Value of different variants of EEG registration in diagnostics of epileptical paroxysms in children

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Revealing of clinic-electrophysiological features of various forms of epilepsy in children on the basis of analysis of results of the complex diagnostic study including clinic-anamnestic, neuro-visualization and electrophysiological data, video-EEG monitoring and working out of tests for their differential diagnostics was under study. Complex diagnostic study with video-EEG monitoring has allowed to establish epilepsy at all children, and inaccurate directional diagnosis has appeared in 22, 08 % of cases, and in most cases (71, 78 %) it was defined.

Keywords: epilepsy, video-EEG monitoring, epileptiform activity.

Introduction. An important condition of adequate therapy is early differential diagnostics of epileptic and nonepileptic paroxsismal conditions at children [10]. Differential diagnostics of these conditions in applied medicine is based now on clinical data, data of anamnesis and indicators of routine EEG which not always is correctly registered and interpreted. The data of routine EEG confirms it's insufficient of information in case of not clear character of paroxysmal consciousness [2, 3]. That is why studying of a complex of the data of research of monitoring EEG and video-EEG except clinical and anamnesis data and indicators of routine EEG is actual.

EEG at children in comparison with adults has a number of features. Slow waves, weak expressiveness of regular rhythmic fluctuations at younger children are observed in norm on EEG. It is caused by non-simultaneous maturing of a bark and subcrustal formations of a brain, and also various degree of their participation in formation of biocurrents of a brain [4, 5].

Video-EEG combines video-monitoring of the patient with simultaneous record EEG. This research allows to fix epileptic activity during an attack, to compare a clinical picture of an attack with changes on EEG, to define epileptic focus, to distinguish epileptic attacks from nonepileptic attacks [2, 6, 7, 8].

Thus, data of EEG at children with paroxismal consciousness frustration has essential value for diagnostics, estimations of efficiency of spent treatment and the illness forecast.

Indicators of EEG should be considered in aggregate with an etiology, pathogenesis and features of clinical display of disease [1, 3].

According to the literature, indicators of video-EEG monitoring have the greatest diagnostic value during different stages of a dream [9, 11]. However, the quantity of publications and detailed discussion of results of video-EEG monitoring at children with paroxismal frustration of consciousness of different age isn't enough.

Objective of this research is revealing of clinical and electrophysiological features of various forms of an epilepsy at children on the basis of the analysis of results of the complex inspection including anamnesis, clinical, neurovisual and the electrophysiological datas, including of video EEG monitoring and working out of criteria of their differential diagnostics.

Materials and research methods. On Department of nervous illnesses, the Center of diagnostics and treatment of an epilepsy and nonepileptic paroxismal frustration of consciousness at children (SPbGPMA) 163 children with paroxismal frustration of consciousness from 1 month till 18 years, from them 37 (22,70 %) children under 3 years, 28 (17,18 %) – from 3 to 6, 32 (19,63 %) – from 6 to 9, 23 (14,11 %) – from 9 to 12, 16 (9,82) – from 12 to 15 and 27 (16,56 %) – from 15 till 18 years are surveyed. Children went to clinic of nervous illnesses SPbGPMA for character specification of paroxismal consciousness frustration. Considerable group patients with suspicion on nonepileptic made character of paroxysms (22,09 %), and at the majority sick (71,78 %) were required to specify the epilepsy form. The basic diagnoses in directions for inspection of children are presented to tab. 1.

Among surveyed children of 95 boys (36,68 %) and 68 girls (26,25 %).

Anamnesis data (a current of pregnancy, sorts, the neonatal period, psychomotor development), the family anamnesis, somatic and neurologic statuses was in detail studied.

For diagnosis specification to all patients monitoring in a condition of wakefulness and in the sleep video-EEG was carried out.

Results and discussion. About 40 % of patients addressed for consultation in SPbGPMA with EEG data, spent in other medical institutions, other patient routine (usual) EEG carried out in clinic (tab. 2). At 4 patients with эпилептическими paroxysms at the moment of record of video-EEG-monitoring the data of routine EEG was absent.

The magnetic resonance imaging of a brain was spent at 117 (71,78 %) children. Absence of organic changes of a brain on MRI is revealed approximately at 1/3 (32,48 %) children with epileptic paroxysms. Expansion of subarachnoideal spaces is established at 19,66 %, ventriculomegalia – at 10,26, the combination of expansion subarachnoideal spaces and ventriculomegalia - at 11,97, expansion of subarachnoideal spaces and ventriculomegalia were combined with other developmental anomalies of a brain only in insignificant number of cases (0,61), other developmental anomalies of a brain are found out at 24,79 % of children with an epilepsy.

For specification of diagnosis it was spent video-EEG-monitoring of all patients in a condition of wakefulness and a dream (tab. 3-4).

To thicket at surveyed children during wakefulness came to light focal epileptiform changes – at 64 (39,26 %). Functional immaturity of a brain was marked at 49 (30,06 %) and only at 1 (0,61 %) patient EEG was normal.

Focal changes with secondary generalization during wakefulness are revealed at 11 (6,75 %) patients, the centers in the left and right hemisphere are found out approximately with identical frequency in frontal and temporal areas. Epileptiform focal changes without secondary generalization are revealed at 64 (39,26 %) patients, is slightly more often they were marked in the left hemisphere, than in right, on frequency of localization of the center frontal and temporal areas prevailed, is more rare – parietal and occipital.

The conducted researches have shown that at photostimulation epileptiform activity at patients with epileptic paroxysms has appeared for the first time in 14 (8,59 %) cases, accrued – in 17 (10,43 %) and remained in 13 (7,98 %) cases.

At photostimulation reaction of mastering of a rhythm was absent at 56 (34,36 %), is moderately expressed at 44 (26,99 %), is expressed at 10 (6,14 %) patients with an epilepsy.

Hyperventilation was spent at 112 (68,71 %) from 163 children. Hyperventilation wasn't spent to children of younger age. Against hyperventilation at an epilepsy paroxysmal epileptiform activity appears at 8,93 % of children, diffuse and focal epileptic activity – at 45,54 % of children, the index of slow wave activity – at 45,54 % of children accrues. As a whole of epileptiform changes on EEG accrue at hyperventilation at 54,46 % of children with an epilepsy.

In the sleep came to light epileptiform focal changes with secondary generalization – at 40 (24,54 %) children is more often, and at 26 (65 %) from them were marked multifocal changes, at 7 (17,5 %) the center settled down in the left hemisphere, mainly in lobno-temporal areas, at 5 (12,5 %) – in the right hemisphere, also mainly in lobno-temporal areas, at 2 (5 %) children – in frontal area of the right and left cerebral hemispheres.

Epileptiform focal changes without secondary generalization are revealed at 28 (17,18 %) children. At 9 (11,25 %) from these patients the center settled down in the left hemisphere, and in 7 (77,78 %) cases – in a frontal share. At 13 (46,43 %) patients the center settled down in the right hemisphere, more often in lobno-temporal areas (76,92 % of cases). In the left and right hemispheres the center is revealed at 6 (21,43 %) patients, and center localization in frontal area was marked at 4 (66,67 %) children.

The general data on EEG changes during wakefulness and a dream during monitoring video-EEG testify that at surveyed children came to epileptiform focal changes with secondary generalization (28,83 %) and without secondary generalization (20,25 %) is more often. Were often found out epileptiform diffuse and multifocal changes (31,29 %), are more rare – generalized epileptiform change (9,20 %) and is rare – epileptiform diffuse activity (3,68 %). Epileptiform activity isn't registered only at 11 (6,75 %) patients, at these children activity and functional immaturity of a brain is revealed diffuse slow wave activity.

Epileptic attacks during carrying out of video-EEG of monitoring were marked at 44 (26,99 %) children. At 18 (40,91 %) from them during attacks were registered epileptic diffuse and multifocal changes, at 14 (31,82 %) – epileptic focal changes with secondary generalization, at 8 (18,18 %) – epileptic focal changes and at 4 (9,09 %) – epileptic focal changes.

The general data about очаговых changes at video-EEG monitoring during the periods of wakefulness and a dream at surveyed children testifies that at 80 (49,08 %) children with epileptic paroxysms in wakefulness and dream stages were more often marked multifocal

epileptiform changes (40 %), approximately with identical frequency the centers of epileptiform activity settled down in the left and right cerebral hemispheres separately and together.

Epileptiform activity was registered in frontal, temporal and frontal-temporal areas is more often, is more rare – in parietal and occipital areas.

Indicators of EEG at sick children testify that after a dream remain focal epileptiform changes (58,28 %), are registered generalized changes (10,43 %) less often, it is quite often marked disorganized α - activity (30,06 %). Normal EEG it is noted only at 2 children of this group (1,23 %).

Frequency of revealing epileptiform changes at children with an epilepsy at different variants of research EEG is presented to tab. 5.

Diagnostic value of given videos-EEG of monitoring in a dream condition proves to be true their statistically authentic difference from the indicators received at other investigation phases (tab. 6).

The given tables testify that there is an authentic distinction in frequency of revealing of epileptiform activity on EEG at video monitoring during a dream in comparison with other variants of record EEG. It confirms necessity of carrying out of video-eeg-monitoring at children with record in the sleep for character specification paroxismal consciousness frustration.

Complex inspection with video-eeg-monitoring carrying out has allowed to establish that at children with an epilepsy the erroneous diagnosis is established in 22,08 % of cases, and in most cases (71,78 %) it was specified (tab. 7).

As a result of complex inspection the definitive diagnosis an epilepsy is established at all surveyed children.

The presented data testifies to enough high diagnostic importance of indicators of EEG at hyperventilation for carrying out of differential diagnostics epileptic and nonepileptic paroxysms at children.

Conclusions

Authentic distinction in frequency of revealing of epileptiform activity on EEG is established at video monitoring during a dream in comparison with other variants of EEG record. Detectability of epileptiform and epileptic activity at video EEG monitoring in comparison with routine EEG increases in 3,7 times.

At character specification of paroxismal consciousness frustration it is necessary to be based on the complex data including careful gathering of the anamnesis, character of clinical displays of paroxysms, results of neuroimaging and laboratory inspection. It is necessary to consider quality of carrying out and adequacy of interpretation of EEG data.

At use of results of video-EEG monitoring (during wakefulness and in the sleep) the probability of statement of the correct diagnosis and appointment of timely adequate treatment considerably raises. The invaluable help in differential diagnostics epileptic and nonepileptic paroxysms and specification of the form of an epilepsy at children is rendered by registration of a paroxysm during monitoring video-EEG.

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Table 1

The diagnoses of children before receipt in clinic of nervous illnesses of SPb ГПМА

	Number of the surveyed children	
Diagnosis	абс.	%
Nonepileptic paroxisms	36	22,09
Epilepsy ?	3	1,84
Epilepsy of the concrete form	17	10,43
Epilepsy of not specified form	106	65,03
Without diagnosis	1	0,61
Total	163	100%

Table 2

The basic results of the analysis of routine EEG

Sign	Number of is surveyed th children	
	abs.	%
Generalized complexes of sharp, spike, polyspike-slow wave	6	3,68
Focal epileptiform activity	35	21,47
Paroxismal activity	13	7,98
Combination of diffuse and focal changes	18	11,04
General diffuse changes	1	0,61
Delay of maturing of a base rhythm	75	46,01
Normal	11	6,75
No data	4	2,45
Total	163	100%

Table 3

Results of video-EEG monitoring at children with epileptic paroxysms during wakefulness

Changes of EEG during wakefulness	Number of children	% from total number of children
Generalized epileptiform activity	11	6,75
Focal epilepriform activity with secondary generalized	11	6,75
Epileptiform diffuse activity (without accurate focus)	15	9,20
Epileptiform diffuse and multifocal changes (3 and more focuses)	12	7,36
Epileptiform focal changes	64	39,26
Diffuse slow wave activity, functional immaturity	31	19,02
Functional immaturity, /// complexes of spike-slow wave	18	11,04
Age norm	1	0,61
Total	163	100%

Table 4

Results of changes of EEG at children with paroxismal consciousness frustration in the sleep

	Number of children with consciousness frustration in the sleep	
changes of EEG during the sleep	abs.	%
Generalized epileptiform activity	18	11,04
Focal epilepriform activity with secondary generalized	40	24,54
Epileptiform diffuse activity (without accurate focus)	13	7,98
Epileptiform diffuse and multifocal changes (3 and more focuses)	51	31,29
Epileptiform focal changes	28	17,18
Diffuse slow wave activity, functional immaturity	13	7,98
Total	163	100%

Таблица 5

Frequency of revealing of epileptiform changes at children with paroxismal consciousness frustration on routine EEG and video-EEG-monitoring

Stages of carrying out of researches	Number of children with epileptiform changes		The relation to number of given routine EEG
	abs.	% in relation to number of children with epileptiform paroxysms	
Routine EEG	41	25,15	-
Video-EEG monitoring – Wakefulness condition	113	69,33	2,76
– Dream condition	150	92,02	3,66
– Dream and wakefulness condition	152	93,25	3,71
– Condition after awakening	112	68,71	2,73

Table 6

Reliability of distinction of frequency of revealing epileptiform activity at different investigation phases of EEG

Compared investigation phases	Number of children with epileptiform changes	Significance value P	Confidential probability
Routine EEG –vide EEG monitoring– wakefulness	41	$2,2 \times 10^{-15}$	> 0,9999
	113		
wakefulness-dream	113	0,001	0,999
	150		
dream and wakefulness	150	0,154	0,846
	152		
dream and wakefulness - after awakening	152	0,00006	> 0,9999

Table 7

Distribution of the specified basic diagnoses at children with epileptiform paroxysms in clinic of nervous illnesses of SPbGPMA

Diagnosis	Number of children	Number of children in %
Idiopatic epilepsy	10	6,14
Symptomatic and kryptogenic genereralized epilepsy	16	9,82
Symptomatic focal epilepsy	66	40,49
Kryptogenic focal epilepsy	68	41,72
Syndrom of Landau-Kleffner	3	1,84
Total	163	100%