

Evaluation Value of Brainstem Auditory Evoked Potentials in Rehabilitation of Children with Developmental Coordination Disorders

Yue Ling, Wang Jing*, Li Xiaoli, Bai Bing*

Neuro Rehabilitation Department, Hebei Children's Hospital Affiliated to Hebei Medical University, Shijiazhuang, China

Email address:

yueling4211@163.com (Yue Ling), 3021296821@qq.com (Wang Jing), 42332532@qq.com (Bai Bing)

*Corresponding author

To cite this article:

Yue Ling, Wang Jing, Li Xiaoli, Bai Bing. Evaluation Value of Brainstem Auditory Evoked Potentials in Rehabilitation of Children with Developmental Coordination Disorders. *International Journal of Biomedical Science and Engineering*. Vol. 11, No. 1, 2023, pp. 16-19. doi: 10.11648/j.ijbse.20231101.13

Received: March 7, 2023; **Accepted:** April 10, 2023; **Published:** April 15, 2023

Abstract: *Objective:* To investigate the effects of brainstem auditory evoked potentials (BAEP) in treatment of developmental coordination disorder (DCD) in children. *Methods:* A total of 87 high-risk children who was examined by brainstem auditory evoked potentials (BAEP) in our hospital from August 2017 to December 2018 were enrolled in the study. According to Peabody motor development scale, these patients were divided into developmental coordination disorder (DCD) group (n=54) and non-developmental coordination disorder (non-DCD) group (n=33). After 3-month comprehensive rehabilitation treatment, the latency and changes of BAEP were observed and compared between the two groups. *Results:* As compared with brainstem auditory evoked potentials (BAEP) in non-developmental coordination disorder (non-DCD) group, the III, V and I ~ III wave latencies in developmental coordination disorder (DCD) group were significantly prolonged ($P<0.05$). After comprehensive rehabilitation treatment, the latency of each wave of BAEP in developmental coordination disorder (DCD) group was significantly shortened ($P<0.01$), as compared with that before treatment and that in non-developmental coordination disorder (non-DCD) group ($P>0.05$). *Conclusion:* Brainstem auditory evoked potentials (BAEP) can comprehensively, objectively and sensitively reflect the conduction function of central nervous system in children with developmental coordination disorder (DCD), which has important clinical application value in the evaluation of early rehabilitation effects.

Keywords: Brainstem Auditory Evoked Potential, High-Risk Infants, Developmental Coordination Disorder

1. Introduction

With the continuous improvement of neonatal intensive care technology, the survival rate of newborns with brain injury has increased year by year [1]. For some severe cerebral hemorrhage, cerebral infarction, children with cerebral hypoxia [2], although he was able to survive, but over the course of time, many children have different degrees of neurological development disorders in infancy, the diseases that it causes generally include: Developmental coordination disorder, Comprehensive sexual developmental disorder, Cerebral palsy, Dysgnosia, and Epilepsia. The clinical presentation involves exercise, language, intelligence, psychology, Behavioral and other aspects of the abnormal performance. Early capacity is easy to ignore. Later, a

small number of children can leave with a variety of disabilities. IT places a serious burden on families and society. Specifically, developmental coordination disorders (developmental coordination disorder, DCD) [3] is children in performing fine and coarse. When doing big action tasks, Movement coordination lags significantly behind that of children of the same age Predicted levels, Infancy is responsible for high-risk factors and postural reflexivity Early diagnosis of children with high risk cerebral palsy or those with cerebral damage, If the comprehensive rehabilitation treatment can be given early, In each developmental milestone to promote the formation and development of various functions in children, IT can improve

the cure rate of young children, Greatly reduce Incidence of cerebral palsy [4-6]. BAEP (brainstem auditory evoked potential, BAEP) was stimulated by sound stimuli recorded in the auditory central cortex of the corresponding temporal lobe. IT can be objective, Sensitive to reflect the function of the CNS [7]. Domestic related bap in the developmental sex association the author has seen relatively little research on the evaluation of treatment effects in children with adjustment disorder. In this study, the clinical value of bap in evaluating the effect of early rehabilitation treatment in children with developmental coordination disorder was explored from the aspect of auditory conduction by testing BAEP in 87 high-risk children.

2. Data and Methods

2.1. The General Data Selected High- Risk

A total of choice Eighty-seven children who visited the Neuro-rehabilitation department of our hospital from August 2017 to December 2018 and met the inclusion criteria were enrolled using the Peabody Motor Development Scale [8]. They were divided into 54 groups of DCD group (with DCD) and non-DCD group (DCD group without DCD). The children were given nutritional brain cells and physical rehabilitation therapy (such as muscle, electrical biofeedback, acupuncture, massage, etc.) for 3 months. The age and sex ratio of group 2 children was not statistically significant ($P > 0.05$), which was comparable. This study was submitted to the hospital medical ethics committee and approved, and the families of the children signed the informed consent form. See Table 1.

Table 1. General data of children in group 2.

group	Age (age, $\bar{x} \pm s$)	Gender [example (%)]	
		man	woman
DCD group (n=54)	3.04 \pm 1.52	30 (53.6)	26 (46.4)
non-DCD group (n=33)	3.69 \pm 1.48	20 (60.6)	13 (39.4)
t (χ^2) price	1.280		0.417
P price	0.204		0.518

2.2. Inclusion and Exclusion Criteria

2.2.1. Inclusion Criteria

- 1) 6 months of age;
- 2) Perinatal brain injury, such as premature birth, hematencephalon, Brain white matter injury, Ischemic and hypoxic encephalopathy, High-risk factors such as hypoglycemic brain injury and bilirubin encephalopathy [9];

- 3) All the children passed through hearing after birth, vision screening.

2.2.2. Exclusion Criteria

- 1) People with obvious auditory and visual impairment and cannot complete the assessment of motor development;
- 2) The presence of neurological malformations, Genetic metabolic diseases, and severe malformations of other systems.

2.3. Detection Method

There was determined by the myographic evoked potentiometer produced by Japan Optoelectronics Company, and the children were given 6.5% orally, chloral hydrate 0.5 ml / kg, tested after sleep. Check in a soundproof shielding room, using a disk silver chloride electrode. Mastoid recording electrode, frontal hairline ground electrode, Cz reference electrode, electrode impedance $< 5 \text{ k}\Omega$. Through short acoustic stimulation, stimulation frequency 10.7 Hz, stimulation intensity 90dBnHL, filtering bandwidth 100 ~ 3 000 Hz, 1 000 stacks and scan time of 10 ms. The contralateral ear was masked with white noise, and the left and right sides were detected separately. If 90 dB does not introduce the waveform, or only wave V is seen, increase the intensity by 10 dB until wave V or typical I, and V, and the maximum stimulation intensity is 120 dB. Repeat at least 2 or 3 times per ear.

2.4. The Abnormal Determination Criteria

There were meeting any of the following items shall be abnormal [8, 10]: (1) 2 standard deviations of each wave incubation period and peak interval in healthy controls; (2) $\sim V$ wave interval / I \sim wave interval > 1.0 ; (3) the difference between both sides of V wave incubation $> 0.4 \text{ ms}$; (4) poor differentiation of V.1.5 Statistical analysis Using SPSS 18.0, statistical software, measurement data expressed as $\bar{x} \pm s$, using t test and count data using χ^2 Test, $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of Latency and Peak Interval

Bap before treatment in 12 group, BAEP III, V, I to prolonged in DCD group were statistically significant ($P < 0.05$). DCD, group with wave I and $\sim V$ incubation period and non-DCD, which were not significant ($P > 0.05$). See Table 2, Figures 1, 2.

Table 2. Two Comparison of incubation ecy and peak interval of bap $\bar{x} \pm s$.

Group	I	III	V	I-III	III-V
DCD group (n = 54)	1.49 \pm 0.16	1.49 \pm 0.16	1.49 \pm 0.16	1.49 \pm 0.16	1.49 \pm 0.16
Non-DCD group (n=33)	1.44 \pm 0.13	1.44 \pm 0.13	1.44 \pm 0.13	1.44 \pm 0.13	1.44 \pm 0.13
t	1.558	6.09	6.156	5.543	1.124
p	0.123	0.000	0.000	0.000	0.264

3.2. Comparison of the Incubation Period and Peak Interval

BAEP before and after treatment, the incubation period of BAEP in the DCD group was shortened, with statistically

significant differences ($P < 0.05$). See Table 3.

3.3. Comparison of Incubation Period and Peak Interval

After treatment in group 2 children of bap I wave, V, I, and ~ V after treatment ($P > 0.05$). See Table 4.

Table 3. Comparison of latency and peak interval between waves before and after bap in the DCD group $n = 54$, $\bar{x} \pm s$.

time	I	III	V	I ~ III	III ~ V
pretherapy	1.49 ± 0.16	4.39 ± 0.30	6.61 ± 0.31	2.91 ± 0.29	2.22 ± 0.21
post -treatment	1.39 ± 0.04	3.77 ± 0.11	5.79 ± 0.13	2.38 ± 0.11	2.00 ± 0.04
t price	4.388	13.348	18.438	11.429	7.203
P price	0.000	0.000	0.000	0.000	0.000

Table 4. Two Comparison of incubation period and peak interval of BAEP after treatment $\bar{x} \pm s$.

group	I	III	V	I ~ III	III ~ V
DCD group ($n = 54$)	1.39 ± 0.04	3.77 ± 0.11	5.79 ± 0.13	2.38 ± 0.11	2.00 ± 0.04
Non-DCD group ($n = 33$)	1.38 ± 0.04	3.78 ± 0.10	5.79 ± 0.12	2.37 ± 0.10	2.01 ± 0.05
t price	1.150	0.377	0.001	0.219	0.535
P price	0.253	0.707	0.999	0.827	0.594

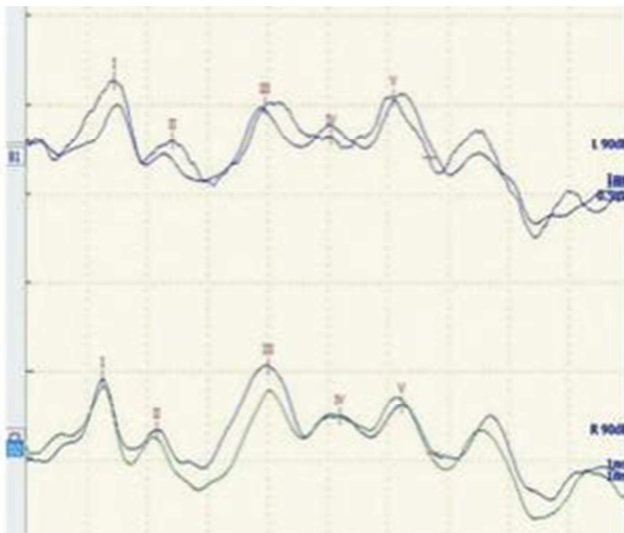


Figure 1. Non-DCD child, 3 months, and BAEP figure.

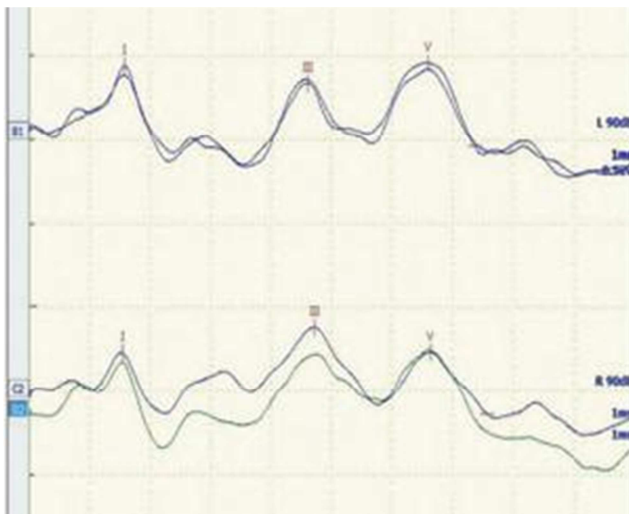


Figure 2. Children with DCD, 3 months, and the BAEP figure.

4. Discussion

High-risk is defined during the fetal period. When childbirth, early infants with high risk factors (especially the central nervous system) that have or may have functional impairment [11, 12]. They may exhibit clinical abnormalities in infancy, but not yet good enough for a diagnosis, such as central coordination disorder, cerebral palsy; may also be clinically normal and they are at higher risk of dysfunction sequelae or backward development than infants without risk factors. Vojta The earliest problem is known as "central coordination disorder" [13]. Proposed as the concept of an early or super-early diagnosis of cerebral palsy, IT has been applied as a new diagnostic name to brain injury diseases, which has been gradually replaced by the term "developmental coordination disorder". Thus for this particular group monitor, follow-up management, IT is very important to give early rehabilitation treatment when necessary. In this study, 87 high-risk infants and 54 were diagnosed with DCD, with an incidence of 62.1%, which may be related to premature infants, neonatal asphyxia and brain injury in case selection.

Damage to the nerve cells can cause changes in the electrophysiology. Brain stems hearing the evoked potentials reflect the function of the nerve conduction pathway from the external ear to the brainstem, the electro physiological situation of nerve cells can be evaluated. It is adopted after a sound stimulation. Through the brain stem listening, the perceptual conduction pathway, the evoked responses were recorded in the corresponding auditory center, with three main waves I, and V, representing the auditory nerve and subcerebral segments, respectively, Electrical activity in the lower segment of the brainstem. Use I, III, Wave V latency and I ~ III, III ~ V peak interval to judge the brain stem auditory pathway and auditory nerve Transmission of the situation. If the corresponding incubation period and peak interval of each wave is extended, then it highly indicates the poor myelination function at the corresponding site [14, 15]. In

this study, 54 children with DCD were significantly longer before treatment, wave V, wave I and non-DCD, but there was no statistical difference ($P > 0.05$), indicating that the brainstem auditory conduction system was impaired in children with DCD, Mainly involving the central part of the auditory pathway, this result is consistent with Xu Shu ling et al [5]. The studies analyze the relative imperfection of central nervous myelination in children with DCD, Leading to slower nerve conduction, and then it affects the motor coordination function of children. At the same time, this study showed that the incubation period of each wave of bap was significantly shortened after treatment, and there was no statistical difference in the incubation period of each wave of BAEP compared with other non-DCP children ($P > 0.05$), indicating the imperfect central nervous myelination function in children with DCD is reversible and can be improved and restored to normal after comprehensive rehabilitation treatment.

At the same time, the BAEP inspection technology is easy to operate and can eliminate subjective factors, Objective evaluation of the auditory conduction function; IT is especially suitable for infants who cannot cooperate with the examination. To ensure the stability of the study results, this study was all conducted by the same operator. Under the same stimulation parameters and recording conditions, considering different months of age infants with age, the myelination function will gradually improve, so the study object is limited to 6 months, so as to minimize the different nerve conduction caused by different months. There can still be false positives, but it is more consistent with medical ethics than with missing some true positives.

5. Conclusion

In conclusion, the early integrated treatment of children with DCD is very important, and brainstem auditory evoked potentials can be integrated from auditory aspects, objective, sensitive to reflect the conduction function of the central nervous system in children with DCD is significant in the evaluation of the rehabilitation treatment effect in children with early DCD.

References

- [1] Wang Xiang's poem. Observation on the therapeutic effect of hyperbaric oxygen on brain injury caused by neonatal hypoxic-ischemic encephalopathy [J]. Modern Health care, 2023, 23 (03): 184-186.
- [2] Yang F Y et al. Dedifferentiation-reprogrammed mesenchymal stem cells for neonates with hypoxic-ischaemic brain injury. [J]. Hong Kong medical journal, 2019, 25 Suppl 5 (4): 12-16.
- [3] Shen Shu. Childhood developmental coordination disorder and their rehabilitation assessment. Chinese Journal of Rehabilitation Medicine, 2014, 29: 1094-1098.
- [4] Novak I, Morgan C, Adde L, et al. Early, accurate diagnosis and early intervention in cerebral palsy: advances in diagnosis and treatment. JAMA Pediatr, 2017, 171: 897-907.
- [5] Herskind A, Greisen G, Nielsen JB. Early identification and intervention in cerebral palsy. Dev Med Child Neurol, 2015, 57: 29-36.
- [6] Tang Jiulai, Wang Baotian, Li Xiaojie. Early diagnosis of cerebral palsy and diagnosis and early intervention of high-risk children of cerebral palsy. Chinese Clinical Journal of Practical Pediatrics, 2018, 33: 1121-1125.
- [7] Xu Shuling, Hu Yulian. Significance of auditory brainstem reaction in the early diagnosis of central coordination disorder in high-risk children. Chinese Journal of Practical Pediatrics, 2013, 28: 790-791.
- [8] Folio MR, Fewell RR, the editor-in-chief. Peabody Motor Development scale. The 1st edition. Beijing: Peking University Medical Press, 2006. 129-233.
- [9] Huang Zhen, Yang Hong, Chen Xiang, et al. Chinese Guidelines for the Rehabilitation of Cerebral Paralysis (2015): Part II. Chinese Journal of Rehabilitation Medicine, 2015, 30: 858-866.
- [10] Guo Dandan. Significance of auditory brainstem reaction in the early diagnosis of central coordination disorder in high-risk children. Chinese Journal of Practical Neurological Diseases, 2016, 19: 84-85.
- [11] Xiang Chen. Early screening and intervention for high-risk children. Chinese Clinical Journal of Practical Pediatrics, 2018, 33: 1045-1048.
- [12] Chu Dongmei, Gao Xinjing, Yao Ling, et al. Comparison of twist motion assessment in prediction of neurodevelopmental outcomes in preterm and high-risk at-term infants. Chinese Clinical Journal of Practical Pediatrics, 2018, 33: 1094-1098.
- [13] Tong Xuetao, Liu Jianjun. Vojta Clinical application of the diagnosis and treatment of central coordination disorder and cerebral palsy. Rehabilitation Theory and Practice in China, 2003, 9: 463-464.
- [14] Zhang Jie, Xing Yan. Auditory evoked potential, transient visual reflex, vestibular muscle evoked potential response for the diagnosis of vertigo. Chinese Otolaryngology Journal, 2016, 4: 495-498.
- [15] Sand T, Kvalcy MB, Wader T, et al. Evoked potential tests in clinical diagnosis diseases. Tidsskr Nor Laegeforen, 2013, 133: 960-965.