Biohacking: Anti-epileptic Drugs as Cognitive Enhancers
Antoni J. Szeglowski, Matthew J. Stroud, Namrata Madoor, Merin Panthapattu, Esteven Tino Mateo, and Alex Ding
Advisor: James N. Jensen, Ph.D.

Introduction
Biohacking refers to the use of innovative, low-cost techniques to improve human performance. The techniques can be mechanical or chemical. Biochemical biohacking includes the use of nootropics ("smart drugs"), some of which improve the response of the brain and nervous system.

The focus of this work is a family of racetams. Racetams are chemicals that contain the pyrrolidone group (Figure 1).

Piracetam is a cognitive enhancer and may have anti-epileptic properties. Levetiracetam is an anti-epileptic drug which may improve certain cognitive abilities such as memory, mood, and concentration.

Background

Piracetam

Piracetam (Figure 1) is a nootropic in the racetams group. It is a derivative of the neurotransmitter GABA. Piracetam was synthesized in 1964 by a team led by Dr. Corneliu E. Glurgea. The team of scientists quickly realized that piracetam has shown cognitive functions.

Levetiracetam

Levetiracetam (Figure 1) is an anti-epileptic drug. It has been available since 2000. The drug was originally intended to serve only as adjunctive therapy for partial-onset seizures. However, recent research has shown that levetiracetam can be used effectively in adjunct therapy for primary seizures.

Mechanisms of Action

**Piracetam**

Piracetam activates α-amino-3-hydroxy-5-methylisoxazole-4-propionate (AMPA)-type glutamate receptors (Malykh and Reza Sadaie, 2010). An increased density of receptor binding sites leads to larger calcium uptake. Higher intracellular calcium uptake levels lead to increased rates of sodium dependent chloride (a precursor molecule for the neurotransmitter molecule acetylcholine, needed in the autonomic nervous system) uptake in rat hippocampal synaptosomes. This is turn leads to increased neuronal impulse flow and an acceleration of cognitive functions.

**Levetiracetam**

Levetiracetam acts through a different pathway for its anti-epileptic activity (NIH, n.d.). Levetiracetam binds to the synaptic vesicle 2A (SV2A) protein in brain membrane and fibroblasts. This binding inhibits neuronal Ca²⁺ ion channels which in turn reduces neurotransmitter release. Subsequently, the impulse conduction across synapses is impeded which causes a decrease in excessive neuronal activity and therefore fewer seizures.

Evidence for Anti-Epileptic Activity with Piracetam

Patients with progressive myoclonus epilepsy were given daily doses of 9.6 g, 16.8 g, and 24 g piracetam over six weeks in a cross-over design (each patient receiving a placebo or two doses for two weeks each). The treatment with 24 g/day of piracetam yielded the best results. Along with a decrease of progressive myoclonus epilepsy, piracetam has also been found to improve functional disability. The dose-effect relationship was linear. Piracetam was shown to have few side effects. It did not negatively affect cognition, unlike other anti-epileptic drugs (Koskiniemi et al., 1998).

Evidence for Cognitive Enhancement Activity with Levetiracetam

Gomer et al. (2007) found that levetiracetam did not decrease the cognitive function of epilepsy patients unlike other anti-epileptic drugs. In several studies levetiracetam improved cognitive function. Improvements were seen in working memory (López-Góngora et al., 2008; Rosche et al., 2004), short-term memory (Ciesielak et al., 2006), motor functions (López-Góngora et al., 2008), psychomotor speed and concentration (Helmaida et al., 2008), and fluid intelligence (Rosche et al., 2004). The greatest effects of levetiracetam may be seen in patients with poor cognitive function before treatment (Huang et al., 2008).

Conclusions

It appears that both piracetam and levetiracetam have both anti-epileptic and nootropic properties. Contrary to older methods of treating epilepsy, piracetam and levetiracetam do not weaken cognitive function. Rather, they improve cognitive function through improvements in working memory, short-term memory, motor functions, psychomotor speed, concentration, and fluid intelligence.

Sources


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