Spectrum of pharmacological effects of glycine

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Abstract

The article presents the wide range of pharmacological effects of the drug Glycine and the results of clinical studies regarding the assessment of its effectiveness and safety. The possibilities of using the drug Glycine in therapeutic and pediatric practice are considered from the standpoint of the results of particular studies.

Key words: amino acids, glycine, neurotransmitters.

Short description

This article is a review of pharmacological effects of glycine.

Amino acids play an important role in the functioning of the body as a material for the synthesis of proteins and a source of various metabolites, including neurotransmitters. And some of them are neurotransmitters themselves. For example, glutamate and aspartate are excitatory neurotransmitters, and glycine and GABA are inhibitory.

With various breakage of such amino acids metabolism (starting in digestive system, or penetration through the blood-brain barrier, or synthesis in the nervous system), excessive or insufficient levels of neurotransmitters arise, which can lead to various neurological disorders [7]. The mechanism of metabolic disorders in different physiological and pathological conditions is different.

There is a concept that considers amino acids as modifiers of homeostasis that regulate key metabolic pathways and contribute to improving health [33], and their deficiency can disrupt homeostasis in general.

Glycine refers to amino acids that are functionally important for newborns. Therefore, in the perinatal period, it is especially important to prevent its deficiency and adjust the balance of amino acids in the body [14].

Glycine is an agonist of the glycine site of the NMDA receptor of glutamatergic structures. It optimizes metabolic processes in the brain tissue, has a sedative and antidepressant effect [27], normalizes the processes of excitation and inhibition in the central nervous system (CNS), increases mental performance, and affects the processes of autonomic regulation [9]. The biological significance of glycine is also due to its participation in the biosynthesis of proteins, in particular collagen, which forms the basis of skin, bones, cartilage, tendons and ensures their strength and elasticity [2, 15].

A study in children with early autism and Asperger Syndrome found a change in serum levels of certain amino acids. This, possibly, is due to the impaired balance of neurotransmitter amino acids: aspartate and glutamate (excitatory), as well as GABA and glycine (inhibitory) [7, 24, 25].

Glycine protects tissues from intoxication during hypoxia or reperfusion [34, 36]. Under hypoxia an increase in the lifespan of neurons of the cerebral cortex during was observed in response to glycine [35]. Glycine significantly reduces the amount of oxidative stress products in the ischemic zone [31], which may be associated with improved microcirculation in this zone [30].

Glycine prevents a decrease in the level of adenosine triphosphate and protects cells from necrotic death [29]. This effect, apparently, is associated with glycine inhibition of the opening of a non-specific anion channel, the activation of which leads to cell swelling and subsequent membrane damage [31].

Under conditions of hypoxia, glycine reduces the generation of ROS and protects energy processes in the mitochondria of the brain [7, 12]. This suggests the possibility of using glycine in the prevention of cognitive impairment in individuals with type II diabetes mellitus [4, 5].

Glycine has a nootropic and detoxifying effect. The use of combined metabolic therapy (glycine, succinic acid and citric acid) eliminates the hypoxic-ischemic component of brain tissue damage.

As a chemical compound, glycine interacts with a number of chemicals (aldehydes, ketones, sulfur-containing toxic substances, nitrates), having a detoxifying effect. This is especially significant for phenol – when glycine interacts with it, completely non-toxic hippuric acid is formed.

Glycine is able to protect the nerve cells by strengthening the neuron membrane, since it is necessary for the synthesis of lecithin, one of the main components of phospholipids [6, 11, 32].

Glycine as a natural human metabolite has the properties of an energy-generated antihypoxic drug, reducing the degree of hypoxic damage to the respiratory chain [17].

When interacting with anticonvulsants, Glycine reduces their toxicity; when combined with tranquilizers, hypnotics, antipsychotics, it reduces side effects on the central nervous system [3].

A randomized, placebo-controlled study confirmed the effectiveness of glycine in adaptation disorders. Glycine has been shown to be safe and well tolerated by patients [8].

The indicated properties of glycine make it possible to widely use the drug Glycine under stress and its consequences; to improve mental capacity and memory; in case of functional and organic lesions of the nervous system and encephalopathies of various origins; in case of residual effects after traumatic injuries of the brain and spinal cord; with chemical (including alcohol) intoxication; and as an antioxidant. Its important properties: good safety profile; lack of age restrictions; wide possibilities for selecting individual doses; the possibility of creating integrated treatment regimens.