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Original article

Effect of early intervention on premature infants' general movements

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Abstract

This study is to investigate the characteristics of premature infants' general movements (GMs) and the effect of early intervention on their GMs.

Methods: The survey was carried among 285 premature infants. (1) Before intervention, the correlation between the gestational age/ birth weight and the GMs was evaluated. (2) The cases were divided into early intervention group ($n = 145$) and control group ($n = 140$), each group was divided into <32 weeks, 32–34 weeks and >34 weeks group according to gestational age. The early intervention was begun at the 3rd day after birth to 54th week gestational age. The rate of GMs among each group was compared after intervention.

Results: (1) Before intervention, gestational age/birth weight was negatively correlated with the rate of cramped-synchronized (CS) ($r = -0.988$, $r = -0.95$, $p < 0.01$), while no correlation with the rate of poor repertoire (PR) ($r = 0.122$, $r = 0.168$, $p > 0.05$). (2) After intervention, for the writhing movement, there was no significant difference ($\chi^2 = 0.509$, 1.401, 0.519, $p > 0.05$) between the early intervention group and the control group. Nevertheless, for the fidgety movement, there was significant difference ($\chi^2 = 7.921$, $\chi^2 = 5.763$, $p < 0.05$) between the two groups, especially in <32 weeks group ($\chi^2 = 5.578$, 4.067 $p < 0.05$) and in >34 weeks group ($\chi^2 = 5.757$, $p < 0.05$).

Conclusions: (1) It shows that the lower birth weight or the younger delivery gestational age, the more abnormal GMs in premature infants. (2) Early intervention could improve the fidgety movements of premature infant.

Keywords: General movements; Early intervention; Premature infants; Gestational age; Birth weight

General movements (GMs) assessment was a reliable and valuable tool to predict the brain function of infants, and it could make accurate and effective prediction on later neurodevelopmental outcome especially more accurately to predict cerebral palsy (CP) before the infants were 4–5 months [1]. Previous studies have shown that the sensitivity of GMs with regard to later CP was 100% with 95% credibility interval (0.73, 1.00) and the specificity was 98% with 95% credibility interval (0.91, 0.99) [2]. In China, Yang concluded that the sensitivity of GMs with regard to later CP was 83% and the specificity was 78% during writhing period, while the sensitivity was 75% and the specificity was 98% during fidgety movement [3]. In addition, it was found the presence of poor repertoire (PR) general movements at 1 month post-term seemed to predict lower neurodevel-

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opmental scores at 2 years especially in the domain of eye and hand coordination [4]. Abnormal fidgety (AF) movements was an early marker for complex minor neurological dysfunction at puberty [5]. More study indicated that cramped-synchronized (CS) general movements and absence of fidget movement (F^-) strongly predict the development of CP [1,2], Therefore, the GMs might serve as an objective and feasible tool for early prediction of neurodevelopmental outcome in high risk infants.

With the rapid development of perinatal and neonatal emergency medicine, the mortality of high risk infants, especially premature infants were reduced greatly, but the damage of central nervous system with different degree of disability rate gradually increased [6]. In recent years, the premature infants suffered severe neurological behavior have changed about 10–15%, with mild nerve behavior have changed about 50% [7]. Therefore, it was very important to take effective measures to promote the growth and development of premature infants, to improve development quotient, and to reduce the incidence of complications as well as the degree of dysfunction [8]. A growing number of research shows that early intervention can improve the growth of nervous system and reduce the incidence of developmental delay or CP effectually [9–11]. Therefore, people were always trying to find the most effective early intervention in these years. Recently, those interventions were confirmed effective as follows: the Newborn Individualized Developmental Care and Interventions Program (NIDCAP), which was a developmental supportive care intervention starting soon after birth and has shown long-time positive effects on behavior and mother–child interaction [12]. The Infant Behavioral Assessment and Intervention Program (IBAIP), a post-discharge intervention could improve the mental, motor, and behavioral outcomes of very low birth weight (VLBW) infants at 6 months corrected age [13], and that found long-time positive effects on children's mobility in daily activities [14]. The qualities of early social interaction seemed to impact the child's language skills, cognitive, social and emotional development [15,16]. However, to date, few studies have been reported about the effects of early intervention on GMs quality. Therefore, this study aimed to investigate the effect of early intervention on premature infants' general movements during writhing period and fidgety period, to guide the preterm infants to carry on early intervention, and to improve their neurodevelopmental outcome and reduce the incidence of CP.

1. Method

1.1. Participants

The study contained 285 premature infants (gestational age < 37 weeks). They were recruited from neonatal intensive care unit (NICU) from Sep 2011 to Dec 2012. The mean delivery gestational age is 33.73 weeks (standard deviation, 2.15 weeks), minimum delivery gestational age is 28 weeks and 2 days, maximum delivery gestational age is 36 weeks and 5 days. The mean birth weight is 2.60 kg (standard deviation, 0.59 kg), the lowest birth weight is 970 g and the highest birth weight is 2850 g. Central nervous system infection, genetic and metabolic disease, chromosomal disease, congenital abnormality, brain malformation and tumors of the central nervous system were excluded.

According to gestational age, all the cases were divided into: <32 weeks group ($n = 29$), 32–34 weeks group ($n = 97$) and >34 weeks group ($n = 159$), according to the birth weight, they were divided into: <1500 g group ($n = 20$), 1500–2000 g group ($n = 90$) and >2000 g group ($n = 175$). And then, all the infants were randomized to one of two groups: early intervention group and control group. The randomization was implemented by sealed envelopes using computer-generated random numbers balanced in groups of eight. Group assignments were generated by the study statistician and unsealed by an individual not involved in data collection. This study was approved from ethics committee of Qilu Hospital of Shandong University and the Affiliated Hospital of Bin Zhou Medical College. All parents of the subjects consented to participate in the study and signed the informed consent in the context of the book.

1.2. Early intervention

The early intervention was carried from the 3rd day after birth to 54th week gestational age. The frequency and maintain time of each intervention would be adjusted according to physical endurance of the infants. The intervention consisted of hospital intervention and family intervention. The infants with stable vital signs in neonatal intensive care unit (NICU) were given hospital intervention, including: (1) auditory stimulation; (2) visual stimulation; (3) tactile stimulation, for 1–2 times a day, 10–15 min each time, performed by a nurse. The infants who leaved NICU and followed up in children health care rehabilitation clinic were given family intervention. These infants would be companied by parent to go to the hospital once a week and accepted neural development evaluation by professional doctor of child development. Then, the parents would be taught the intervention methods by the doctor. The intervention including: (1) auditory stimulation; (2) visual stimulation; (3) tactile stimulation; (4) vestibular motion stimulation; (5) pediatric gymnastics; (6) hydrotherapy. (1)–(5) were performed 2–3 times a day by parents, 15–25 min each time. (6) was performed once a day, 15–30 min each time. Detailed intervention methods: (1) auditory stimulation: talking to the baby, singing and playing music, hearing sound of nurse or mother,