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Diagnostic Criteria of Encephalitis in Children

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Abstract

In the structure of neuroinfections in children, encephalitis and meningoencephalitis range from 10 to 20%. According to the World Health Organization, the frequency of registration of encephalitis is 7-9 per 100,000 population annually, of which up to 70-75% falls on children [6, 7, 9].

Keywords: neuroinfection, ARVI, Pneumonia and bronchopneumonia, Intestinal infections

Introduction

In the genesis of primary encephalitis, the leading etiological role belongs to the herpesvirus family, known for their neurotropicity [1, 3, 8]. Herpes simplex virus is the most common causative agent of viral encephalitis, in which persistent neurological deficit in the outcome of the disease is observed in 10-15% of patients [1, 2, 4, 10]. The outcome of the disease depends on timely and adequate antiviral therapy [2, 5, 9]. Severe lesions of the central nervous system lead to severe neurological disorders, gross disability and complete social maladjustment [3, 4, 9, 10].

It is known that even a favorably ended encephalitis and meningoencephalitis subsequently leaves children with a neurological defect that causes mental delay and sensory deficit [4, p. 125].

In the period of encephalitis convalescence, there remains a high risk of symptomatic epilepsy formation. This is due to a local necrotic (encephaloclastic) process mainly in the gray matter of the brain with the formation of structural defects, the presence of which can cause the formation of a persistent focus of pathological activity in the residual period. [2, p. 48].

All of the above indicates the need to study the clinical and paraclinical features of primary and secondary encephalitis in children.

Objective: to study the features of clinical, neurological and paraclinical manifestations of primary and secondary primary and secondary encephalitis in children.

Materials and methods of research: to solve the set tasks from 2017 to 2020 in stationary conditions, we examined 50 children aged 1 to 13 years with primary and secondary encephalitis. The examined first group included 26 children with primary encephalitis (average age - 3.1 ± 0.1 years), the second group - 24 children with secondary encephalitis (average age - 9.1 ± 0.2 years). All children underwent targeted clinical and neurological, laboratory and instrumental examinations.

The diagnosis was made on the basis of the results of clinical and neurophysiological (EEG, computed and magnetic resonance imaging of the brain) studies.

To differentiate primary encephalitis from secondary encephalitis, an enzyme-linked immunosorbent assay for HSV was performed with the determination of IgM and IgG antibodies, which was determined using the diagnostic test systems of the "Human" company (Germany).

In the examined group with secondary encephalitis, the provoking concomitant diseases were ARVI, thus, had a viral etiology, while the group with primary encephalitis consisted of children with herpes encephalitis.

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Results of the study: in 70% of patients, the first complaints were convulsive syndrome, against the background of general cerebral symptoms.

When collecting anamnesis in the group of children with primary and secondary encephalitis, as a rule, complaints of worsening of the condition appeared 3-7 days after the onset of the disease. Upon admission to the hospital, the main complaints presented by the parents of children with secondary encephalitis, in addition to complaints about the underlying disease, were lethargy, lethargy, drowsiness in 10 children (50%); 8 children (40%) had convulsions; 9 children (45%) had general cerebral symptoms in the form of nausea and vomiting, 3 older children (15%) complained of headache; impairment of consciousness was observed in 5 (25%) children (soporous state). All patients were hospitalized in the ICU due to their serious condition.

According to the literature, herpetic encephalitis belongs to the most severe viral lesions of the brain. The formation of necrosis in the frontal and temporo-parietal lobes of the brain contributes to such clinical manifestations of the disease as impaired consciousness, behavioral disorders and seizures of a partial nature, as well as its outcomes.

In all children with primary encephalitis for 1-3 days. a coma of 26 ± 6 days developed, which was preceded by partial or secondary generalized seizures. It should be noted that 83% (20) of children with primary encephalitis were under 2 years of age.

The premorbid background in children with PE and EE was studied (Table 1).

Table 1

Premorbid background in children with primary and secondary encephalitis

Analyzed indicators	Children with PE n = 24		Children with EE n = 26	
	abs (%)	abs (%)		abs (%)
ARVI	18	75	15	58
Pneumonia and bronchopneumonia	20	83	13	50
Intestinal infections	18	75	16	62
TORCH carrier	24	100	0	0
Anemias	8	33	6	23
Sepsis	12	50	5	19*
DIC syndrome	6	25	1	4*
Respiratory Disorders	18	75	5	19*
Heart failure	12	50	4	15*

Note: * - reliability of data between groups (P<0,05)

The condition of 24 children with primary encephalitis and 26 children with secondary encephalitis was aggravated by such concomitant diseases as anemia (33% and 31%), malnutrition (25%), respiratory distress syndrome (30%), heart failure (48%), endotoxicosis (16 %). The manifestation of one or several foci of infection (bronchopneumonia - 83% and 50%, sepsis - 50% and 19%) significantly worsened the somatic status. This was manifested by symptoms of intoxication: an increase in temperature to subfebrile and febrile numbers, a lack of weight gain, regurgitation, bloating due to intestinal paresis, an enlarged liver. In 6 (25%) children with primary encephalitis of the group, signs of disseminated intravascular coagulation (DIC) were observed, which was manifested by increased bleeding from the injection sites, small punctate skin hemorrhages.

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In the group with primary encephalitis, a course of moderate severity in 14 children and a severe course in 10 children of this group were noted; impaired consciousness corresponded to a coma of 2-3 degrees.

The first symptoms of the disease were impaired consciousness and seizures, which were more partial, motor ones in 16 children (67%), and 17% had generalized tonic-clonic seizures.

A wide range of organic disorders was characteristic of children with primary encephalitis. In 16 children (75% of children (18) had bulbar disorders. 16 children (67%) had meningeal symptoms, stiff neck muscles, Kernig's symptom, which leveled out. Cranial nerve damage was noted in all children, depending on the severity diseases.

Oculomotor nerves - decreased convergence in 16 children (67%), lack of reaction to light in 10 children, convergent strabismus in 13 children (57%), horizontal nystagmus in 16 children (57%). Central paresis of the facial nerve was observed in 18 children (75%), tongue deviation in 10 children (42%). Oral automatism symptoms were observed in 8 children (33%).

An increase in muscle tone was noted in 12 children, while 10 children had muscle hypotension with a decrease in tendon reflexes. Formation of paresis and paralysis was observed in 23 children (96%) with primary encephalitis. In 71% of children, pathological reflexes and foot marks were observed. Sensory disturbances in the form of hypesthesia were observed in 10 (67%) children and hyperesthesia in 11 (42%) children.

Emotional-volitional disorders, tearfulness and dysarthria were noted in 4 children (17%). These children were older, the course of the disease was moderate.

When examining 26 children with secondary encephalitis, impaired consciousness was observed in 6 children (23%), a state of coma of 1, 2 degrees, in 6 (23%) children, a state of sopor was noted. In 6 children (23%), meningeal symptoms were noted - the stiffness of the occipital muscles, were not expressed. Cranial nerve damage was observed in all children, depending on the severity of the disease. Oculomotor nerves - decreased convergence in 5 children (19%), convergent strabismus in 6 children (23%), divergent strabismus in 1 child (4%), horizontal nystagmus in 10 children (50%). Central paresis of the facial nerve was observed in 7 children (35%), decreased pharyngeal and palatal reflexes in 6 children (30%), deviation of the tongue in 5 children (19%). In dynamics, convulsions were observed in 14 children (54%) and were the first signs of the disease, at low-grade fever in 6 children (23%), they were clonic-tonic, in 8 children (31%), convulsions were partial, motor seizures. With the appointment of antiepileptic therapy, it was not possible to stop completely, as a result, these children developed symptomatic epilepsy.

Violation in the motor sphere in the form of increased tone was observed in 12 children (46%), the formation of paresis and paralysis was noted in 5 children (19%). Of the sensory disorders, hyperesthesia prevailed in 11 children (42%). Dysarthria was observed in 8 children (31%), while emotional-volitional disorders were observed in 17 children (65%).

Thus, the analysis of clinical and neurological parameters of children with primary and secondary encephalitis showed more severe and persistent organic disorders in primary encephalitis. It should be noted that the course of primary encephalitis was accompanied by impaired consciousness in the form of a 2-3 degree coma. While in the group with secondary encephalitis, a milder course was noted, the period of coma of 1–2 degrees lasted about 10–12 days. Persistent organic deficit was observed in 2 children in the form of paresis and paralysis; in general, the outcome was favorable.

In the acute period of viral encephalitis, the absolute indication for CT and MRI studies was differential diagnosis with other diseases of the central nervous system. First of all, in order to exclude a

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mass formation (abscess, tumor, etc.), since the severity of the disease and the nature of neurological disorders did not allow to unambiguously determine the nature of the process by clinical signs. Therefore, in the first place, CT was performed in patients with severe cerebral syndrome in the form of impaired consciousness, the development of prolonged status epilepticus and symptoms of focal lesions of the central nervous system.

MRI and CT studies carried out at various times in children with primary encephalitis made it possible to establish various types of structural disorders resulting from the inflammatory process. Thus, 59.3% of children with PE had foci of reduced density in both hemispheres of the brain, followed by the formation of post-inflammatory cysts, 40.7% had foci of reduced density. They have been noted in herpes encephalitis, which is highly neurotropic. In 3 cases, there was local, frontotemporal and cortical atrophy.

As a result, 9 children with secondary encephalitis showed a picture of the absolute norm. During imaging, 8.7% of children with EE had fuzzy hyperintense foci, and subsequently they had persistent organic deficiency. In 10 cases (43.5%) there was diffuse cortical atrophy (Fig. 1), in 3 cases (13%) in 3 children (13%) - signs of edema of the brain substance. Established violations in the structures of the brain confirmed the diagnosis.

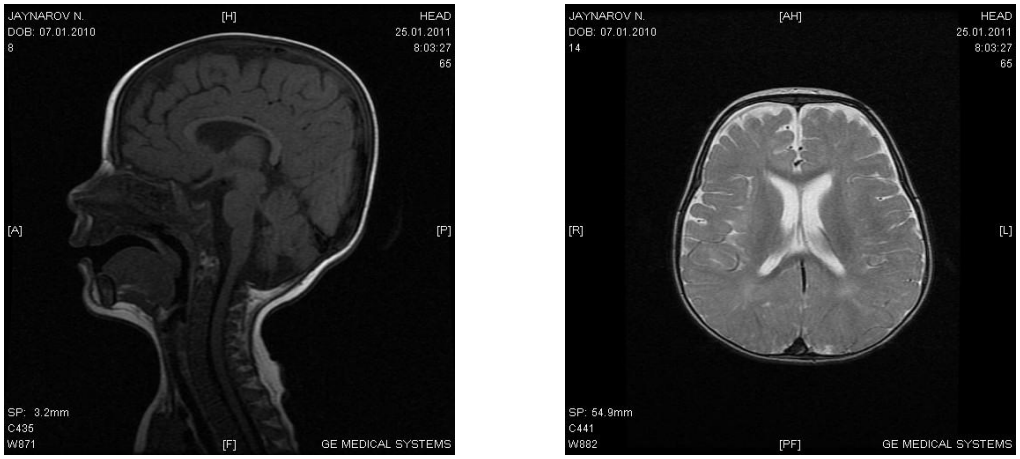

Figure: 1. Atrophy of the parietal-temporal parts of the brain

The revealed disorders contributed to the formation of persistent neurological symptoms, the severity of which prevailed in children with PE. According to the literature, an EEG study in acute encephalitis reveals pathological changes in the bioelectrical activity of the brain in the form of diffuse or focal slow-wave activity, the presence of epileptiform signs and high-amplitude bilaterally synchronous flares [13]. All authors point to a large variability of the EEG pattern in patients with encephalitis, which is revealed during repeated studies at different times after the onset of the disease.

In all children with primary encephalitis, the EEG study revealed pronounced changes in cortical electrogenesis (Table 2).

Inhibition of the BEA of the brain, characterized by a flattening of the curve almost to the isoline, was observed in 10 children (42%) with PE who were in an extremely serious condition. In all 10 cases, prolonged coma, the status of epileptic seizures, gross organic lesion of the central nervous system, and extensive foci of destruction of both hemispheres of the brain, detected by CT were observed.

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Table2

Changes in the bioelectric activity of the brain according to EE studies in the acute period of viral encephalitis (n = 50)

EEG data	Primary EF (n = 24)		Secondary EF (n = 26)		Total (n = 50)	
	Abs.	%	Abs.	%	Abs.	%
Normal background activity	3	12,5	9	34,6*	7	14
Suppression of BEA of the brain	10	41,7	2	7,7*	12	12,2
Diffuse slow (Θ-Δ) activity	13	54,2	6	23,1*	19	37,8
Regional slow (Δ) activity	9	37,5	10	38,5	19	37,8
Epileptiform activity	13	54,2	6	23,1*	19	37,8

Note: * - reliability of data between groups (P<0,05)

The diffuse nature of the pathological process in VE determines the absence of significant local changes in the background pattern. However, in children, a regional deceleration of activity (delta range) is determined, mainly in the projection of the temporoparietal regions, against the background of disorganization of the cortical rhythm and the predominance of theta range oscillations in all leads.

A repeated EEG study, carried out in the early period of convalescence (2-3 months), showed positive dynamics in all children in the form of recording a stable, mildly disorganized alpha rhythm and the absence of regional changes observed in the primary study.

Epileptiform signs in EE were recorded in 6 children against the background of pronounced diffuse changes in BEA in the form of a predominance of slow-wave theta-delta oscillations in the pattern in all leads. In 3 cases, multiple, sharp waves and peak-wave complexes were noted in the central-parietal-temporal areas of both hemispheres with lateralization. In the clinical picture, these children showed the status of complex partial seizures with prolonged coma of 1-2 degrees. When re-examining after 2 months in both cases, there was a negative dynamics in the form of dominance of the delta rhythm and registration of the "acute-slow" wave complexes in one of them along the parieto-occipital leads of one hemisphere.

On the basis of our study, a differential diagnostic table was compiled (Table 3.) of clinical and paraclinical correlations in primary and secondary encephalitis in children.

Table3

Differential-diagnostic table of clinical and paraclinical correlations of primary and secondary encephalitis.

Sign	**Primary encephalitis**	**Secondary encephalitis**
Temperature	High	Subfebrile
General cerebral symptoms	+++	+++
Focal symptoms	+++	+++
Impaired consciousness	Coma 2-3 degrees up to 4 weeks	Coma 1 degree up to 10 days
Flow	Moderate or severe	Relatively heavy
Convulsions	Partial, often motor	Polymorphic against the background of impaired consciousness

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Neuroimaging	Predominantly hyperintense lesions. Expansion of the lateral ventricles. Formation of postnecrotic cysts during convalescence	Signs of non-occlusive hydrocephalus
EEG	BEA oppression	Diffuse slow delta activity

Thus, focal neurological symptoms of encephalitis are characterized by polytopicity: the predominance of cerebellar stem (48.6%), pyramidal (28.5%), cerebellar (15.6%) and stem (7.3%) disorders. A characteristic feature of the clinical course of primary encephalitis in children is the prevalence of severe and moderate forms of the disease and a high incidence of residual consequences (64%). Secondary encephalitis of viral etiology is generally mild.

The study of the bioelectric activity of the brain in secondary encephalitis in 65.4% of patients reveals pathological types of EEG: slow-wave, polyrhythmic, desynchronous, disorganized, while in primary encephalitis in 87.5% of cases.

Conclusions:

1. 1. Neurological consequences of encephalitis are characterized by polytopicity of focal neurological symptoms with a predominance of cerebellar stem (48.6%), pyramidal (28.5%), cerebellar (15.6%) and stem (7.3%) disorders in primary encephalitis, whereas in secondary encephalitis, neurological symptoms were less common (28.3%) and were scattered.
2. 2. An early sign of cerebral dysfunction, indicating a pronounced violation of neuronal metabolism, is the presence on the EEG of diffuse generalized high-amplitude activity (81.6%, $p < 0.05$), refractory to functional loads.
3. 3. In the early recovery period of encephalitis, 90.7% of children have neurological changes with a predominance of CSFD, as well as cerebrasthenic syndrome, vegetative dystonia syndrome, cerebral microsymptomatics syndrome, especially in herpes encephalitis (primary).

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SUMMARY

Focal neurological symptoms of encephalitis are characterized by polytopicity: the predominance of cerebellar stem (48.6%), pyramidal (28.5%), cerebellar (15.6%) and stem (7.3%) disorders. A characteristic feature of the clinical course of primary encephalitis in children is the prevalence of severe and moderate forms of the disease and a high incidence of residual consequences (64%). Secondary encephalitis of viral etiology is generally mild. The study of the bioelectric activity of the brain in secondary encephalitis in 65.4% of patients reveals pathological types of EEG: slow-wave, polyrhythmic, desynchronous, disorganized, while in primary encephalitis in 87.5% of cases.

Key words: encephalitis, neurological manifestations, clinic, diagnosis, children