

EFFECT OF EARLY INTERVENTION ON DEVELOPMENTAL OUTCOME OF LOW BIRTH WEIGHT INFANTS

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Abstract

Improving perinatal and neonatal care has led to increased survival of infants who are at-risk for long-term and chronic morbidities, but adverse outcome in low birth weight (LBW) infants continues to be high and has not much declined. Early detection of infants at high-risk is of paramount importance to assess their developmental status and for planning intervention to avoid secondary problems.

A prospective, controlled trial was conducted to assess the effect of early physical therapy intervention on LBW infants. A cohort of 100 LBW infants who got admitted in neonatal intensive care unit (NICU) and referral newborn (RNB) of Raja Muthiah Medical College and hospital (RMMCH) were included prospectively. Infants who received regular early intervention were assigned as interventional group (EI) & infants who were advised but did not turn up for early intervention as control group (NEI). Early intervention (EI) consists of providing continuous multidisciplinary services to infants from birth throughout the first year of life. The Denver developmental screening test (DDST) was used and results were compared. The average level of the achievement in developmental domains for both groups and infants of <50th percentile and >50th percentile were also compared. **Results:** The data shows significant benefit in the achievement of developmental domains in EI group. **Conclusion:** The study suggests a positive effect of early intervention in the developmental outcome in EI group over NEI group of low birth weight infants.

Keywords: Low birth weight infants, Early Intervention, Developmental outcome

1. Introduction

Improving perinatal and neonatal care has led to increased survival of infants who are at-risk for long-term disabilities^{1, 2}. Even though there is a substantial improvement in neonatal survival, the incidence of long-term and chronic morbidities, and adverse outcome in LBW infants continues to be high and has not much declined.^{3, 4,5,6,7} Early detection of infants at high-risk is of paramount importance to assess their developmental status and for planning intervention to avoid secondary problems.^{8,9}

Early intervention (EI) consists of providing continuous multidisciplinary services to infants from birth throughout the first year of life. It means interventional therapy specified for babies at-risk for developmental delay and periodic developmental assessment of motor, cognitive function, language/adaptive functioning¹⁰. EI promotes child health, minimize developmental delays, prevents functional deterioration, and promotes parent-child interaction.¹⁰

The primary aim of the study is to assess the clinical effectiveness of early intervention as assessed by the developmental outcome in low birth weight infants. DDST comprising of gross motor, fine motor, personal social and language domains was used prospectively to evaluate the effects of intervention.

There are various longitudinal studies related to the developmental outcome of infants born prematurely.^{11,12,13,14} EI showed greater developmental progress in acquisition of skills, cognition, intellectual, social functioning and increased weight gain.^{15,16,17,18} However, results from several studies are not conclusive. Many recommend the study of specific developmental training techniques to find positive effects of EI on neurodevelopment of infants during their first year of life.^{19,20,21} Thus, we employed these techniques to study the impact of EI in the developmental outcome of low birth weight infants.

2. Method

Subjects

LBW newborns from NICU and RNB of our hospital over a period of two years were recruited for the study. Inclusion criteria: birth weight <2500 gm²², Singleton delivery. Exclusion criteria: Congenital infections, Neonates with major congenital malformations of cardiovascular, central nervous and respiratory systems or dysmorphic babies. Infants who received regular early physiotherapy intervention were assigned as interventional group (EI) & infants who were advised but did not turn up for early intervention as comparison group (NEI). Sixty infants constituted the EI group (31 male and 29 female) and forty infants (21 males and 19 females) in the NEI group.

Early Intervention

EI was initiated for high risk infants right from the neonatal period after the babies became stable. Early intervention applied remarkably to LBW infants, in order to arouse their actions and feelings, ultimately giving them a normal experience of development through interaction with the mother and environment.¹⁰ The individually adjusted program was described to the parents (especially to the mother), who were trained and received written programs elaborated for their infants. These programs contain intensive schedules to develop elementary sensorimotor patterns^{23,24}, individualized care plans centered on the infant behavioral organization, mother-child interaction, and extending to vision, hearing, feeding, and vocalization. Stimulation was given for at least one hour a day, according to the infant feeding and sleep-time schedules. Infants were reviewed every month. It was emphasized that, aside from the training programs, the infant requires the affection and care of the family members.

Denver developmental screening test (DDST)

The Denver Developmental Screening Test is a simple, clinically useful tool for early detection of infants with developmental delay.²⁵ The test comprised of four domains: gross motor, fine motor/adaptive, language and personal social. The levels of achievement were scored as Advanced, ok/pass, caution and fail depending on the age line.²⁶ The milestones assessment was done according to the corrected age, often calculated prior to developmental assessment for a more accurate comparison of the developmental status.⁴ The date of assessment and the infant corrected age were mentioned against each milestone.

3. Data Analysis

The efficacy of the intervention strategies on achievement in various developmental domains namely gross motor, fine motor, personal social and language at 4th, 8th and 12th months for EI and NEI LBW infants was evaluated using Hotellings T² test for equality of mean.²⁷

The impact of early intervention in improving the average level of achievement in all developmental domains with early intervention and non-early intervention at 4th month and after 12th month was examined, the non-parametric test namely Kolmogorov – Smirnov test²⁸ for equality of means was carried out.

The average level of the achievement in developmental domain for all infants with birth weight of < 50th percentile and >50th percentile were also examined. To examine whether the intervention has any effect between these two groups at 4th, 8th and 12th months for EI and NEI infants, the Kolmogorov- Smirnov test²⁸ was conducted.

4. Results

The age of each infant in both groups was corrected for comparison, and the last examination for the objectives of this study was performed at 12 months of corrected age. No differences in age, socioeconomic features, and examination results were observed at the first examination. Significant differences between groups were observed with better performance in EI than NEI infants.

The efficacy of the intervention strategies on achievement in various developmental domains namely gross motor, fine motor, personal social and language at 4th, 8th, and 12th months for EI and NEI LBW infants was evaluated. In order to compare the achievement in these four developmental domains in both groups it was proposed to test the equality of the mean vectors using the multivariate test procedure, namely, Hotellings T² test for equality of mean. Hypothesis-There is no significant difference in the level of achievement between the infants under EI and NEI groups. The results are given in table 1.

Table 1: The equality of mean vectors of four developmental domains in early intervention low birth weight (EI LBW) infants and non-early intervention low birth weight (NEI LBW) infants at 4th, 8th and 12th months

Age of infants	Hotellings T ²	F statistic	Significance p
4 th month	14.376	100.633	0.000
8 th month	24.189	96.758	0.000
12 th month	23.404	93.614	0.000

The F statistics value with corresponding p value of 0 implies that the means of all the developmental domains differ significantly between the EI and NEI infants. The mean vectors of the four developmental domains differ significantly from 4th to 12th months.

The impact of early intervention in improving the average level of achievement in all developmental domains in LBW infants with early intervention (EI) and non-early intervention (NEI) at 4th month and after 12th month was examined. It was proposed to examine whether there is a significant difference in the average achievement of various developmental domains between these two groups, the non-parametric test namely Kolmogorov – Smirnov test for equality of means was carried out. The results are given in table 2.

Table 2: Kolmogorov–Smirnov test for achievement in all developmental domains at 4th month and after 12 months in LBW infants

Domains	At 4 th month		After 12 months	
	Kolmogorov Z statistic value	p (Significance)	Kolmogorov Z statistic Value	p (Significance)
Gross Motor	0.449	0.988	3.184	0.000
Fine Motor	0.408	0.996	2.817	0.000
Personal Social	0.694	0.721	3.225	0.000
Language	0.694	0.721	3.470	0.000

From the table 2, it is observed that the Kolmogorov – Smirnov Z statistic value have a corresponding P value of > 0.05 at 4th month. So there is no significant difference between the average levels of achievement in all developmental domains for the infants in both groups. After 15 months the corresponding P value of < 0.05 and there is a significant difference between the average level of achievement in all developmental domains in infants of EI and NEI groups. It shows that the achievement in gross motor, fine motor, personal social and language domains differ between the two groups of infants.

The average level of the achievement in developmental domain for all LBW infants of < 50th percentile and >50th percentile at 4th, 8th and 12th months were examined. To examine whether the intervention has any effect between two groups, the Kolmogorov Smirnov test was conducted. Hypothesis- The average level of achievement of the developmental domain do not differ significantly among the LBW infants i.e. < 50th percentile and >50th percentile, in both EI and NEI groups. The results of the analysis are given in the table 3.

Table 3: Kolmogorov – Smirnov test for achievement in all developmental domains at 4th, 8th and 12th months in EI and NEI infants of > 50th percentile and <50th percentile

Domains	Kolmogorov Z statistic value and Significance (p) value for EI and NEI infants of > 50 th percentile and <50 th percentile											
	4 th month				8 th month				12 th month			
	Z value		p value		Z value		p value		Z value		p value	
	EI	NEI	EI	NEI	EI	NEI	EI	NEI	EI	NEI	EI	NEI
Gross Motor	1.532	0.747	0.018	0.632	1.632	0.581	0.012	0.888	1.320	0.362	0.051	0.999
Fine Motor	1.721	0.612	0.005	0.847	1.532	0.612	0.018	0.847	1.296	0.790	0.069	0.561
Personal Social	1.719	0.592	0.005	0.875	0.896	0.592	0.399	0.875	0.849	0.559	0.468	0.913
Language	1.712	0.592	0.004	0.875	1.084	0.778	0.190	0.580	0.825	0.362	0.504	0.999

From the above table the p value for the corresponding Kolmogorov Z statistic value for all domains in EI infants are significant at 4th month. But personal social and language domains were not significant at 8th month. But for gross motor, the p value was significant at 12th month. In NEI infants, there is no difference between the two groups of infants with birth weight of < 50th percentile and in > 50th percentile.

5. Discussion

We studied the effects of early intervention in selected sample of high risk infants. We found differences in developmental outcome between EI and NEI infants, with a better performance in EI infants. The study suggests a positive effect of EI on developmental outcome in LBW infants.

“Early” can be understood in several ways, for example: 1) early after birth; 2) early in the first year of life; and 3) early after onset of the condition. Each intervention type is associated with advantages and disadvantages. Very early treatment interventions are provided for infants who are at risk for neuromotor disorders, and treated as soon as possible to minimize future handicaps.²⁹ CDC model of ‘early stimulation therapy’ was effective. The beneficial effect also persisted at 2 years, without any additional interventions. A reduction of 40% in poor performance could be achieved by EI in LBW babies in Trivandrum.³⁰ Various studies related to the developmental outcome of LBW infants, EI showed greater developmental progress in acquisition of skills, cognition, intellectual, social functioning and increased weight gain.^{31,32}

EI have been carried out in the NICU, after hospital discharge, or may initiate during the first semester of life^{33,34}. Various studies suggested that children who were born prematurely are discharged from the NICU were still at risk for future developmental disabilities^{35,36}, this necessitates systematic monitoring, follow-up, and early intervention services. But in our study we began EI during newborn period itself before hospital discharge and continued during the first year of life by reviewing infants every month. NEI group were also advised to take EI for their infants, but they did not turn up.

A difference in developmental items was observed when comparing infants under EI group with those of NEI group. The level of achievement in all developmental domains in EI infants is greater when compared to NEI infants. There is a significant difference in the level of achievement in the chosen developmental domains as the duration of intervention increases, greater at 12th month when compared to other durations. This implies the effectiveness of the early intervention given. In our study, EI therapy helps in the process of achieving higher level of achievement in gross motor domain, similar studies^{34, 38} is in agreement with our result.

In EI LBW infants, the >50th percentile infants show a better improvement when compared to those infants with < 50th percentile infants in all developmental domains at 4th month; gross motor and fine motor domains at 8th month; and personal social and language domains at 15th month. At 12th month, there is no difference in the level of achievement in all developmental domains between two categories of infants. In NEI LBW infants, there is no difference between the two categories at 4th, 8th and 12th months of intervention.

6. Conclusion:

Early intervention improved the developmental outcomes of high-risk infants. The study suggests a positive effect of early intervention in the level of achievement of developmental domains in LBW infants. This method of intervention prevents disability of the child in future. Intervention is likely to be more effective and less costly when it is provided earlier in life rather than later.

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