



EFFICACY OF HOME BASED EARLY INTERVENTION PROGRAM TO PREVENT CHILDHOOD DEVELOPMENTAL DIFICULTIES AMONG LOW BIRTH WEIGHT BABIES

Paediatric Medicine

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ABSTRACT

Objectives: Prevention of developmental disability in high risk low birth weight babies (<1800gm) requires time intensive developmental therapy since early childhood. Age old Hospital based intervention need to be supplemented by regular goal directed therapy, at home setting by family members. **Method:** High-risk baby after discharge from neonatal intensive care unit, parents counseled about the benefit of regular intervention from the very beginning to bring them out of the disability in future. 29 subjects with Hammersmith Infant Neurological Examination (HINE) Score below 60 were allocated in intervention arm. Home based goal directed intensive activity protocol demonstrated using the principle of coaching (relationship-directed, family-centred intervention; RD-FCI) to their parents. Another 29 subjects of control arm who attended follow-up at fixed schedule, received only routine institutional care (need based care). Subjects were evaluated by using HINE at baseline during recruitment at age of 3rd month corrected age and then followed up at 6th, 12th, 18th & 24th months. **Result & Discussion:** Changes in HINE score at 3rd, 6th, 12th, 18th & 24th months were plotted longitudinally to show score trajectory of individual participants (in linear mixed effect models). Median value of HINE score of both group at each visit is compared in figure(attached). Median value of HINE Score obtained at 3rd months was- 52 (Intervention group) vs 51 (control group). Similarly at 6th month- 59 vs 55, at 12th month -65 vs 61, at 18th month -70 vs 66, at 24th month-74 vs 70 respectively. Median value HINE score of intervention group shows better outcome, compare to control group at age 6th, 12th, 18th & 24th month which indicates the intervention module is effective. **Conclusion:** Parent delivered home based early intervention model is effective in achieving the better development of LBW baby.

KEYWORDS

Low Birth Weight (LBW), Neurodevelopment, Early Intervention (EI), Home Based Intervention

INTRODUCTION

Babies with low birth weight (<1800 gm) can be born prematurely or full-term. The first 1000 days i.e., from conception through age 24th months, are foundational for brain development (Fox, S. E et al., 2010). About 8% of total birth annually in the USA and 16% of birth worldwide are low birth weight and about 1.5% of children are born with very low birth weight in 2013 (Martin, J. A., et al. 2013.). Various factors contribute to low birth weight, including maternal health issues, poor nutrition, infections during pregnancy, and multiple pregnancies. Low birth weight infants are vulnerable for neurodevelopmental delays including cognitive development, motor skills, and learning abilities (Upadhyay et al., 2022). As low birth weight and developmental delays are often interconnected, low birth weight infants suffer from a higher risk of developmental delay in various developmental domains i.e. cognitive development, motor skills and learning abilities in future (Kyriakidou et al., 2020). These delays can impact the child's ability to reach age-appropriate milestones, necessitating early and continuous intervention. It is obvious that low birth weight infants face challenges of cognitive developmental, difficulties with memory, and impaired intellectual & slower language acquisition, besides, motor developmental delay and learning disabilities (Suvorov et al., 2022).

The developmental issues related to Premature birth can include, vision and hearing impairments, and difficulties with social and emotional development also (Arvind Krishna et al., 2025). As preterm and low birth weight neonates are vulnerable to neurodevelopmental disability, Regular follow-ups with pediatricians and specialists are essential to track progress and address any emerging concerns related to the issue.

Early intervention programs enhance neurodevelopment, providing the necessary support to promote brain development (Kyriakidou et al., 2020). Parents and caregivers play a crucial role in supporting the growth and development of low birth weight infants by providing a stimulating environment, they can help improve the child's long-term

outcomes (Jeong et al., 2021 & Incomioernani et al., 2024) . Thus we planned to assess the impact of intensive developmental therapy at home setting, delivered by care giver & to assess the result through serial HINE examination. HINE is a well-studied examination tool to assess the developmental progress of high risk babies (LBW) (Maitre et al., 2016) .

Methods

Objective of the Study: The aim is to find out the effectiveness of home based early developmental intervention on high risk babies to improve their neuro-developmental performance & prevention of disability.

Study Setting: Sick Newborn Care Unit (SNCU) follow up clinic of Dr. B.C. Roy Post Graduate institute of Pediatric Science,

Study Population: Low birth weight babies (<1800 gm) discharged from SNCU were the study population. To assess neurological abnormality, the Hammer Smith Neonatal Neurological Examination at 3rd month age was done.

Study Design: We have designed a randomized interventional study where the subjects will be randomized in two arms. One arm received home based early stimulation and intervention along with usual institutional care & other received only routine institutional care (need based care). The early intervention program described to the parents (especially to the mothers) of low birth weight SNCU discharged babies. These programs include complete schedules to improve elementary sensory motor patterns, individualized care plans centered on the infant behavior, mother child interaction, extending to vision, hearing stimulation with feeding and vocalization.

Upto 6th month activity of generic multimodal sensory motor stimulation (Ramachandran, S. et al., 2010 and Lekskulchai R et al., 2001) & 6th - 24th months received therapy as per different age stratification (as per NICU protocol, AIIMS New Delhi, a WHO supported neonatal research unit). Family members observe their child development in their time age as per developmental observation card (DOC) for parents developed by Child Development Centre (CDC)

(Nair MKC, et al., 2017). If child shows any delay in milestone that were being recorded to decide about next activity, Therapy activity based on "goal oriented intervention" as per protocol ("early stimulation and developmental activities" chapter as described in David Warner's book "Disabled Village Children" (Werner D., 1987). Appropriate parents covered through topic discussion and goal specific therapeutic intervention with pictures or video & demonstration at clinic with regular interval feedback. Mother (preferable) and father empowered to deliver the desired therapeutic module. Involvement of parents further improve the cognitive & psychomotor aspect. Age specific feeding-nutrition & hygienic practice advised through module also. In our studies we used frequent interaction that occurred after initial training, interaction to support parents to achieve implementation fidelity for the use of a specific intervention protocol with directive feedback, on how parent could work to improve implementation of the strategy, Child's performance were recorded at 3rd, 6th, 12th, 18th & 24th months using HINE done by qualified examiner. Study Protocol approved by institutional ethical committee of Dr. B C Roy PGIPS, Kolkata, W.B.

RESULTS

The primary objective of the study was to evaluate whether a home based early developmental intervention could improve sensory motor development among low birth weight (<1800) infants compared to control group. Mean & median value of HINE score are almost similar, We are considering median value for better representation, as it is more meaningful in our study setting.

At the 3rd-month follow-up, the median value of HINE scores of the intervention and control groups were nearly identical i.e. 52 & 51 respectively. Besides, 6th months of age, early signs of the intervention's impact became noticeable. The intervention group recorded significantly higher HINE scores 59 compared to the control group 55. This value reveals a significant developmental progress of home based intervention at 6 month of age.

A marked deviation in neurodevelopmental outcomes emerged at the 12th month assessment, where the intervention group achieved substantially higher HINE scores compared to control group i.e. 65 and 61 respectively. These results indicate that the developmental (sensory-motor) benefits of home based early intervention during the second half of early life.

Moreover, at 18th months, the intervention group continued to exhibit superior neurodevelopment, with median value of HINE scores of 70 compared to 66 in the control group. This value instigated the development of cognitive-motor pathways and adaptive functioning due to continuous goal-oriented activities delivered by parents.

Finally, 24th-month follow-up, the intervention group maintained its developmental advantage, achieving median scores of 74 compared to 70 in the control group. These results indicate that gains achieved in the first year continued to strengthen, enhancing motor coordination, posture, reflex maturation, and better cognitive-social integration. Comparison of progression improvement in developmental trajectories between the two groups across the follow up period shown in (Fig No – 1). Individual trajectory of HINE score given in different group for better perception (Fig – 2&3).

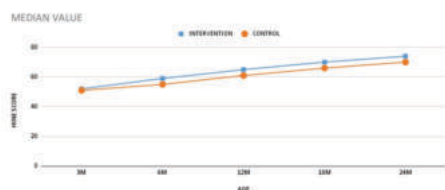


Fig. 01. Line diagram shows that the median value of HINE according to various time points (n=29 each)

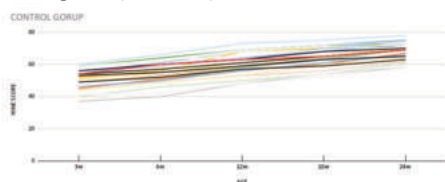


Fig. 02. Trajectory of HINE SCORE of each subject (control group) at various time points (3rd, 6th, 12th, 18th & 24th month) (n=29)

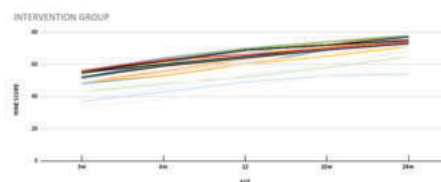


Fig. 03. Trajectory of HINE SCORE of each subject (intervention group) according to various time points (3rd, 6th, 12th, 18th & 24th month) (n=29 each group)

DISCUSSION

Family-centered practices that emphasize active involvement of the family in the child's care have increasingly become the preferred approach in pediatric rehabilitation and early childhood intervention programs. Systematic reviews have consistently indicated that parental engagement in early intervention is associated with improved cognitive, motor, and socio-emotional outcomes for infants, as well as greater parental satisfaction and empowerment (Dunst CJ et al., 2007 & Schirin A. et al., 2020). Findings pointing towards the importance of integrating parents of infants and young children with special needs as active participants in all stages of intervention, including goal setting, intervention planning, implementation, and outcome evaluation. Over the past decade, coaching (RD-FCI), using early intervention (EI) strategies has emerged as a complex yet effective approach. This methodology involves multimodal interventions designed to promote parent-infant interactions and facilitate developmental gains (Rush D et al., 2011).

In contrast to earlier studies using coaching principles in early intervention, the present study offers several key advantages. Firstly, the intervention was longer in duration, extending up to 24th months, whereas prior studies typically implemented short-term programs averaging six months. Secondly, our intervention protocol was goal-oriented, with collaborative goal setting between parents and the primary treating physician, ensuring individualized, needs-based therapy (Friedman M., et al., 2012 & Blauw-Hospers C. H., et al., 2011 & Kaiser A. P., et al., 2013). Structured parent-delivered early intervention into follow-up care for high-risk neonates can serve as a feasible strategy to prevent long-term developmental disabilities.

Blauw-Hospers et al. reported that infants of mothers with relatively low educational levels benefited more from RD-FCI in terms of cognitive outcomes compared to infants of more educated mothers (Blauw-Hospers CH et al., 2011). Empowering families and leveraging the home environment as a therapeutic setting, this approach reduces reliance on resource-intensive hospital-based therapies while maintaining high efficacy, which applicable for LMIC setting.

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