhibit the occurrence of abnormal electrical activity in the brain. Epilepsy discharge can be reduced or disappeared during exercise, which may reduce the recurrence of epilepsy[15].

3. Conclusion

The results of clinical studies and animal experiments have proved that moderate exercise has a protective effect on the brain and can promote recovery after brain injury [16, 17].The protective effects of exercise include reducing the frequency of seizures and alleviating behavioral disorders in animals after brain injury [18];promoting the expression of brain-derived nerve growth factor[19]; promoting the plasticity of injured nerve circuits and tissues in the brain [17, 19, 20];Improve animal cognitive function[16].

Clinical and experimental studies have analyzed the effects of physical exercise on epilepsy. Studies have shown that physical activity can reduce the frequency of seizures and improve the cardiovascular and mental health of patients with epilepsy. Most physical activities or exercises are safe for patients with epilepsy. There is evidence that patients with well-controlled epilepsy can participate in contact sports and non-contact sports at the same time. Without harming the frequency of attacks.

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