International Journal of Physiotherapy and Research,
Int J Physiother Res 2021, Vol 9(1):3730-35. ISSN 2321-1822
DOI: https://dx.doi.org/10.16965/ijpr.2020.181

Original Research Article

Effect of individualized home-based intervention program in preterm infants at 35-36 weeks gestational age using prechtl's general movement assessment: a pre-post experimental study

Jinali Jain *[1], Deepa Metgud [2].

[*1] KAHER JNMC Nehru Nagar, Belagavi, Karnataka-India.

[2] KAHER JNMC Nehru Nagar, Belagavi, Karnataka-India.

ABSTRACT

Background: Preterm birth associated with various abnormalities can have a detrimental impact on an infant's developmental outcome which marks the need of a landmark tool to detect an abnormality at an early age and incorporate specific intervention strategies. Positive effects of intervention on developmental outcomes have been noted, however tailored home-based intervention programs on developmental enhancements are essential.

Purpose: To evaluate the impact of Individualized Home Based Developmental Program on the neurodevelopmental outcome of preterm infants using Prechtl's General Movement Assessment.

Methodology: Ninety preterm infants admitted to the NICU (Neonatal Intensive Care Unit)of a tertiary care hospital in Tertiary care hospital at Belagavi, Karnataka, India. The study was carried out for a duration of 12 months. Participants were conveniently selected from a population-based sample from May 2018 to March 2019. Based on the inclusion criteria of the study, these infants were screened for the movement trajectories on Prechtl's GMA at 3-36- and 38-40-weeksGA(Gestational Age) respectively. Out of the 90 infants, 19 infants showing abnormal movement trajectories were recruited for individualized home-based developmental program for a duration of 12 weeks followed by re-evaluation at 3 months post term age.

Results: The results were statistically significant ($p<0.001$) with 14 out of 19 infants exhibiting 70% improvement with normal Fidgety movements at 3 months post term age.

Conclusion: IHBP delivered for 12 weeks was found to be effective in promoting developmental outcome in preterm infants.

KEY WORDS: Preterm infants, Prechtl's General Movement Assessment, home-based early intervention.

Address for correspondence: Dr. Jinali Jain, PT., KAHER JNMC Nehru Nagar, Belagavi, Karnataka-India; Contact Number: 8879101753. **E-Mail:** jainjinali471@gmail.com

Access this Article online	Journal Information
Quick Response code	**International Journal of Physiotherapy and Research** ISSN (E) 2321-1822 | ISSN (P) 2321-8975 **https://www.ijmhr.org/ijpr.html** **DOI-Prefix:** https://dx.doi.org/10.16965/ijpr
DOI: 10.16965/ijpr.2020.181	**Article Information** Received: 01 Nov 2020 Accepted: 30 Nov 2020 Peer Review: 01 Nov 2020 Published (O): 11 Jan 2021 Revised: 28 Nov 2020 Published (P): 11 Feb 2021

INTRODUCTION

Preterm birth is one of the global problems accounting for early neonatal deaths. However, with improving survival rates of preterm infants, they are at an increased potential for developing cerebral palsy, intellectual deficits, cardiovascular and respiratory illness which extends to deleterious consequences in later life [1]. Developmental outcome of the infants is jeopardized by the common risk factors including maternal age, health and nutrition, socio economic status and environmental exposures [2,3,4]. Due to the immature Central nervous system, infants demonstrate poor

growth and development which are supported right from the Neonatal Intensive Care Unit (NICU) and followed post discharge. This necessitates developmental supportive care using Early Intervention (EI) programs.

Widely used developmental programs like (Newly Individualized Developmental Care And Assessment Program) NIDCAP[5-7], (Norwegian Physical Therapy Study For Preterm Infants)[8] NOPPI, (Victorian Infant Brain Study) ViBES plus, (Coping for and Caring for Infants with Special Needs) COPCA [10]and parenting programs [11] work on broad guidelines of consistency of care-giving during the hospital stay as well as post discharge. However, home based developmental programs have gained paramount importance in the recent times. It encompasses a multifaceted approach which includes individualized program for every infant, modifications in the living environment and gradually challenging the infant's capacity to an advanced level of function [12-16].

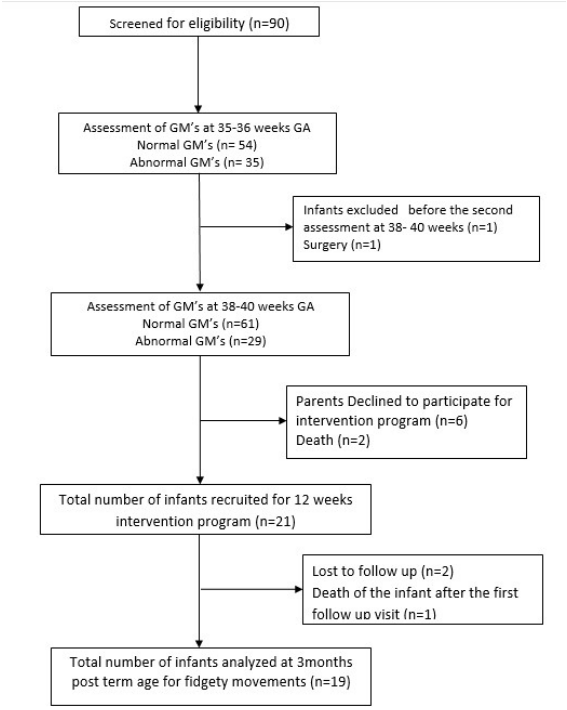
There is a dearth of studies focusing on appropriate time period for executing a developmental program for risk in infants with a goal of achieving a positive and a specific outcome through a standardized examination tool. This study incorporated an individualized home-based developmental program (IHBP) based on elements of NDT(Neurodevelopment Treatment) and sensory integration combined with modifications in the living environment for a period pf 3 months which matches with most of the early intervention studies for promoting neuromotor development in infants.

However to ensure an effective interventional approach, a reliable tool is mandatory to identify neuromotor delay in early months of the life of a preterm infant. Extensively used evaluation tools like Test Of Infant Moor Performance(TIMP), Alberta Infant Motor Scale (AIMS), Denver-2 and cranial imaging methods [17-19] have been less predictive in identifying an abnormality in the early months of the life of a preterm infant. Prechtl's General Movement Assessment (GMA) is considered as a gold standard developed by Heinz Prechtl and others in determining the developmental trajectories in preterm, term and young infants. Through observation of age specific movement characteristics during the writhing and fidgety age, this tool has proven to be sensitive enough with a strong predictive power of 88.9%, denoting integrity of the nervous system [20].

Hence, this study aimed to investigate the effectiveness of IHBP for 12 weeks in moderate to late preterm infants using Prechtl's GMA.

METHODOLOGY

Fig. 1: Flow chart.



Infants of 35-36 weeks GA from the NICU of a tertiary care hospital in Belagavi were conveniently selected from a population based sample admitted from May 2018- March 2019. After obtaining approval from the Institutional Ethics Committee meeting the standards with the Helsinki Declaration as revised in 2008, 90 infants were evaluated on Prechtl's GMA over a period of 1 year at 35-36 weeks and at 38-40 weeks GA after obtaining consent from the parents based on the inclusion criteria, for the observation of the infant's movement quality through a video recording medium at 35-36 weeks and 38-40 weeks GA respectively. Infants with a genetic disorder, congenital anomalies and those who were mechanically ventilated were excluded as it influences the neuromotor outcome. Figure1. represents the Flow Chart depicting the process of screening and recruitment of infants for the IHBP. The

principal investigator trained in the basic course of Prechtls' GMA observed and recorded the quality of movements at both the time frames depending upon the behavioral state of the infants. Infants demonstrating abnormal trajectories of poor repertoire, cramped synchronized and chaotic movements during both the time frames were recruited for the intervention program for duration of 12 weeks.

Intervention: The intervention program was administered at 40 weeks term age to infants with abnormal variation of general movements. It was a tailored home based developmental program where the techniques were demonstrated to the parents in the hospital and they were asked to perform the techniques in front of the therapist until they understood it accurately. They were also allowed to take a video recording of the techniques performed by the therapist.

The first follow up appointment was scheduled after 2 weeks where the difficulties faced by the parents in delivering the intervention were addressed and the therapist would revise the protocol. Major emphasis was on administration of sensory stimulation, positioning and handling techniques. Importance of incorporating an enriched environment with required modifications in advancement of the development of the child was highlighted [21].

Before the second follow up scheduled after 1 month, a phone call was made by the therapist to ensure about the wellbeing of the child by delivery of appropriate care at home and also as a reminder for the next consecutive visit. At the second visit, therapist focused on the postural techniques of NDT promoting play, reciprocal movements of the legs and maintaining a balance between the shoulder, chest and abdominal muscles.

The third follow up visit focused on age appropriate intervention strategies to advance the child to the next level of function. Therapist emphasized on bimanual co ordination, increasing the strength of the trunk muscles, equilibrium reactions and structured play in the home environment with the parents to promote parent-infant bonding. At every follow up visit, parents were motivated to interact and play with the child without any hindrance by external factors.

At the end of 3 months, these infants were evaluated for fidgety movements (F) of Prechtl's GMA which have a strong predictive power for future neuromotor impairment

Outcome Measure

Prechtl's General Movement Assessment (GMA): Prechtl's GMA is a qualitative instrument designed by Heinz F R Prechtl et al to determine the spontaneous motor repertoire in preterm, term and young infants.This tool is built on the Gestalt perception of the movement complexity, variability and fluency right from preterm age (28-35-36 weeks of gestation), writhing age (upto 6-9 weeks post term age), till the final fidgety age (upto 5 months PTA). The tool has been globally used for early prediction of infants posing a risk of any neurological dysfunction. It has been authenticated against several clinical evaluation tools used in infancy and have proved to be a standardized measure with a strong inter rater and test- retest reliability (87-93%) [22-27].

However fidgety movements demonstrate a strong predictive power of 94-100% [20].

Statistical Analysis: The data was analyzed using R i386.3.5.1 statistical software. Continuous variables were represented in the form of Mean (SD) and the categorical variables represented by the frequency table. The Mc Nemar chi-test was applied to study the association between the data obtained at two time points. Per Protocol analysis was used to study the descriptive statistics of fidgety movements of 19 infants. Level of significance was considered 5% ($p<0.05$).

RESULTS

Out of 90 infants screened for GMA, a total of 19 infants were recruited for the intervention program. Table 1 depicts their descriptive profile of gestational age, gender, birth weight and the medical diagnosis respectively. It represents gestational age 35.19 (0.46) with majority of male infants (57.89%). 52.63% infants weighed between 1.1-1.5 kg at birth with mean 1.55(0.34). Table 2 represents a significant difference between the two time

frames of GMA depicting a greater proportion of infants with poor repertoire at 40 weeks who initially presented with normal General Movements. The per protocol analysis depicts 78.95% infants with normal fidgety movements post intervention at 3 months of age, 10.53% with sporadic fidgety movements, 5.26% with absent fidgety movements (Table 3).

Table 1: Descriptive statistics of 19 infants according to age, gender and birth weight.

Factor	Subcategory	Frequency	Mean (SD)
Gestational Age	≤34	0	35.19(0.46)
	34-35	13(68.42%)	
	35-36	6(31.58%)	
Gender	Boys	11(57.89%)	-
	Girls	8(42.11%)	
Birth weight of infant	≤1	3(15.79%)	1.55(0.34)
	1.1-1.5	10(52.63%)	
	≥1.51	6(31.58%)	

Table 1 depicts their descriptive profile of gestational age, gender, birth weight and the medical diagnosis respectively. It represents gestational age 35.19(0.46) with majority of male infants (57.89%). 52.63% infants weighed between 1.1-1.5 kg at birth with mean 1.55(0.34).

Table 2: Difference in the abnormalities of GMA at two time frames.

General Movement Assessment (GMA)	GMA at 35-36 weeks	GMA at 38-40 weeks	P-value
Poor repertoire	16(84.21%)	19(100%)	0.0023*
Normal	3(15.79%)	0	

Table 2 represents a significant difference between the two time frames of GMA depicting a greater proportion of infants with poor repertoire at 40 weeks who initially presented with normal General Movements.

Table 3: Descriptive statistics of 19 infants for fidgety movements at 3 months post term age.

Normal(F+)	**15(78.95)**
Absent(F-)	**1(5.26)**
Sporadic (F-)	**2(10.53)**
Lost to follow up	**1(5.26)**

Table 3 represents the per protocol analysis depicts 78.95% infants with normal fidgety movements post intervention at 3 months of age, 10.53% with sporadic fidgety movements, 5.26% with absent fidgety movements.

DISCUSSION

Statistically significant results were obtained with majority of infants demonstrating normal fidgety movements post intervention at 3 months of age. There was a significant change in GMA between 2 time points highlighting the importance of the writhing and fidgety age which are the major phases of neural transformation. The per protocol analysis for 19 infants showed 78.95% of infants with normal fidgety movements highlighting the effectiveness of 12 weeks of IHBP. The intervention emphasized on age appropriate tailor made program with gradually challenging the infant to the next level of function during scheduled follow up visits. Considering the previous successful intervention programs [5-9], the IHBP incorporated multimodal stimulation, postural techniques of NDT and facilitation of righting and equilibrium reactions to augment the infant's potential.

However, there was heterogeneity among previous research trials regarding the follow up period, effective dosage of the intervention program and a sensitive measure to detect at risk infant. As per previous meta-analytical studies and randomized controlled trials [28], there was a variation in the length of the intervention program. The intervention approach had proven effective but did not include a standard dosage for the delivery of the program. Hence, the present study aimed to concentrate on the standardization of the duration of intervention which proved to be useful for the infant's development. During this time period, encouragement was provided to the parents about the importance of early intervention, regular monitoring of infants during follow up visits, modifications of the home environment to meet the infant's needs, different handling positions and emphasis on play were the major requisites. Also, the family interaction with the infant may have had an impact on neurodevelopment outcome as neuroplasticity is enhanced during the early years of infancy. This supports the COPCA intervention which delivered the program for 12 weeks and demonstrated significant correlations between contents of intervention and outcome at 18 months.

However for delivering an appropriate quality of intervention program, an outcome measure

sensitive enough to detect subtle changes in the young brain is essential. Majority of the trials have reported the use of standardized clinical examination tools like BSID, Denver 2, TIMP, AIMS, PDMS and Griffith Mental development Scale [18,22] from infancy up to the post term age. They have been authenticated against Prechtl's GMA for the diagnosis of future neuromotor impairments. As Precthl's GMA is regarded as the criterion referenced tool, the two major phases, writhing and fidgety movements have the strongest predictive power with a strong inter rater and test retest reliability between 89-93% and 94% sensitivity to detect the underlying abnormality [20]. This is well supported by the guidelines put forward by Einspieler et al and several collaborative studies reporting the use of GMA as an early indicator of neuromotor abnormalities after perinatal brain lesions [23]. Fidgety age being the major phase of neural transformation, post intervention outcome evaluation was done through the observation of fidgety movements.

The positive outcome could also attribute to the interval period provided to the infant for the stabilization of physiological parameters. The trajectories of movement repertoire are important when using Prechtl's General Movement Assessment as a predictive tool. An optimum difference noted in the number of infants displaying abnormal movements at both the time periods was due to either a transient or a consistent brain abnormality or the difference in neural mechanisms. As general movements are likely to normalize between the writhing and fidgety age, it would indicate a transient abnormality which does not require an intervention program. A deviation from the normal noted during both the time frames would indicate a consistent abnormality of cortical subplate which demands the need for an intervention program. Therefore, our study also indicates the need for periodic screening at 35 weeks and 40 weeks to determine the necessity for an intervention program in preterm high risk infants.

Limitations: The study had a small number of infants with abnormal GM's who participated in the intervention program. Low retention rate for the intervention follow up visits was noted due to travel and financial constraints. As the assessment and intervention were carried out by the same investigator, there may have a risk of bias.

CONCLUSION

The individualized home based program was effective in improving the developmental outcome of preterm infants. As the present study found that within 12 weeks of intervention, improvement in the developmental outcome of the infants was noted. Hence, the duration of 12 weeks may be an effective dosage but further studies are desired to rectify the same.

ACKNOWLEDGEMENTS

Funding, material support and other financial support provided are clearly identified in the manuscript.

Conflicts of interest: **None**

REFERENCES

[1]. Shapiro-Mendoza CK, Lackritz EM. Epidemiology of late and moderate preterm birth. Semin *Fetal* Neonat. 2012;17(3): 120-125

[2]. Bos AF, Einspieler C, Prechtl HF. Intrauterine growth retardation, general movements, and neurodevelopmental outcome: a review. Dev Med Child Neurol. 2001;43(1):61-8.

[3]. Meis PJ, Ernest JM, Moore ML. Causes of low birth weight births in public and private patients. Am. J. Obstet. Gynecol. 1987;156(5):1165-8

[4]. Allen MC. Neurodevelopmental outcomes of preterm infants. Curr Opin Neurol. 2008;21(2):123-8

[5]. Ohlsson A, Jacobs SE. NIDCAP: a systematic review and meta-analyses of randomized controlled trials. Pediatrics. 2013;131(3):e881-93

[6]. Sehgal A, Stack J. Developmentally supportive care and NIDCAP. Indian J. Pediatr. 2006;73(11):1007-10.

[7]. Als H, Gilkerson L. The role of relationship-based developmentally supportive newborn intensive care in strengthening outcome of preterm infants. Semin Perinatol. 1997: 21 (3)178-189

[8]. Øberg GK, Campbell SK, Girolami GL, Ustad T, Jørgensen L, Kaaresen PI. Study protocol: an early intervention program to improve motor outcome in preterm infants: a randomized controlled trial and a qualitative study of physiotherapy performance and parental experiences. BMC pediatrics. 2012;12(1):15.

[9]. Spittle AJ, Ferretti C, Anderson PJ, Orton J, Eeles A, Bates L, Boyd RN, Inder TE, Doyle LW. Improving the outcome of infants born at< 30 weeks' gestation-a randomized controlled trial of preventative care at home. BMC pediatrics. 2009;9(1):73

[10]. Levi D, Ibrahim R, Malcolm R, MacBeth A. Mellow Babies and Mellow Toddlers: Effects on maternal mental health of a group-based parenting intervention for at-risk families with young children. J. Affect. Disord. 2019; 246: 820-7.

[11]. Hadders Algra M, Boxum AG, Hielkema T, Hamer EG. Effect of early intervention in infants at very high risk of cerebral palsy: a systematic review. Dev Med Child Neurol. 2017;59(3):246-58

[12]. American Academy of Pediatrics. Follow-up care of high-risk infants. Pediatrics. 2004; 114 (5):1377-97.

[13]. Øberg GK, Campbell SK, Girolami GL, Ustad T, Jørgensen L, Kaaresen PI. Study protocol: an early intervention program to improve motor outcome in preterm infants: a randomized controlled trial and a qualitative study of physiotherapy performance and parental experiences. BMC pediatrics. 2012; 12(1):15.

[14]. Dusing SC, Murray T, Stern M. Parent preferences for motor development education in the neonatal intensive care unit. Pediatr Phys Ther. 2008; 20(4):363-8.

[15].Sgandurra G, Bartalena L, Cioni G, Greisen G, Herskind A, Inguaggiato E, Lorentzen J, Nielsen JB, Sicola E. Home-based, early intervention with mechatronic toys for preterm infants at risk of neurodevelopmental disorders (CARETOY): a RCT protocol. BMC pediatrics. 2014;14(1):268.

[16]. Becker PT, Grunwald PC, Moorman J, Stuhr S. Effects of developmental care on behavioral organization in very-low-birth-weight infants. Nurs. Res. 1993;42(4):214-20.

[17]. Lekskulchai R, Cole J. Effect of a developmental program on motor performance in infants born preterm. Aust J Physiother . 2001;47(3):169-76.

[18]. Cioni G, Prechtl HF, Ferrari F, Paolicelli PB, Einspieler C, Roversi MF. Which better predicts later outcome in fullterm infants: quality of general movements or neurological examination?. Early Hum. Dev. 1997; 50(1):71-85.

[19]. Spittle AJ, Anderson PJ, Lee KJ, Ferretti C, Eeles A, Orton J, Boyd RN, Inder T, Doyle LW. Preventive care at home for very preterm infants improves infant and caregiver outcomes at 2 years. Pediatrics. 2010;126(1):171-8.

[20]. Ferrari F, Einspieler C, Prechtl H, Bos A, Cioni G. Prechtl's method on the qualitative assessment of general movements in preterm, term and young infants. Mac Keith Press. 2004:1-104

[21]. White-Traut RC, Nelson MN, Silvestri JM, Vasan U, Littau S, Meleedy-Rey P, Gu G, Patel M. Effect of auditory, tactile, visual, and vestibular intervention on length of stay, alertness, and feeding progression in preterm infants. Dev Med Child Neurol. 2002;44(2):91-7

[22]. Nicholls A, Williams JM. Can the Prechtl method for the qualitative assessment of general movements be used to predict neurodevelopmental outcome, at eighteen months to three years, of infants born preterm?. Phys Ther Rev. 2016;21 (3-6):131-7.

[23]. Prechtl HF, Einspieler C, Cioni G, Bos AF, Ferrari F, Sontheimer D. An early marker for neurological deficits after perinatal brain lesions. The Lancet. 1997; 349(9062):1361-3.

[24]. Guzzetta A, Mercuri E, Rapisardi G, Ferrari F, Roversi MF, Cowan F, Rutherford M, Paolicelli PB, Einspieler C, Boldrini A, Dubowitz L. General movements detect early signs of hemiplegia in term infants with neonatal cerebral infarction. Neuropediatrics. 2003; 34(02):61-6.

[25]. Hadders-Algra M. Evaluation of motor function in young infants by means of the assessment of general movements: a review. Pediatr Phys Ther. 2001;13(1):27-36.

[26]. Darsaklis V, Snider LM, Majnemer A, Mazer B. Predictive validity of Prechtl's method on the qualitative assessment of general movements: a systematic review of the evidence. Dev. Med. Child Neurol. 2011;53(10):896-906.

[27]. Hadders-Algra M, Mavinkurve-Groothuis AM, Groen SE, Stremmelaar EF, Martijn A, Butcher PR. Quality of general movements and the development of minor neurological dysfunction at toddler and school age. Clin. Rehabil. 2004;18(3):287-99.

[28]. Hughes AJ, Redsell SA, Glazebrook C. Motor development interventions for preterm infants: a systematic review and meta-analysis. Pediatrics. 2016;138(4):20160.

How to cite this article:

Jinali Jain, Deepa Metgud. Effect of individualized home-based intervention program in preterm infants at 35-36 weeks gestational age using prechtl's general movement assessment: a pre-post experimental study. Int J Physiother Res 2021;9(1):3730-3735. **DOI:** 10.16965/ijpr.2020.181