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TRANSCRANIAL MAGNETIC STIMULATION (TMS) - A METHOD USED TO TREAT EARLY AUTISM IN THE ARAL SEA REGION

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Abstract: The article presents a review and analytical study of the use of transcranial magnetic stimulation (TMS) as an additional method of treating autism spectrum disorders (ASD) in children, using the example of practice in the Republic of Karakalpakstan. The author, psychiatrist Umida Yusupbaevna Niyazimbetova, focuses on the relevance of the problem of early childhood autism, the difficulties of diagnosis and the limitations of traditional methods of therapy. TMS is considered as a promising, non-invasive neuromodulation technology capable of correcting key symptoms of ASD: decreased social adaptation, autostimulation, anxiety, and deficits in verbal and non-verbal communication. Based on data from international and domestic studies, including clinical observations at the Nukus Psychoneurological Dispensary, the potential effectiveness of TMS has been substantiated, especially when using repetitive (rTMS) and theta-rhythmic stimulation (iTBS). The proposed neurophysiological mechanisms of action of TMS are considered: restoration of the balance of excitation and inhibition in the brain, stimulation of the prefrontal cortex, improvement of neuroplasticity and emotional regulation. The need for an integrated approach combining TMS with behavioral therapy and cognitive rehabilitation is emphasized.

Despite the encouraging results, the author notes the limited evidence base, small samples and the need for further randomized controlled trials. Nevertheless, TMS is considered a promising direction in neuropsychiatry, opening up new opportunities for improving the quality of life of children with ASD.

Key words: autism, early childhood autism, autism spectrum disorders (ASD), transcranial magnetic stimulation (TMS), neuromodulation, rTMS, iTBS, neuroplasticity, social adaptation, behavioral therapy, child psychiatry, innovative treatment methods.

I. INTRODUCTION

Recently, an anomaly of mental development called early childhood autism (ECA) has been included in scientific research and practice in psychiatry.

We are talking about children with a special pathology of the nervous system, which makes it difficult for the child to form emotional contacts with the outside world and, most of all, with people. These children lack communication and interaction with the outside world and people. This feeling most often arises in early childhood, and therefore distorts the entire course of the child's mental development, which, in turn, hinders his social adaptation.

In the absence of timely diagnosis and adequate psychological and pedagogical correction, a

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significant portion of such children become unteachable and maladapted to life in society. Conversely, if correction is started in a timely manner, most autistic children can study at school, often revealing giftedness in certain areas of knowledge and art.

Currently, our country is actively searching for various approaches - medicinal and, first of all, psychological and pedagogical, aimed at correcting autistic dysontogenesis and normalizing the mental development of such a child.

II. MAIN PART

Autism (from the Latin word authos - oneself) manifests itself as a separation from reality, isolation from the world, absence or paradoxical reactions to external influences, passivity and hyper-vulnerability in contacts with the environment as a whole. [1, p.2]

It should be emphasized that autism is associated, first of all, with a violation of adequate emotional connection with the people around the child. At the same time, the child seems not to notice anyone around him. He does not respond to the question, does not ask anything and does not ask for anything, avoids looking into the eyes of another person, often even his mother. These difficulties are very clearly evident in contacts with peers: ignoring, active withdrawal, contemplation from the side, playing "nearby". If people around him persistently try to involve such a child in interaction with others, then the child becomes anxious, tense, and sometimes aggressive.

With the progress of drug therapy and psychological and pedagogical correction of early childhood autism, the problem of TMS is becoming increasingly significant - a promising, but still auxiliary method in the treatment of mental disorders in children. It does not replace drug and behavioral therapy, but may improve treatment effectiveness in resistant cases. The method is being actively studied, particularly in relation to autism, depression and ADHD.

Transcranial magnetic stimulation (TMS) is an innovative method of neurostimulation that is actively researched and used to treat various neurological and mental disorders. This method is based on the use of magnetic pulses that stimulate certain areas of the brain.

Transcranial magnetic stimulation (TMS) is a non-invasive neuromodulation technique that uses a magnetic field to stimulate specific areas of the brain. In child psychiatry, TMS is used as an adjunctive or experimental treatment, especially for persistent, difficult-to-correct symptoms.

The TMS method is the following action. A magnetic pulse is delivered through a coil placed on the scalp, causing electrical activity in neurons in the underlying cortical areas. The following types of stimulation are used:

- rTMS (repetitive TMS) - used most often;

- iTBS (intermittent theta stimulation) - a short, accelerated technique.

The most common stimulation zones are the dorsolateral prefrontal cortex (DLPFC), supramarginal gyrus, parietal and temporal regions.

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If autism is thought to be affected by disruptions in synaptic plasticity, interhemispheric interactions, and sensory information integration, then TMS may reduce symptoms of irritability, aggression, improve attention, and reduce anxiety.

In autism spectrum disorder (ASD), dysfunctions in the prefrontal cortex, temporal lobes, and mirror neurons are common, which can impact social cognition and emotional regulation. While mainstream therapy includes behavioral and educational approaches, scientists are actively researching neuromodulation techniques such as transcranial magnetic stimulation (TMS) to treat symptoms.

III. RESULTS AND DISCUSSIONS

Research shows that TMS may be an effective tool for treating some symptoms of autism. «In autism, the mechanisms of action of TMS include:

a. Regulating cortical inhibition: People with autism often have an imbalance between excitation and inhibition in the brain. TMS helps restore this balance by improving the synchronization of neural activity, especially in the gamma range. This has a positive effect on cognitive and behavioral aspects.

b. Prefrontal cortex stimulation: Low-frequency TMS targeting the dorsolateral prefrontal cortex (DLPFC) has been shown to improve executive functions such as self-control and adaptability. This is reflected in reduced stereotypical behavior and improved social skills.

c. Improving neuroplasticity: Magnetic pulses stimulate neuroplasticity, helping to form new neural connections. This helps improve cognitive functions, including speech and attention.

d. Reduced anxiety: TMS can target areas of the brain associated with emotional regulation, which reduces anxiety levels and improves overall emotional well-being».[2]

These mechanisms make TMS a promising method for correcting autism symptoms, although its effectiveness depends on the individual characteristics of the patient and stimulation parameters.

The method may also be more effective when combined with other approaches, such as behavioral therapy - combining TMS with neurofeedback and cognitive training may enhance the results. For example, in her work, M. Kirkovsky combined TMS with applied behavior analysis (ABA) therapy, which enhanced the effect compared to monotherapy. [3]

In the last decade, the use of TMS in autism (ASD) has attracted great interest, and in this regard, new studies have emerged that clarify its effectiveness and mechanisms of action. Studies published on the PubMed platform demonstrate the positive effects of TMS on cognitive functions and social skills in patients with autism spectrum disorders; the results of using TMS to improve emotional state, reduce anxiety and develop communication skills in children with autism are described. For example, research by L.M. Oberman in 2016 showed that low-frequency TMS over the right inferior frontal gyrus can reduce the hyperexcitability

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of mirror neurons, improving emotion recognition and empathy. In studies, participants demonstrated improved eye contact and responses to social stimuli.

Likewise, in our studies conducted in the psychoneurological dispensary of the Republic of Karakalpakstan, out of 209 children suffering from various psychoneurological diseases, 14 children with autism showed that when using TMS, their socialization skills improved, autostimulation decreased, and in some cases, verbal and non-verbal communication improved.

Of course, it is necessary to take into account some features when using TMS. For example, it is not recommended to use it in severe epilepsy, to use it in a limited way and under supervision, more often in clinical trials. To date, there are practically no studies with TMS in children with schizophrenia, Down syndrome or organic disorders. The method is used only in experimental or pilot settings, without full-fledged RCTs.

Also, according to L.M. Oberman, autism spectrum disorder (ASD) is a behaviorally conditioned complex neurodevelopmental syndrome characterized by disturbances in social communication, the presence of limited and repetitive behavior, interests and activities, as well as disturbances in sensory reactivity. Transcranial magnetic stimulation (TMS) is a promising, emerging tool for the study and potential treatment of ASD. Recent studies suggest that TMS interventions provide rapid and noninvasive pathophysiological biomarkers of ASD. Furthermore, repetitive TMS (rTMS) may represent a new treatment strategy for reducing some of the core and associated symptoms of ASD. However, the existing literature on the use of TMS in ASD is preliminary, consisting of studies with methodological limitations. Thus, the off-label use of clinical rTMS for therapeutic interventions in ASD without an investigational device exemption and outside of an IRB-approved research trial is premature, pending further, adequately powered and controlled trials. [4]

Scientists from around the world in this field gather annually for a two-day conference (prior to the 2014 and 2015 International Council for Autism Research (ICAR)) to discuss the latest advances, promote collaboration between laboratories, and establish consensus on protocols. Although the true potential of TMS in ASD has yet to be determined, TMS represents an innovative research tool and a new, potentially transformative approach to the treatment of neurodevelopmental disorders.

A 2021 review identified 18 studies, including 8 RCTs, and found statistically significant reductions in stereotypic behavior, irritability, and improvements in social function and executive skills, but most studies were at moderate/high risk of bias. [5]

A more recent review from 2024 found 17 studies (7 RCTs, 10 open label): low- and high-frequency rTMS and theta burst were used; improvements were noted across multiple scales, including stereotypic and verbal social behavior. Moreover, clinical studies have shown that rTMS (15 Hz over the left parietal lobe) enhanced long-term functional connectivity of the brain and reduced manifestations of ASD - data from EEG and clinical scales. [6]

In children with low-complex autism, low-frequency rTMS 2r/n resulted in increased EEG alpha coercion and improvement in Autism Behavior Checklist. [7]

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And the combination of rTMS over the left inferior frontal gyrus and speech therapy produced a moderate effect on speech skills (CARS scale). [8]

Thus, there are encouraging signs of clinical benefit of TMS for ASD (social interaction, stereotyping, speech), but the evidence base is still limited by small samples and risk of bias.

Therefore, the development of new directions in the treatment of autism provides hope for improving the lives of people suffering from this disorder. Researchers around the world are striving to find innovative approaches that can help autistic patients in their development and adaptation.

IV. CONCLUSION

The research perspectives for treating autism range from pharmacological research looking for new drugs to the use of psychological techniques and technologies. One of the key areas, of course, is an individual approach to each patient, taking into account his characteristics and needs.

Research also shows that the use of technology in the treatment of autism has great potential. Virtual reality, robotics, computer games and mobile applications are used to teach social skills, develop communication and improve cognitive functions. Thanks to the development of modern technologies, patients with autism have the opportunity to develop skills in a comfortable and controlled environment.

However, in addition to technological advances, researchers are also exploring the importance of other approaches, such as music, art therapy, physical activity, and alternative communication methods. A comprehensive approach to treating autism that combines various methods could significantly increase the effectiveness of therapy and help patients better cope with the challenges associated with this disorder.

Many autism treatment studies are in their early stages, and research prospects offer new opportunities to improve the quality of life for people with this disorder. However, it is important to keep in mind that each person with autism is unique, and the effectiveness of individual treatments may vary. Therefore, further research and development of new approaches to autism treatment are important to achieving the best results.

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