CHEMICAL COMPOSITION OF GLYCINE AND ITS USE IN MEDICINE

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DOI: https://doi.org/10.55475/jcgtm/vol3.iss1.2024.267

Keywords:
glycine, quantum-chemical calculation, geometry, electronic structure, nervous diseases

Abstract
In the article, the chemical composition of glycine, the simplest representative among amino acids used in diseases of the nervous system, was studied using the mechanism of action and the quantum chemical method. At the same time, as a result of the study of the glycine geometry and electronic structure, the reactivity of the molecule was evaluated and clarified by specific methods.

How to Cite

Introduction
Neurasthenic syndrome is a slowly developing psychopathological disease that accompanies many diseases, is one of the most common symptoms of many somatic and mental diseases, and manifests itself even in their initial stages possible. This is the most common syndrome in the clinical practice of any doctor, and the share of complaints related to it is about 60%.

Neurasthenia is defined as a disorder of the nervous system due to metabolic disorders, infectious, somatic, endocrine diseases, operations, psychophysiological overloads, etc. According to etiological categories, reactive neurasthenia, which develops against the background of stress and emotional overload, is distinguished [1].

There are two main types of manifestations of neurasthenia - mental (concentration problems, inattention, memory impairment) and physical fatigue (weakness, muscle pain even after slight exertion, restlessness). Both forms of the disease are accompanied by common symptoms - dizziness, headache, irritability, self-doubt, mild depression and anxiety, and sleep disturbances. Neurasthenia is characterized by an asthenic syndrome that can develop under the influence of various exogenous and organic factors. If the main etiological factor of a mental disorder is a somatic or endocrine disease, then a somatogenic disease is diagnosed, not a neurosis. The relevance of the problem of neurotic diseases with asthenic syndrome (neurasthenia) is confirmed by many studies of social and age-related manifestations of this phenomenon. This condition is observed in children, students, middle-aged people and the elderly. Thus, in recent years, senile asthenia syndrome (weakness) has become a topic of special interest not only for geriatric doctors, but also for doctors of all specialties, because due to the increase in life expectancy, it is the main point of application of therapeutic, rehabilitation and treatment methods. can be

Timely detection of neurasthenic symptoms and the use of complex therapy reduce the risk of recurrence and chronic formation of the disease. The problem of identifying new approaches to the treatment of neurasthenia is still relevant. It is noted that all specialists note the presence of neurasthenia in their patients, but often do not treat them and sometimes do not fully understand the nature of this disorder. In addition, the situation is complicated by the fact that doctors do not have
enough objective diagnostic methods, and the assessment of the situation is often based on patients' complaints, which are interpreted subjectively by doctors. The main goals of patient therapy are to reduce the level of neurasthenia and associated symptoms and improve the patient's quality of life. Today, it is important to search for new drugs with a mild sedative effect that can quickly and effectively stop the manifestation of neurasthenic syndrome [2].

Epidemiology Neurasthenia is observed in all categories of the population, it is considered one of the disasters of our time due to its impact on physical and intellectual abilities of a person. Neurasthenia significantly disrupts people's daily life and reduces its quality. It was found that women suffer from neurasthenic syndrome 2-3 times more often than men. This affects not only people of working age, but also elderly people who have several chronic diseases, on the one hand, and whose adaptation mechanisms are impaired, on the other hand. Modern Russian research studies not only the epidemiology of neurasthenic syndrome at different ages and social groups, but also preasthenia. For example, the average prevalence of senile asthenia is 12.9%, and senile preasthenia is 48.9%.

Classification Depending on the duration of the neurasthenic syndrome, acute and chronic forms are distinguished. Acute neurasthenia usually has a functional character and develops after severe stress, acute illness or infection. Chronic neurasthenia lasts a long time and is usually organic. Chronic functional neurasthenia includes chronic fatigue syndrome.

The symptom complex of neurasthenic syndrome includes three components:

1. Real clinical manifestations of asthenia
2. Disorders associated with the main pathological condition
3. Disorders caused by the patient's psychological reaction to the disease.

There are two main types of breakdowns, and they mostly overlap. The main characteristic of the first type is the complaint of increased fatigue after mental stress, which is often associated with a slight decrease in performance or productivity in daily activities. Patients are characterized by mental fatigue, apathy, memory impairment, inability to concentrate and inefficiency of mental activity. In other types of disorders, there is a feeling of physical weakness and fatigue after even minimal exertion, accompanied by muscle pain and a feeling of relaxation. Both types of disorder are characterized by a number of common unpleasant physical sensations, such as dizziness, tension headaches, and a general feeling of unsteadiness. Common features also include concerns about decreased mental and physical abilities, irritability, loss of joy, mild depression, and anxiety. Sleep is often disturbed in its early and middle stages, but drowsiness can also be severe.

Neurasthenia should be distinguished from normal fatigue caused by excessive physical or mental stress, time zones or climate change, non-compliance with work and rest regime. Unlike physiological fatigue, neurasthenia develops gradually, lasts for a long time, does not go away after proper rest, and requires medical intervention to eliminate it.

Neurasthenia is often accompanied by disorders of the autonomic nervous system: tachycardia, decreased heart rate, changes in blood pressure, feeling of cold or heat in the body, general or local hyperhidrosis, loss of appetite, constipation, pain in the intestines, headache pain and dizziness may occur.

Depending on the form of neurasthenia, it can be accompanied by various types of sleep disorders. Hyperstenic asthenia is characterized by difficulty falling asleep, restless and intense dreams, night awakenings, early awakening and a feeling of weakness after sleep. Hyposthenic asthenia is characterized by daytime sleepiness. At the same time, problems with falling asleep and poor quality of night sleep remain. Sleep is a natural physiological process, and the average duration of sleep in humans is 7-8 hours. With a lack of sleep, immunity, activity, ability to work, quality of life, decrease in psycho-emotional state, neurasthenia and other diseases can develop. According to Russian and foreign data, the prevalence of insomnia, night sleep and daytime wakefulness in the population has increased from 8-15% to 20% in the last 5 years, and in some regions it is even higher. Many researchers associate it with psycho-emotional tension and the stressful situation in the world. There are both modifiable and non-modifiable risk factors for developing insomnia. Non-modifiable
risk factors include genetic predisposition, female gender and age. Modifiable factors include acute stress, prolonged psycho-emotional overload, and the nature of work. Many drugs, for example, antibiotics, hormonal drugs, antiarrhythmics, antihypertensives, antidepressants, diuretics, nootropic drugs can disrupt sleep. Acute and chronic somatic and neurological diseases cause the development of insomnia. Patients suffering from insomnia are tired in the morning, and in the afternoon, on the contrary, they are in an excited state, which is due to an increase in the secretion of cortisol, which contributes to the hyperactivity of the renin-angiotensin system. Manifestations of insomnia can be any disturbances in the sleep process - its initiation (presomnia), maintenance (intrasomnia) or completion (postsomnia). Presomnia disorder is characterized by difficulty falling asleep for a long time. Worrying thoughts, evening hyperactivity for various reasons prolongs the time to fall asleep by 3-4 hours. Intrasomnic disorders are manifested by frequent awakenings at night, difficulties in falling asleep after such awakenings. Postsomnia disorder is characterized by early, early (1-2 hours) awakening [3].

**Research results.** Due to the smoothness of the symptoms and the difficulty of objective confirmation of the diagnosis, it is difficult to diagnose neuroses, and the doctor may miss the initial signs of more serious diseases. Symptoms typical of neuroses can be observed in almost any mental illness, it is necessary to make a differential diagnosis of asthenic syndrome characteristic of neurasthenia with masked depression. Depression is characterized by pessimism, moodiness, decreased vitality, apathy, low self-esteem, increased symptoms in the morning, and early awakening. Manifestations of neurasthenic syndrome, on the contrary, increase in the evening, drowsiness is observed in the morning, inhibition processes with neurasthenia are weakened, a person incorrectly assesses his capabilities and overestimates them.

If asthenia is a consequence of stress, injury, disease or is a harbinger of pathology that has started in the body, its symptoms are determined. If neurasthenia occurs against the background of an existing disease, then its manifestation may go into the background and not be noticeable behind the symptoms of the main disease. To obtain an objective image, it is necessary to study the patient's mnemonic field, evaluate his emotional state and response to various external signals. In some cases, it is necessary to differentiate asthenia from hypochondriac neurosis, hypersomnia and depressive reactions.

With neurasthenia, it is necessary to choose the order of work and rest, to give up various harmful effects on the patient, including the consumption of alcohol, to include healthful physical activity in the daily routine, and to follow a fortified diet that corresponds to the main disease. It should be noted that with neurasthenia, as a rule, even a long rest does not bring significant benefits, because after returning to normal, the symptoms of asthenic syndrome are restored. For patients, a calm working environment and psychological comfort at home are of great importance. In such cases, psychotherapy, training on "increasing personal efficiency" and proper allocation of personal time will be useful.

Symptomatic therapy includes sedatives to relieve symptoms of neurasthenia and normalize sleep. Glycine drug enhances inhibitory processes in the cerebral cortex, which is especially manifested by an increase in the excitability of the central nervous system. By affecting the first stage, glycine facilitates the onset of natural sleep and thus exerts a physiological effect without disturbing its structure. This contributes greatly to the restoration of neuropsychic function and breaking the vicious cycle of asthenia. Glycine is a mild sedative and antiasthenic drug. Glycine is a local drug that is easily absorbed in the gastrointestinal tract. It is recommended to use in vegetative manifestations in the form of neurasthenic syndrome, sleep disorders, cardialgia, tachycardia and blood pressure instability.
Patients often self-medicate and take well-known and relatively inexpensive drugs, including phenobarbital, which cause various side symptoms. Thus, when using such drugs, the cardiovascular system may experience bradycardia and hypotension. From the central nervous system, it causes side effects such as nervousness, headache, depression of the respiratory center, drowsiness, dizziness, anxiety. In the United States, the practice of treating neurasthenia with large doses of B vitamins has been adopted, however, this method of therapy is limited by a high percentage of adverse allergic reactions. A number of authors believe that complex vitamin therapy is optimal, including not only B vitamins, but also C, PP, as well as trace elements (zinc, magnesium, calcium) and neuroprotectors involved in their metabolism. However, their effectiveness in neurasthenia has not been clearly proven due to the lack of extensive research in this area. Neurasthenia requires symptomatic psychotropic treatment. For neurasthenia, antidepressants - serotonin and dopamine reuptake inhibitors, antipsychotics and procholinergic drugs are prescribed on an individual basis. The success of the treatment of asthenia caused by any disease is mainly determined by the effectiveness of the treatment of the other [4].

Clinical observation Glycine drug, which is widely used in medicine and treatment of nervous diseases, is C2H5NO2, the simplest aliphatic amino acid or aminoacetic acid [1, 2], with a sweet taste and no optical isomer. Since there is no asymmetric carbon atom in its molecule:

![Fig. 1 Mirror reflection of optical isomers](image)

Glycine derivatives have sedative, mild anti-anxiety and antidepressant effects, weaken the side effects of antipsychotics (neuroleptics), hypnotics and anticonvulsants, and are used in a number of therapeutic practices to reduce alcohol, opiate and other withdrawal. as an auxiliary drug, it has a mild sedative and sedating effect. It has some nootropic properties, improves memory and associative processes. Glycine tablets are white in color and available in the form of flat cylindrical capsules. Glycine is a metabolic regulator, normalizes and activates protective inhibition processes in the central nervous system, reduces psycho-emotional stress and increases mental activity.

Active substance (XPN): glycine (aminoacetic acid). Active ingredient: glycine (aminoacetic acid), excipients: sodium carboxymethylcellulose (carmellose sodium) or water-soluble methylcellulose, magnesium stearate or calcium stearate. Glycine is a metabolic regulator, normalizes and activates protective braking processes in the central nervous system, reduces psycho-emotional stress, and increases mental capacity.

Glycine glycine and Hamk have alpha-1-adenoblocking, antioxidant, antitoxic effects, controls the activity of glutamate (NMDA) receptors, due to which the drug reduces psycho-emotional tension, aggression, quarrels, increases social flexibility, improves mood, sleep. relieves withdrawal and normalizes sleep, increases mental capacity, reduces vegeto-vascular disorders (including in the climacteric period), reduces the severity of brain disorders in ischemic stroke and
brain injuries, toxic effects of alcohol and other drugs that depress the activity of the central nervous system reduces the mystery.

Pharmacokinetics It easily enters most biological fluids and tissues of the body, including the brain, breaks down into water and carbon dioxide, does not accumulate in tissues.

Application: decreased mental capacity, stress conditions - psycho-emotional stress, mild forms of moral disorder in children and adolescents, hyperexcitability, emotional instability, decreased mental capacity and sleep disorders: neuroses, neurotic states and vegeto - it is used in vascular dystonia, neuroinfections and consequences of brain injuries, perinatal and other forms of encephalopathies (including alcohol genesis), various functional and organic diseases of the nervous system, and ischemic stroke.

Research results. to study the electronic structure and reactivity of glycine, we performed quantum chemical calculations with the 3-21G basis set with full optimization of the geometrical parameters using the DFT-B3LYP method [3, 4], which we used previously. study of organic molecules [5 - 7]. The results of calculating energy parameters and charge distribution in atoms are shown in the figure below.

Fig 2. Distribution of electronic charges to glycine atoms

Research results According to the distribution of electronic charges in the atoms of the glycine molecule, it has two electrophilic attack centers: amino acids and carboxyl groups. In charge-controlled reactions, the center of attack for electrophiles must be the nitrogen atom. The same trend is observed in Figure 3 below: the contribution of amino acids to the HOMO of the molecule is the highest. Therefore, we can imagine that an electrophilic substitution reaction occurs selectively by replacing a single proton in an amino acid.

On the contrary, the contribution of the carboxyl group to the LUMO of the molecule is high. Therefore, it can be assumed that the possibility of the formation of inter-peptide molecular bonds between their amino acids and carboxyl groups during dehydration is not excluded. Theoretically calculated total energy of glycine is Ep = -177484.0283 kcal/mol, dipole moment m = 2.2906 D.
EHOMO= -0.21186 eV \quad \text{ELUMO}=0.00919 \text{ eV}

Fig 3. Spatial pattern of glycine GO.

**Conclusion** The energy difference between the boundary Thus, the glycine molecule shows high reOrbitals (GO), not so high, the total active energy of which easily turns into a cation is $\Delta E = 0.20267 \text{ eV}$. ny, zwitterion or anion form:

\[
\begin{align*}
\text{COOH} & \quad \text{H}^+ \\
\text{H}_2\text{N} & \quad \text{C} \quad \text{H} \\
\text{R} & \\
\text{COO}^- & \quad \text{H}^+ \\
\text{H}_2\text{N} & \quad \text{C} \quad \text{H} \\
\text{R} & \\
\end{align*}
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Scheme 1. Chemical transformations of the glycine molecule

This probably explains the effective mechanism of action of glycine on the human nervous system.

**References**