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CLINICAL PHARMACOLOGICAL APPROACH TO THE USE OF PSYCHOTROPIC DRUGS

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ABSTRACT

This article explores the clinical and pharmacological principles underlying the use of psychotropic drugs. It examines the pharmacokinetics, pharmacodynamics, and therapeutic applications of various classes of psychotropic medications, including antidepressants, antipsychotics, anxiolytics, and mood stabilizers. The discussion emphasizes individualized treatment strategies, focusing on the patient's specific condition, comorbidities, and potential side effects. The importance of monitoring drug interactions, adherence to treatment guidelines, and evaluating long-term safety profiles is highlighted. Recommendations are provided to optimize the efficacy and safety of psychotropic drug therapy in diverse clinical scenarios.

Keywords: Psychotropic drugs, clinical pharmacology, pharmacokinetics, pharmacodynamics, antidepressants, antipsychotics.

INTRODUCTION

The use of new methods of brain research in the last decade has shown that mental and behavioral disorders have a neurobiological nature. This is reflected in the biopsychosocial model of mental and behavioral disorders, in which mental disorders with different causal determinacy are defined as having a certain structural and functional basis. The three components of the biopsychosocial model are integrated in a complex way into mental pathologies. In modern psychiatry, which is fundamentally based on sociology and psychology, the terminological vocabulary and conceptual apparatus from neuropsychology, psychophysiology, psychoanatomy, neurobiochemistry and molecular genetics are increasingly used. Many of the key neurobiological concepts, theories and ideas have already found application in the educational program of psychiatry, but they have not yet been fully covered in the educational literature.

MATERIALS AND METHODS

The process of transmitting information in the brain through the contact points between neurons is called synaptic transmission. When transmitting information, the cell sending the signal (presynaptic) releases a certain substance onto the receptor surface of the receiving (postsynaptic) neuron. This substance, called a neurotransmitter, serves as a molecular messenger for transmitting information from the transmitting cell to the receiving one. The neurotransmitter chemically transmits information through the synaptic cleft - a structural gap between the transmitting and receiving cells at the synapse.

It is important to note [1]:

1. One neuron receives information from several other neurons, but transmits its own directly to only one nerve cell. This is what determines the ordered direction of information transmission in the central nervous system.
2. All chemical synapses function on the valve principle: information in it can only be transmitted from the presynaptic cell to the postsynaptic cell and never vice versa. Synapses are able to amplify or weaken the transmitted signals. The efficiency of synaptic transmission changes due to an increase or decrease in the current of ions (calcium, chlorine), which is accompanied by an increase or decrease in the amount of the released mediator.
3. The activity of the synapse can change due to the changing sensitivity of the postsynaptic membrane, which is capable of decreasing or increasing the number and efficiency of its receptors. Due to this, the plasticity of intercellular connections is manifested, on the basis of which synapses participate in the learning process and the formation of memory traces.
4. The chemical synapse is the area of action of many biologically active substances, drugs or other chemical compounds that have entered the body for various reasons (toxins, poisons, drugs). Some substances, having a molecule similar to the mediator, compete for the right to bind to receptors, others do not allow mediators to be destroyed in a timely manner, others stimulate or inhibit the release of mediators from presynaptic endings, and others enhance or weaken the action of inhibitory mediators. The result of changes in synaptic transmission in certain chemical synapses may be the emergence of new forms of behavior.

RESULTS AND DISCUSSION

Modern neuroscience has proven that mental processes are dynamically localized in the brain. The frontal cortex. This area of the human brain's intellect formed phylogenetically later than other parts of the brain. It develops plans for achieving consciously set goals. It selects communication methods that will bring the greatest benefit in the long term. It retrieves data from long-term memory and uses it to form images of similar data that may be useful in the future. It is here that a person's character is concentrated - a multitude of coordinated reactions, including social reliability and responsibility [3]. It is this part of the brain that is responsible for self-awareness - the ability to remember the past, reflect, and not only act, but also be aware of your actions, evaluate possible scenarios and prospects. For example, choosing passive behavior: imagining how the world would change if we did not take any actions or if we did not exist at all. With this ability come freedom from the routine of everyday life, philosophical reflection on the mystery of life and death, a sense of beauty, religion, in short, all interests that are connected with the past, with the future, with our “I”. The frontal lobes are also the receptacle of the most fragile components of our personality, qualities that require maximum conscious effort and experience, such as logic, planning, evaluating our own behavior and achieving desired goals. In the process of becoming a responsible social being, we learn at the beginning of life to soften the impulses coming from the deep parts of the brain. It is the conflicts between these two different systems - between emotion and rationality, libido and intellect, flash and self-control - that determine our existence and even destiny. In the frontal lobes, presentiment, intuition and foresight are realized. This is the place of consolidation of individual mental processes into the mental “I”. The sense of "I" is due to [4]:
1) the ability to see oneself in time in the present between the past and the future;

2) the ability to distinguish between thoughts that can be shared and those that can never be revealed to others under any circumstances;
3) metaconsciousness - the awareness that the "I" can be aware.
People with damaged frontal lobes of the brain lack desires, they are unable to plan and resist base passions. A special role in foresight, executive functions and behavioral control belongs to the prefrontal dorsolateral cortex. The function of the prefrontal cortex is general control and planning, allowing the individual to form behavior at the highest hierarchical level and compensate for the lack of continuity in its structure. It is believed that the executive function serves as a kind of marker of the function of the frontal lobes. The prefrontal cortex is responsible for deciding on a course of action and allocating the cognitive and motor resources necessary to implement it, for which the following are important:
– planning and control;
– organization and temporal coordination of behavior;
– problem solving and social intentions;
– autonomy or independence of the source, which is an
internal controller, attitude, motive, and plan;
– feelings. We begin to recognize our impulses and allow them to influence our behavior due to the processes occurring in the frontal cortex. Dysfunction manifests itself in a flattening of the emotional sphere, apathy, and poverty of emotions.
Mental disorders caused by impaired neurotransmission of acetylcholine. In Alzheimer's disease, decreased acetyltransferase activity was found in neurons of the Meynert nuclei located in the basal forebrain under the striatum and overall suppression of acetylcholine neurotransmission. In this regard, cholinergic transmission is disrupted, which is considered an important link in the development of senile dementia. In schizophrenia, an excess of cholinergic neurons is observed, which may partly explain the occurrence of hallucinations in this mental illness. Pharmacological aspects. Acetylcholine antagonists reduce the effectiveness of mental activity. Cholinesterase inhibitors lead to the accumulation of acetylcholine, which is accompanied by an improvement in short-term memory and better preservation of its traces.
Mental disorders caused by disruption of neurotransmission of catecholamines. Excessive activity of the noradrenergic system plays a leading role in the development of panic syndrome, accompanied by a feeling of irresistible horror.
Degeneration of neurons of the substantia nigra leads to loss of control over one's body, muscle rigidity and tremor (Parkinson's disease). In schizophrenia, a violation of the dopamine circulation is detected: increased activity of the mesolimbic system and insufficiency of the mesocortical system.
Pharmacological aspects. For the treatment of Parkinson's disease, a dopamine precursor is used - L-DOPA, which, unlike dopamine itself, is able to overcome the blood-brain barrier.
In depression, drugs are used that increase the concentration of catecholamines in the synapses of the central nervous system.
Calcium entering through NMDA receptor channels activates a cascade of calcium-dependent secondary messenger reactions. This mechanism plays a very important role in the formation

of memory traces. NMDA receptor-associated channels open slowly and only in the presence of glycine: they are blocked by magnesium ions and the narcotic hallucinogen phencyclidine.
The activation of NMDA receptors in the hippocampus is associated with the emergence of long-term memory.
Mental disorders caused by impaired glutamate neurotransmission. Excessively high concentrations of glutamate are toxic to neurons. Excess glutamate increases seizure activity in the brain. Increased glutamate neurotransmission occurs in epilepsy, neuroinfections and some degenerative diseases (e.g. Huntington's chorea).
Pharmacological aspects. To reduce seizure activity, medications are used that stimulate the conversion of glutamate into non-toxic glutamic acid.

CONCLUSION

Pharmacological interventions targeting these neurotransmitter systems have proven effective in mitigating symptoms and improving patients' quality of life. For instance, cholinesterase inhibitors enhance memory in Alzheimer's patients, dopamine precursors alleviate motor symptoms in Parkinson's disease, and medications that regulate glutamate levels reduce seizure activity in epilepsy. These findings underscore the need for a nuanced understanding of neurotransmitter functions and targeted therapies to address the complex interplay of biological, cognitive, and emotional factors in mental health.

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