Effects of Ultra-early Intervention on Gross Motor Function in Neonates with Hypoglycemic Brain Injury

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Abstract: Objective: To investigate the effect of ultra-early intervention on gross motor function of neonates with hypoglycemic brain injury and evaluate the application value. Methods: we choose thirty four children with hypoglycemic brain injury who hospitalized in the neonatology department of Tai'an City central hospital from January 2017 to December 2019. They were randomly divided into conventional treatment group and ultra-early intervention group, each with 17 people. The conventional treatment group received conventional treatment. In addition to conventional treatment, the ultra-early intervention group was given ultra-early intervention . When two groups of children's corrected gestational age at 40 weeks, 42 weeks and 44 weeks, they need to be tested for NBNA neonatal neurobehavioral testing, and Alberta Infant Exercise Scale (AIMS) assessment. Results: When the child's corrected gestational age is 40 weeks, there is no significant difference in the scores of NBNA and AIMS between the ultra-early intervention group and the conventional treatment group; When the child's corrected gestational age is 42 weeks, the NBNA and AIMS scores of the ultra-early intervention group are higher than those of the conventional treatment group, but there is no statistical significance; When the child's corrected gestational age is 44 weeks, the ultra-early intervention group had higher NBNA and AIMS scores than the conventional treatment group, which was statistically significant ($P<0.05$). Conclusion: After ultra-early intervention, the development level of gross motor in the ultra-early intervention group was significantly higher than that in the conventional treatment group. Ultra early intervention has obvious effect on the improvement of gross motor function in neonates with hypoglycemic brain injury.

Keywords: Ultra-Early Intervention; Hypoglycemic Brain Injury; Gross Motor Function

Hypoglycemia is a common disease of metabolic disorders in the neonatal period. Continuous or repeated hypoglycemia can affect the development of the central nervous system and even lead to irreversible and permanent brain damage[1]. It has placed a heavy burden on the family and society. Early intervention is an organized and purposeful educational activity in a rich environment. According to the law of intellectual development of infants and young children, it can promote the development of their potential and prevent or reduce their disability. [2]. In general, high-risk children with a high risk of developmental disorders should receive early intervention as soon as possible[3]. The treatment of infants and young children from birth to less than 3 months is called ultra-early treatment. At present, the routine treatment of neonatal hypoglycemia is the main clinical treatment, and the ultra-early intervention treatment is less involved. In order to further explore the effect of ultra-early intervention treatment on gross motor function in children with hypoglycemic brain injury, the authors conducted relevant research, and the report is as follows.

1. Data and Methods

1.1 General Information

Inclusion criteria: ① gestational age ≥ 37 weeks, blood glucose level below 2. 2 mmo/L to diagnose hypoglycemia. ②Have related clinical symptoms co-occurring with hypoglycemia, or a history of severe hypoglycemia (0-1. 7mmol/L); ③Have neurological symptoms at the occurrence of hypoglycemia and a period of time after blood sugar correction, such as convulsions, poor response,etc;

Exclusion criteria: ① Severe intracranial hemorrhage ② Intracranial infection ③ Abnormal brain development ④ Brain injury caused by congenital metabolic diseases and endocrine diseases.

A total of 34 children with hypoglycemic brain injury who were hospitalized in Tai'an Central Hospital from January 2017 to December 2019 were selected. Randomly divided into ultra-early intervention group and conventional treatment group. There were 17 cases in each group, and there was no significant difference in general data between the two groups.

1.2 Treatment methods

Routine treatment group: give routine oxygen inhalation, maintain the balance of blood pressure, blood sugar, intracranial pressure and water and electrolyte quality, correct acidosis, and do the routine treatment such as fluid rehydration, anti-infection, improve microcirculation and so on. The ultra-early intervention group gave the ultra-early intervention (15 points / time, 2 times / day) on the basis of routine treatment for 4 weeks. The specific treatment methods are as follows:

1.2.1 Sensory integration training

① Visual perception training: The child is placed in a supine or semi-sitting position in a quiet and aroused state, with a vertical distance of about 20cm from the child's eyes, and a black and white card or a red ball is moved left and right for visual tracking training. At the same time, focus on strengthening and looking at the face, 2 times a day, 1 ~ 2min/time. ②Auditory training: select low-frequency band (between 16-160HZ) soft and pleasant music, gentle speech and singing for auditory stimulation in the awakened state, 2 times a day, 3-5 min/time. ③Tactile training: wrap the child with wrapping pressure or wrap the limbs in a thin cotton hug, try to keep the fingers close to each other, try to get a large area of stable, deep deep sensory stimulation 2 times/day, 3-5 minutes each time Second-rate. ④Vestibular training: Supine position, prone position, lateral position and conversion between various positions. ⑤Proprioceptive training: gentle passive activities of limbs, variable movements of limbs, etc.

1.2.2 Posture management

①Correct limb positioning of the child to suppress abnormal postures and abnormal patterns: lie supine in the "nest" shaped warm box made of bedding, forming a symmetrical flexion posture with a slightly curved head and symmetrical limbs.

1.2.3 Traditional Chinese Medicine Massage

①Using pushing and pressing along the meridians, massage along the meridians of the limbs, 5-8 times/time, 1 time/day. ②Press the acupoints and select "Sishencong, Baihui, Yongquan, Qihai, Guanyuan, Yintang, Quchi, Hegu, Huantiao, Biguan, Yangling, etc. ” Do point pressure, 2-3min/each time. ③Routine health care techniques: open the gate of heaven, push the palace, rub the sun, rub the high bones behind the ears, knead the spine 5-8 times/time, 1 time/day.

2. Evaluation method

At 40, 42, and 44 weeks of corrected gestational age, the infants were evaluated by NBNA neonatal neurobehavioral measurement and Alberta Infant Motor Scale (AIMS).

2.1 NBNA determination method

NBNA scoring criteria are mainly divided into 5 items and 20 items. It mainly includes: behavior ability (6 items), passive muscle tone (4 items), active muscle tone (4 items), original reflection (3 items), and general valuation (3 items). Each item was divided into three grades of 0,1, and 2 points, with a total score of 40 points and 37 points as normal. The test was performed by 1 experienced physician in a quiet, semi-dark environment at a room temperature of 22 to 27℃.

2.2 Alberta determination method

In the prone, supine, sitting and standing positions, the score under each position was obtained, and the total AIMS score was calculated. According to the total AIMS score and month age, the percentile corresponding to the AIMS score is less than 10% as the criterion for abnormal motor development[5-6].

3. Statistical methods

Analysed using SPSS 22. 0 statistical software, measurement data were represented by x ± s and t-test for mean comparison between groups. A P <0. 05 was considered as a statistically significant difference.

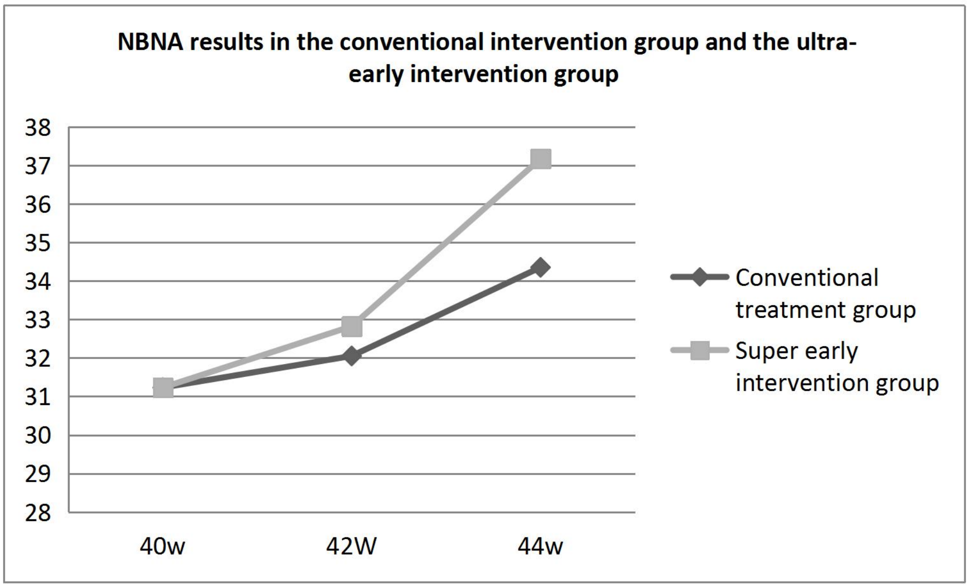
4. Results

(1) The NBNA scores were not significantly different at 40 and 42 weeks (P> 0. 05), and significantly higher in the ultra-early intervention group at 44 weeks compared with the conventional treatment group, and the difference was significant (P <0. 05). See Table 1,2.

Table 1 Comparison of w NBNA measurement results of 40w, 42w, 44 among the groups in conventional treatment group and super-early intervention group (x ± s, points)

group	n	gestational age	capacity for action	Passive muscle tone	Active muscle tone	primary reflection	General reaction	total points
Conventional treatment group	17	40w	8. 94±1. 19	6. 70±1. 04	5. 29±0. 68	4. 82±0. 72	5. 47±0. 71	31. 23±1. 85
ultra-early intervention group			9. 0±0. 86	6. 58 ±1. 27	4. 94±0. 55	5. 05±0 5. 6	5. 64±0. 49	31. 23±2. 07
Conventional treatment group	17	42w	9. 17±1. 13	6. 82±0. 95	5. 47±0. 62	5. 0±0. 86	5. 59±0. 51	32. 05±1. 98
ultra-early intervention group			9. 29±0. 68	6. 82±1. 07	5. 52 ±0. 51	5. 29±0. 46	5. 76±0. 43	32. 82±1. 66
Conventional treatment group	17	44w	9. 94±0. 74	7. 17±0. 88	6. 17±03. 6	5. 41±0. 71	5. 64±0. 49	34. 35±1. 61
ultra-early intervention group			10. 88±0. 69	7. 82±0. 39	6. 64±0. 49	5. 88±0. 33	5. 94±0. 24	37. 17±0. 80

Table 2 NBNA Results

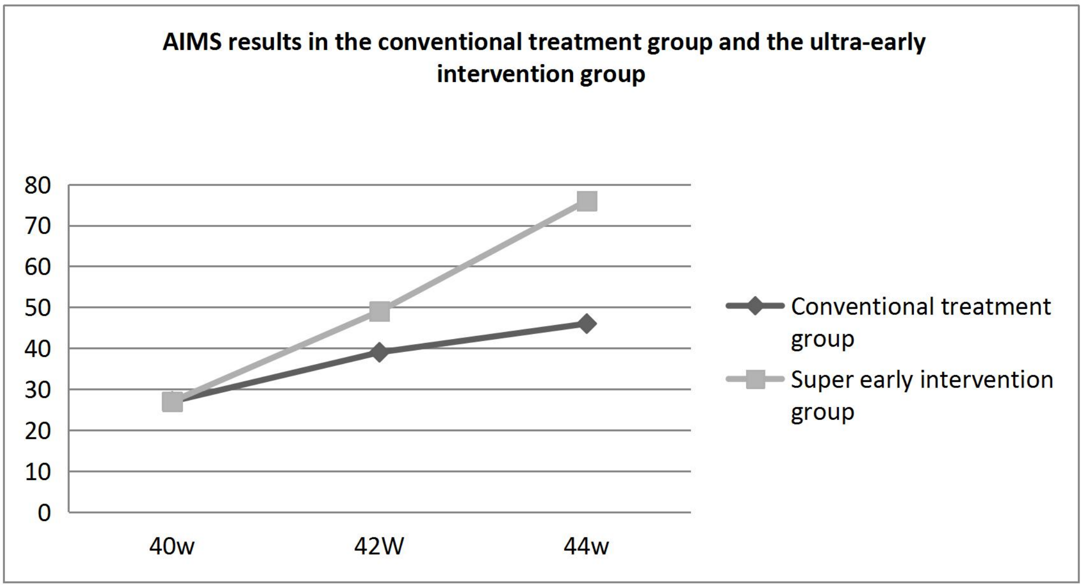


(2) The AIMS scores and total scores of the two groups were compared at 40 and 42 weeks of corrected gestational age (P> 0. 05), and the ultra-early intervention group at 44 weeks was significantly higher than the conventional treatment group, and the scores were significant (P <0. 05). See Table 3,4.

Table 3 Comparison of w AIMS measurement results of 40w, 42w, 44 conventional treatment groups among conventional treatment groups in conventional treatment group and super-early intervention group ($\bar{x} \pm$ s, points)

group	n	gestational age	prone position	dorsal decubitus	a place to sit	erect position	total points
Conventional treatment group	17	40w	1. 0	0. 58±0. 5	0	0	1. 58±0. 5
ultra-early intervention group			1. 0	0. 58±0. 5	0	0	1. 58±0. 5
Conventional treatment group	17	42w	1. 05±0. 24	1. 41±0. 50	0	0±0. 11. 33	2. 29±0. 58
ultra-early intervention group			1. 23±0. 43	1. 11±0. 33	0	0±0. 23. 43	2. 88±0. 78
Conventional treatment group	17	44w	1. 58±0. 50	1. 52±0. 51	0	0. 17±0. 39	3. 29±0. 77
ultra-early intervention group			2. 11±0. 48	2. 05±0. 65	0. 23±0. 43	0. 52±0. 51	4. 94±1. 08

Table 4 AIMS Results



Discussion

Neonatal hypoglycemia is a common metabolic disorder. Continuous repetition can cause irreversible damage to the nervous system, resulting in different degrees of sequelae and dysfunction[1]. The early infancy brain has great plasticity and compensation, and early intervention and rehabilitation training can promote the proliferation of nerve cells and the regeneration of myelin after brain injury to increase the information transmission between neurons[7-8]. Early in life, the brain has enormous plasticity. During passive and active movement in early intervention, synapses are always connecting with each other, establishing connections between nerve cells and compensating for damaged brains[9]. Therefore, actively conducting ultra-early intervention is of profound significance.

ultra-early intervention treatment for visual, auditory, tactile, vestibular, proprioception and other sensory integration training. Sensory integration theory holds that basic senses such as sight, hearing, touch, taste, and smell have been acquired in the neonatal period, and the development of muscle tone, balance, body posture control, and emotional adjustment is closely related to the continuous input of multiple senses. Multiple sensory inputs are integral to promoting the perfection of the developing brain. When these important sensory stimuli are insufficient or impaired, there will be different degrees of paresthesia, which will affect higher-level development such as cognitive ability, action planning, emotion regulation, and hand-eye coordination. [10]Visual training increases visual stimulation through face (red ball) to improve social ability. Hearing training adopts different tones, sound quality and volume sound input, which can guide children to actively find the sound source and enhance the discrimination ability and sensitivity of sound. Body compression (limb pressing) can increase tactile input, reduce tactile sensitivity, and enhance the perception of the limbs. Vestibular perception training increases the sensory input to position perception and vestibular perception through the supine, prone, and lateral lying interposition transformation, which facilitates the regulation of muscle tone. Ontoception training increases proprioception and induces active movement of the limbs through passive limb activity and joint extrusion. Zhang Yanan et al. showed that the input of multiple sensory stimuli can improve the ability of sensory reception and processing in high-risk children[11]And the neurobehavioral ability[12]。

Children in the neonatal period, due to the lack of muscle tension, the limbs are often in a stretched state; and for a long time in this position can lead to muscle movement and development disorders, serious can cause deformity[4]. Through the "nest" shaped position, can promote the development of limb symmetry, make the limbs in the midline flexion position, in order to promote the development of their hand and mouth comprehensive ability, improve self-comfort, and improve self-regulation ability, is conducive to the neuromuscular maturation and autonomic stability[4]; Therefore, early postural management can suppress abnormal posture and promote the development of correct movement patterns.

Traditional Chinese medicine massage is an important part of the essence of traditional Chinese medicine, and the theory of traditional Chinese medicine massage serves as an auxiliary means to promote the development of the rough motor function of high-risk children[13]。

After treatment in the ultra-early intervention group of this study, the gross exercise capacity was significantly higher than that in the conventional treatment group. After treatment, 2 groups compared behavioral ability in NBNA score, significantly and statistically different. This is related to the visual perception and auditory training in the sensory integration training, which improves the habituation of sound and light, and improves the active participation of the children through the adult interaction ability during the training process. Comparison of the AIMS scores in the supine and prone positions of the 2 groups showed a statistically significant ability improvement in the supine and prone positions. This is related to the improvement of the integration ability of visual and hearing, vestibular perception, and position perception, as well as the conversion of various positions, passive limb activity, and traditional Chinese medicine massage, which promotes the muscle activation of the head, neck and back. However, the AIMS scores compared between the sitting and standing positions showed no significant difference, which may be related to the monthly age and the growth and development rules of the children included in the study.

Therefore, the implementation of ultra-early intervention for newborns with hypoglycemic brain injury can significantly improve the gross motor function, promote exercise development, improve the doctor-patient relationship, improve parents' confidence in rehabilitation, and promote the potential of children.

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