Evaluation of the effects of activation and blockade of GABAA receptors in early life on synaptic plasticity of hippocampal CA1 neurons, learning and memory in adult male rats

Abstract

Background:

The neonatal stage is an important stage in neuronal growth and development that exposure to harmful chemical agents early in life will have adverse effects on behavior. Gamma-aminobutyric acid receptors play an important role in synaptic plasticity, axonal growth, dendritic maturation and neural network formation, survival and differentiation and neuronal migration, and synaptic communication early in life. GABA is the largest, most important and first inhibitory neurotransmitter in the mammalian central nervous system. In humans, a high percentage of neural pathways make up the gabaergic system. As we know, the hippocampus is the main place of learning and spatial memory. The hippocampus plays a central role in receiving and processing memory in three stages: acquisition, consolidation, and recall. Neural processing of memory requires chemical changes at the synaptic level that can be produced experimentally by induction of long-term amplification (LTP).

Aim: Considering the effects and role of GABA in early life on neuronal growth and development and considering that inhibition of GABA A receptors during puberty causes anxiety and depression in animals and the direct relationship between anxiety and depression and the mechanisms Memory and Learning In this study, the effects of using GABAA receptor agonists and antagonists in early life on the synaptic plasticity of hippocampal CA1 neurons and memory and learning were investigated in adult male rats.

Materials and Methods: Wistar rats were randomly divided into 3 groups of 20: control group and GABA agonist and antagonist group in males. The neonates were treated with bicuculline (300 μg / kg) and muscimol (500 μg / kg) and DMSO and saline as bicolucin and muscimol solvents on days 7,9,11, respectively, and then on day 21. Weaned after birth and after reaching puberty, ie 60-70 days, were used for electrophysiological studies and behavioral tests.

Results: Electrophysiological findings of the hippocampus and frontal cortex show that obstruction and stimulation of the GABA receptor after birth by bicuculline and muscimol

effectively impair spatial and working memory and short- and long-term synaptic plasticity of hippocampal CA1 neurons and encoding It worsens spatial memory in adulthood.

Conclusion: This study provides electrophysiological insights into the effect of stimulation and blockade of GABAA receptor in early life on synaptic plasticity of hippocampal CA1 neurons in adults.

Keywords: Postnastal, GABA Stimulation/Blockade, Synaptic plasticity, learning and memory