

INTEGRATIVE ASSESSMENT OF THE CLINICAL CONSEQUENCES OF VARIOUS-GENEZED NEUROINFECTIONS IN THE CHILDREN POPULATION: RESULTS OF A TWO- DIRECTIONAL STUDY AT THE CLINICAL BASE OF SAMARKAND STATE MEDICAL UNIVERSITY

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Abstract: Neuroinfections represent one of the most pressing and socially significant problems of modern pediatric neurology and infectiology. Inflammatory diseases of the central nervous system of various etiologies occupy a special place in the structure of childhood morbidity, causing high rates of disability and mortality in the pediatric population.

Key words: Inflammatory diseases of the brain, children, neuroinfections, meningitis, encephalitis, meningoencephalitis, long-term outcomes, neurological consequences.

Introduction. Neuroinfections represent one of the most pressing and socially significant problems of modern pediatric neurology and infectiology. Inflammatory diseases of the central nervous system of various etiologies occupy a special place in the structure of childhood morbidity, causing high rates of disability and mortality in the pediatric population. According to the World Health Organization, the frequency of neuroinfections in children is 2-10 cases per 100,000 children per year, with indicators significantly varying depending on the region, socio-economic conditions, and accessibility of medical care. In the structure of infectious diseases of the nervous system in children, viral encephalitis (60-70%), bacterial meningitis (20-25%), and mixed forms of meningoencephalitis (10-15%) predominate.

It is particularly alarming that even with modern intensive care and neuroanimation capabilities, the mortality rate in severe forms of neuroinfections in children remains at 10-30%, and the frequency of neurological complications and residual phenomena reaches 40-60% of cases. This circumstance determines not only the medical but also the significant socio-economic significance of the problem.

Childhood is characterized by a number of anatomical and physiological features of the nervous system, which predispose to a more severe course of neuroinfections and the formation of persistent neurological deficits. Such features include: incomplete myelination processes, increased permeability of the blood-brain barrier, peculiarities of cerebral blood circulation, immature immune defense mechanisms of the CNS.

In the Republic of Uzbekistan, according to the Ministry of Health, 150-200 cases of acute neuroinfections in children are registered annually, while in the Samarkand region, pediatric cases account for approximately 25-30% of the total number of cases. The region's geographical location, climatic conditions, and high child population density create prerequisites for the circulation of various

neurotropic pathogens. Modern research in pediatric neuroinfections primarily focuses on studying the acute period of the disease, etiotropic therapy, and urgent intensive care measures. At the same time, the problem of long-term consequences of neuroinfections, especially in terms of a comprehensive assessment of neurological, cognitive, behavioral, and social disorders, remains insufficiently studied. The lack of unified approaches to assessing the long-term outcomes of neuroinfections in children, insufficient development of criteria for predicting the course of the disease, and limited data on factors influencing the formation of residual phenomena determine the need for comprehensive research in this area.

The study of the relationship between the etiological factors of neuroinfections, the features of the clinical course of the acute period, and the nature of long-term consequences is of particular interest. Understanding these patterns will allow for optimizing approaches to the treatment and rehabilitation of children with neuroinfections, as well as developing effective programs for the prevention of disabling outcomes. The development of long-term consequences of neuroinfections is due to a complex of pathogenetic mechanisms, including the direct cytopathic action of pathogens, toxic damage to nerve tissue, microcirculation disorders, and the development of secondary autoimmune processes. The features of the morphofunctional organization of a child's brain, characterized by immature neuronal structures and ongoing myelination processes, determine the increased vulnerability of a child's nervous system to infectious influences.

Despite the obvious clinical and social significance of the problem, there is a lack of systematized data in the domestic literature on the frequency, structure, and risk factors for the development of long-term consequences of neuroinfections in children. Most studies are limited to describing the acute period of the disease or analyzing immediate outcomes. Issues of long-term prognosis of the disease course have not been sufficiently studied, and unified approaches to assessing long-term consequences and organizing follow-up observation have not been developed.

Purpose of the study: to conduct a comprehensive integrative assessment of the clinical consequences of neuroinfections of various origins in children to develop scientifically based approaches to predicting the outcome of the disease and optimizing rehabilitation measures.

Research material and methods. The study involved children aged 10 to 15 years with a previously established diagnosis of "secondary encephalitis/meningoencephalitis," with information collected during the anamnesis serving as the basis for acutely occurring neurological symptoms more than six months (two years) ago. The work was carried out on the basis of the SamSMU Multidisciplinary Clinic, for the period 2022-2025, on the departments of pediatric neurology, neurosurgery, as well as in the outpatient setting of the polyclinic under the SamSMU Multidisciplinary Clinic and the city polyclinics of Samarkand. Anamnesis data (during the acute phase of the disease) and retrospective data (particularly laboratory tests) on patients were obtained from the Samarkand City Infectious Diseases Hospital. At the time of hospitalization in the MS SamSMU or outpatient (primary examination), the following were included: clinical and neurological examination; assessment of complaints, epidemiological, premorbid history, and physical examination data. All patients underwent standard clinical trials, including: clinical blood analysis, clinical urine analysis, and biochemical blood analysis. Electroencephalographic examination was conducted to assess the bioelectrical activity of the brain; neurovisualization (magnetic resonance imaging) was performed to assess the structure of the brain. In all patients upon admission to the infectious diseases hospital, the following were studied: in the dynamics of the disease, cerebrospinal fluid, bacteriological culture of cerebrospinal fluid and microscopy of cerebrospinal fluid smears, blood enzyme-linked immunosorbent assay, blood PCR, saliva, and clinical observations were conducted, taking into account the symptoms (somatic and neurotic). Statistical indicators were studied on an individual computer using special programs.

Research results. A total of 39 children with secondary meningoencephalitis (ME) and encephalitis (En) (viral etiology) were examined during the study period. At the same time, according to retrospective data (study of medical histories, during the acute period of the disease in the meningitis/meningoencephalitis department of the Samarkand city infectious diseases hospital), the

following etiological and epidemiological features were revealed in the examined patients. ME and En revealed herpes simplex virus in 20%; TORCH infection signs, in particular cytomegalovirus infection, in 13%; measles infection in 10%; zoster virus in 10%; the remaining cases revealed mixed etiology or infection (idiopathic) of unspecified etiology. Meningoencephalitis and encephalitis, according to literature, manifest at any age, however, in most cases, the disease occurs in childhood (adolescence) age. The most pronounced manifestations of clinical and neurological symptoms in meningoencephalitis and encephalitis are considered to be cognitive impairments, impaired consciousness (of varying degrees), various focal symptoms (local) in the form of neurological deficit, characteristic features on the neuroimaging picture (MRI), and the peculiarity of changes in bioelectrical activity (EEG).

Analysis of the results obtained during the study showed a correlation between etiological factors and clinical symptoms, as the consequence of ME and En, the etiology of which represents and is based on laboratory confirmation, was simple herpes, in almost 50% of cases, motor-motor changes developed in the form of para- and tetraparesis. In addition, these same patients, individually or in combination, more than 26% of cases reveal signs of symptomatic epilepsy and in 21% of cases symptoms of cerebellar ataxia, while cognitive insufficiency was noted in 17% of cases.

In cases where bacterial infection was detected in patients during the acute period (*Streptococcus pneumonia* and *Neisseria meningitidis* pathogens), long-term neurological consequences were detected in 35% of cases, by the type of symptoms of aphasia and dysphagia, the most common of all symptoms up to 19%, the second most common symptom of hearing loss was detected in three patients. It is important to note that in patients with excess ME and En, at the onset of the disease in the acute period, signs of a chronic disease were identified, such as congenital hydrocephalus in two patients; perinatal encephalopathy of hypoxic origin in five cases; congenital combination of brain anomaly with visual and hearing impairment in one patient; congenital spinal cord hernia in one case; congenital stridor in one patient. Thus, from the data of the retrospective analysis, bacterial ME and En are more often observed in children with background chronic diseases and congenital malformations. The median level of C-reactive protein during the hospitalization period in the hospital (acute period, infectious diseases hospital) was 90 mg/l, mainly in older children, while disseminated intravascular coagulation was diagnosed in children (2 patients) in younger childhood. All patients who were hospitalized in the pediatric neurology department for treatment and rehabilitation, during the long-term effects of ME and EN, underwent neurovisualization (MRI examination of the brain, areas of increased MR signal in T2 mode and decreased MR signal in T1 mode were described in the corresponding zones). At the same time, if we distinguish the areas of damage, then this is more often the temporal-parietal part of the brain, in addition, in comparative parameters: the acute period and long-term consequences of the disease, the predominance of an extensive space of disruption of the brain structure is noted during the long-term process (Fig. 1)

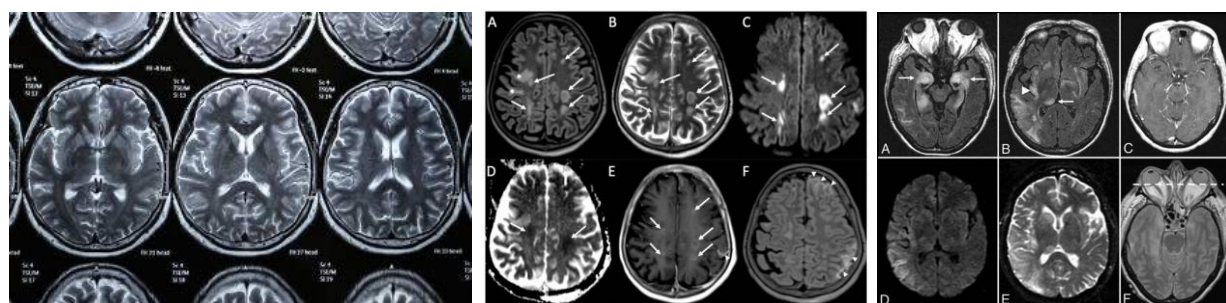


Fig. 1. MRI shows signs of degenerative changes with foci of encephalomalacia in the basal nuclei and hippocampal regions on both sides. Vascular encephalopathy. Indirect signs of intracranial hypertension. Nasopharyngeal adenoid tissue hypertrophy II degree.

The distribution of bioelectrical activity levels in the examined patients depended on the conducted period, out of the total number in the acute period, changes in EEG were recorded only in 10 patients of older age, in dynamics. In the position where patients underwent treatment and rehabilitation in the

remote period, their health condition allowed for the diagnosis of bioelectrical activity in a more favorable atmosphere. The analysis results showed that in more than 80% of cases in children with ME and En, gross defects in bioelectrical activity were noted, while in younger children, such a violation exceeded 95%, and in older age, 37% corresponded to a moderate degree of impairment, where the comparative coefficient was $p < 0.05$. However, in the older group, pathological complexes in the form of peak waves, with clear signs of epileptic activity, were more frequently registered (Fig. 2).

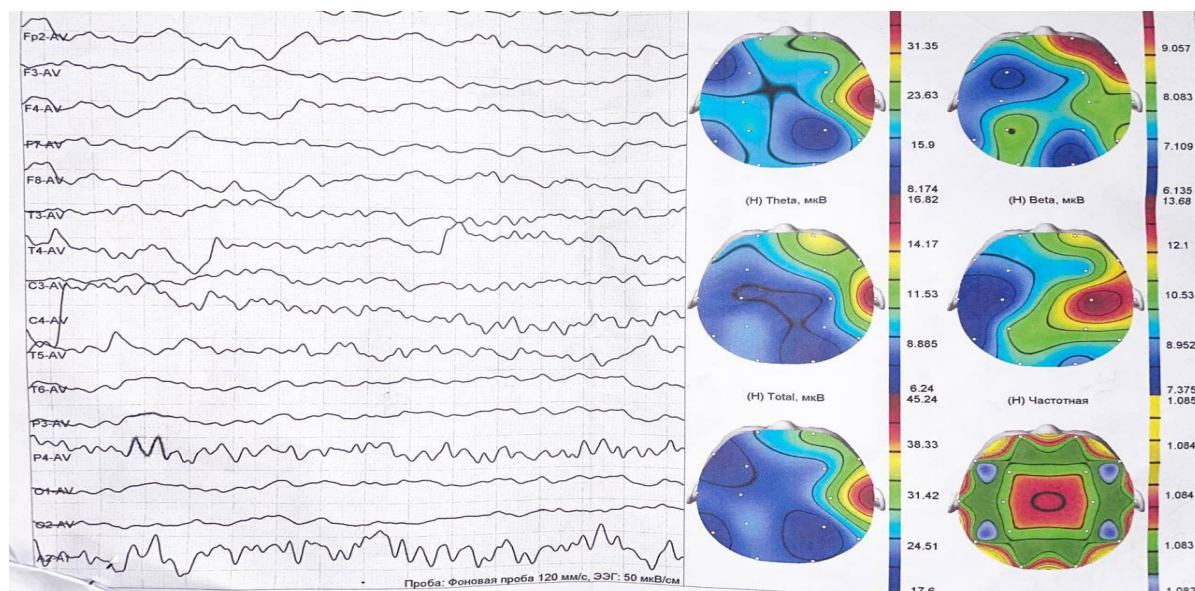


Fig. 2. EEG recording is poorly organized, represented by low-amplitude monomorphic activity.

Periodic slow-wave activity against the background of a rhythmic high-frequency rhythm (with predominance from the frontal-temporal leads) is revealed. Interregionally from the middle, central, posterior-temporal, and parietal branches (more to the left) against a background of continued low-amplitude acute-wave activity, grouped flares of acute-wave activity are recorded. The back dominant rhythm is absent. The front-back gradient is slightly smoothed.

It is natural that the treatment and rehabilitation of patients with long-term consequences of ME and EN requires a comprehensive and long-term approach, taking into account the complex medical, behavioral, social, emotional, and cognitive problems that patients face. Rehabilitation should be focused not only on solving the problem but also on training parents aimed at improving mobility and increasing functional activity, primarily using neuromuscular fossilization methods, so-called static strengthening exercises, and targeted exercises to eliminate specific disorders associated with the consequences of ME and EN of various etiologies. In addition, patients received medication support in the form of neuroprotectors, cholinesterase drugs, B vitamins, i.e., the entire spectrum of drugs included in the treatment standards, for subsequent treatment as reinforcement, medications were proposed: cytoline-santo in the form of syrup; elcar syrup; depakin chrono (for patients with epileptic syndrome, constant intake), for a duration of at least 3 months. When comparing patients, after 4 months, it was noted that patients, especially with mild and moderate neurological disorders, had access to productive contact, children better followed simple instructions. Signs of memory deficiency, visual agnosia phenomena, difficulty in speech skills, and instability of psycho-emotional state persisted. From the side of motor disorders, paresis of the hands: tone and tendon reflexes are high on the paretic side, coordination tests remain unchanged, all these clinical symptoms demonstrate an unfavorable outcome of the consequences of ME and En and the need for further treatment and rehabilitation measures. Therefore, it is advisable to implement individualized neurorehabilitation programs (kinesiotherapy, ergotherapy, spasticity management, orthopedic correction, etc.) to reduce tone, restore motor skills, and prevent secondary complications.

CONCLUSIONS: Meningoencephalitis and encephalitis in children are characterized by a high risk of developing persistent neurological consequences, including cognitive, motor, speech, and emotional-volitional impairments. In most patients during the acute phase of the disease, predisposing

factors are identified - congenital or perinatal pathologies of the central nervous system, which exacerbate the course of the disease and worsen the outcome. Motor disorders after ME and En manifest as persistent paresis, increased muscle tone, and hyperreflexia with preserved coordination tests, reflecting residual focal brain damage and indicating the need for long-term restorative treatment. Cognitive and speech impairments (decreased memory, attention, slowing of mental processes, dysarthric disorders) persist in a significant portion of children and require early inclusion of cognitive and speech therapy rehabilitation. A comprehensive approach, including medication therapy, physiotherapy, therapeutic exercise, neuropsychological correction, and speech therapy, contributes to a more pronounced positive recovery and improvement in patients' quality of life.

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