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Visual pathways involvement in children with acute viral encephalitis

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Received: 2013-04-17 Accepted: 2013-09-03

小儿急性病毒性脑炎的视觉通路受累

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摘要

目的:探讨急性病毒性脑炎患儿的视觉通路受累程度和性质。

方法:对 30 例急性病毒性脑炎患者(年龄 5~12 岁),疾病最初显现的 12d 内视觉诱发电位(VEP)进行调查。在急性病毒性脑炎患者和水痘蜱传脑炎患者之间比较 P_{100} 峰潜伏期及振幅。

结果:两种形式脑炎患儿之间无显着差异。研究对象组中,40%的患者表现出视觉皮层功能障碍(P_{100} 振幅降低),沿视觉通路(P_{100} 潜伏期延长)电导率温和放缓的迹象。

结论:研究发现,视觉通路对病毒性脑炎有很强的耐受性。功能性视皮层对该疾病的抵抗力低。

关键词:视觉诱发电位; 病毒性脑炎;儿童;视觉通路

引用:Voitenkov VB, Komancev VN, Skripchenko NV. 小儿急性病毒性脑炎的视觉通路受累. 国际眼科杂志 2013;13(10):1953-1955

Abstract

• AIM: To investigate extent and nature of visual pathways involvement in children with acute viral encephalitis.

• METHODS: Thirty patients (age 5-12 years) with acute viral encephalitis underwent visual evoked potentials (VEP) investigation within 12 days from the appearance of the first signs of disease. Latency and amplitude of P_{100} peak were compared with normative data and between patients with varicella and tick-borne encephalitis.

• RESULTS: There were no significant differences between children with these two forms of encephalitis. In the whole group in 40% of the cases signs of the visual cortex dysfunction (P_{100} amplitude lowering) and mild slowing of the conductivity along the visual pathways (P_{100} latency lengthening) were seen. In 3% of the cases retrobulbar optic neuritis was diagnosed.

• CONCLUSION: The results indicate that visual pathway have good endurance to the viral encephalitis anatomically, but functionally visual cortex is quite vulnerable towards general disturbances caused by this kind of illness.

• KEYWORDS: visual evoked potentials; viral encephalitis; children; visual pathway

DOI:10.3980/j. issn. 1672-5123. 2013. 10. 03

Citation: Voitenkov VB, Komancev VN, Skripchenko NV. Visual pathways involvement in children with acute viral encephalitis. *Guoji Yanke Zazhi* (*Int Eye Sci*) 2013;13(10):1953-1955

INTRODUCTION

Central visual pathways lesions become main cause of visual impairment in children in developed countries[1]. Due to improved therapy strategies and better survival, encephalitis and meningitis nowadays are one of main reasons for cortical blindness in children. Up to 12. 3% of the cortically blind children acquired this condition due to encephalitis or meningitis[2]. Objective evaluation of the conduction in the visual system in children meets some difficulties[3]. Best neurophysiologic method for this evaluation is visual evoked potentials (VEP)[4]. There are two main VEP recording methods: initiated by flashes of light and by checkerboard pattern. Shape, amplitude and latency of main negative peak in pattern-evoked VEP (P_{100}), change significantly in abnormal conditions[5].

In adults asymmetry of P_{100} amplitude and latencies and amplitude lowering described in Lyme disease and tuberculosis meningitis[5,6]. Visual pathway is often involved in pathological process in multiple sclerosis: VEP abnormalities are obvious in 90% of the patients with long history of this disease [7]. In viral encephalitis in adults main peaks latencies mostly stay intact; amplitude lowering described in

Table 1 VEP latency, amplitude and latency asymmetry in encephalitis group (n=30) and it's comparison with normative data $\bar{x}\pm s$

P_{100} parameter	Patients with encephalitis	Normative data (Creel, 2012; Komantsev*et al*, 2010)
P_{100} latency, left eye (ms)	101.3±6.7	80-106
P_{100} latency, right eye (ms)	102.3±6.6	80-106
P_{100} amplitude, left eye (μV)	10.2±4.93	8-12
P_{100} amplitude, right eye (μV)	10.1±4.44	8-12
Latency asymmetry (ms)	1.75±1.35	Up to 2

43% of the cases [8]. Some authors see VEP abnormalities as the important predictive factor in herpetic encephalitis [9] and white matter lesions in young children [10].

Thus, visual pathway disturbances in adults with inflammatory or neurodegenerative lesions of the brain are well-described. In children with encephalitis these disturbances are less thoroughly investigated. Our aim was to investigate extent and nature of visual pathways involvement in children with acute viral encephalitis.

SUBJECTS AND METHODS

Subjects Thirty children (age 5-12 years, mean 8) with acute viral encephalitis were enrolled in the study. Inclusion criteria were established by thorough neurologic examination and MRI acute viral encephalitis with moderate severity (typical lesions on MRI, no consciousness disturbances, neurological symptoms of moderate severity, ability to walk, ability to communicate and follow instructions). Exclusion criteria were MRI negative results, unconscious state, and age more than 17 years. There were 6 cases of varicella encephalitis (20%), 7 patients with of tick-borne encephalitis (23%) and 17 cases of unidentified viral encephalitis (57%). All patients were examined by ophthalmologist. There were no severe visual disturbances in the group. All patients were conscious.

Study was approved by the local ethical committee according to the Helsinki declaration. The purpose of the study was fully explained to the participants, their parents or legal representatives, written informed consent was obtained from all patients' parents or legal representatives.

Methods All patients underwent VEP procedure, standard checkerboard 30' pattern, reversed every half-second; Neiro-MVP-4 evoked potentials apparatus, in darkened room. VEP were recorded according to currently accepted standard procedures [5]. IBM 654741N CRT 17 inches monitor was used. 2Hz and 100Hz filters, rejection algorithm with upper threshold 300μV, fixation was monitored. Standard cup electrodes (8mm) were used, 10-20 system modified according to the smaller head size. All equipment and EP software was manufactured by Neurosoft Company (Russia).

Average time from the onset of the disease to VEP recording was 12 days (from 6 to 16 days). Amplitude, latency and asymmetry of the main peak P_{100} were evaluated and compared to the medical normative data. At least 2 recordings from each eye were taken and averaged in case of repeatability. Recordings were undertaken through normal pupils and with normal accommodation.

Visual acuity in all children save one enrolled was normal; in one patient, male aged 7, with tick-borne encephalitis moderate drop of visual acuity on both eyes was registered.

Statistical Analysis Statistical analysis was performed by using statistical analysis software for Windows 7.0, STATISTICA package. For the demographic features of the cohort descriptive statistics were used. For group comparisons Chi-squared test was used, the Student's t-test was used for normally distributed parameters. For not normally distributed values Mann-Whitney U-test was used. A P value of <0.05 was considered statistically significant.

RESULTS

Obtained data on average VEP latency, amplitude and asymmetry and it's comparison with normative data (age matched normal cohort) are presented in Table 1.

Average VEP parameters in children with viral encephalitis were comparable with medical normative data. In individual cases slight P_{100} latency abnormality (110-112ms) was seen in 33% of the patients (n = 10). Severe P_{100} latency abnormality (132ms bilaterally) was seen in 1 patient with tick-borne encephalitis (3%). P_{100} amplitude was lower than 12μV and down to 5μV in 40% of the patients (n=12), and lower than 4μV (1.7-4μV) in 13% (n=4). Severe P_{100} amplitude asymmetry (more than 3μV) was seen in 6.7% of the patients (n=2).

Tick-borne encephalitis and varicella encephalitis subgroups each consisted more than of 5 patients. Additional analysis was made and VEP data for these groups compared. Obtained results are summarized in Table 2. Data for the patients with unidentified encephalitis was comparable with that of indentified ethiology; there were no distinctive pattern characterizing unidentified ethiology encephalitis group in general.

DISCUSSION

As it can be seen from the data presented, no significant differences were seen between average VEP parameters in both encephalitis subgroups ($P>0.05$). In 1 patient with tick-borne encephalitis bilateral P_{100} latency extension to 132ms and amplitude drop to 1.7-3μV were seen. Mild bilateral extension of the P_{100} latencies to 107-108ms and amplitudes lowering to 5-12μV were found in 3 patients with varicella and 3 with tick-borne encephalitis.

Table 2 VEP latency, amplitude and latency asymmetry in tick-borne encephalitis and varicella encephalitis subgroups $\bar{x}\pm s$

P_{100} parameter	Varicella encephalitis ($n=6$)	Tick-borne encephalitis ($n=7$)
P_{100} latency, left eye (ms)	102.6±8.55	105.4±10.4
P_{100} latency, right eye (ms)	101.1±8.4	105.6±11.6
P_{100} amplitude, left eye (μV)	12.6±4.97	12.2±3.93
P_{100} amplitude, right eye (μV)	12.1±5.7	12.1±4.6
Latency asymmetry (ms)	2.2±0.9	2.4±0.7

Thus, average VEP parameters in children with acute viral encephalitis were comparable with medical normative. Individual analysis revealed P_{100} amplitude lowering in 40% of the cases. This may reflect diffuse lowering of functional activity of visual cortex neurons. In 30% of the cases mild bilateral visual conduction slowing was seen. Neurophysiologic findings which suffice retrobulbar optic neuritis were obvious in 1 case (3%).

We propose that viral encephalitis affects visual pathways along with general central nervous system disturbances. This involvement is frequent and non-selective in most of the cases. Direct severe affection of visual pathways are relatively rare (3% of the cases according to our data). As we have described before, tick-borne encephalitis usually cause multi-level medullo-pontine-mesencephalic abnormality of brainstem auditory evoked potentials (BAEP). This abnormality is reversible and thus can be described as brainstem dysfunction indicator, but not evidence of its anatomical lesions[11]. We can assume that VEP abnormalities, seen in our study in acute viral encephalitis in children, also can be described in this way.

In conclusion, visual pathway shows good endurance to the viral encephalitis anatomically. Direct involvement of it may be seen in relatively small amount of cases. Nevertheless, visual cortex neurons in children are quite vulnerable towards general disturbances caused by acute encephalitis. There are no significant differences in encephalitis of different etiologies (tick-borne, varicella) concerning their action towards visual pathways in children.

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