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Impact of Early intervention in the developmental outcome of Infants with Birth asphyxia

KEYWORDS: Birth asphyxia (BA), Early intervention (EI), Developmental outcome.

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ABSTRACT *Background: Despite advances in perinatal care over the past three decades, the incidence of birth asphyxia has not changed. In developing countries, the incidence of post asphyxiate neurological damage is extremely high. Neonatal brain damage due to Birth asphyxia is a primary cause of cerebral palsy, mental retardation.*
Objective: To study the impact of early intervention in the developmental outcome of infants with birth asphyxia till one year of life.
Design: This study had conducted on 48 newborns with birth asphyxia who got admitted in neonatal Intensive Care Unit (NICU) of Rajah Muthiah Medical College& Hospital (RMMC&H). Fifty normal newborns age and weight matched served as control. The infants in the study group received early intervention. Denver developmental screening test (DDST) had administered to both groups every four months of age till one year. The results have compared with regard to the various domains.
Results: There is a significant difference with regard to four domains namely gross motor fine motor personal social and language. The magnitude of the observed domains differs significantly between the treated birth asphyxia infants and the normal infants. The difference in mean values of the four domains gradually narrowed by one year of life in birth asphyxia infants.
Conclusion: The early physical therapy program for infants with birth asphyxia in developmental outcome after one year of age has improved when compared to normal infants.

I Introduction

According to World Health Organization four to nine million cases of newborn asphyxia occurs each year[1]. The incidence of birth asphyxia ranges from 0.3/1000 in a Swedish study[2] to 36.6/1000 live birth infants in an Indian study[3]. Higher rates occur in developing countries with limited diagnostic and interventional resources[4]. In spite of substantial advances in monitoring technology, obstetric care and knowledge of foetal and neonatal pathologies, asphyxia remains a serious condition causing significant mortality and long-term morbidity[5]. Perinatal asphyxia have resulted in clinical presentations such as seizure, cerebral palsy, mental retardation, speech, hearing, visual and learning disabilities[1,6]. An early intervention (EI) could improve developmental outcomes in survivors of birth asphyxia. Early identification of infants at high risk is of paramount importance, in order to assess their developmental level and for planning intervention to avoid secondary problems.

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 regular developmental assessment of motor, cognitive function, language/ adaptive functioning[7]. EI promotes child health minimizes developmental delays cures existing disabilities prevents functional deterioration and promotes parent child interaction[7]

Little effort had done on neurodevelopmental outcome of babies surviving birth asphyxia in developing countries[8]. Very few studies had done on the outcome of asphyxiated infants. High-risk follow up programs specifically by physiotherapists have not been widely reported or studied[9]. No physiotherapist generated studies on the developmental outcome and/ or follow up of asphyxiated infants could be found except the study by Robertson and Finer[10]. Involvement of physiotherapist in the immediate and long-term assessment, and follow up of the asphyxiated infant remains largely unexplored. Various studies on the outcome of neonatal asphyxia weredocumented[11,12,13,14]. By reviewing these studies there is no uniformity regarding inclusion criteria, methods, the age of follow up or assessors. This makes it extremely difficult to compare the outcome of these studies. Hence a trial has made to study the effects of EI in the development of BA infants followed till one year of age.

The goal of this study is to assess the impact of EI program in a group of BA infants. The hypothesis is that BA infants under EI have narrowed developmental outcome when compared to normal infants. DDST has used prospectively to evaluate the effects of EI on their progress during follow up in the first year of life which comprising of gross motor, fine motor, personal social and language domains .

II. Methods

2.1Subjects

Asphyxiated newborn infants who got admitted in NICU and normal newborn infants of RMMC&H have recruited for the study as experimental group and control group.

Inclusion criteria- For asphyxia group; term newborn infants with Apgar score <7 at 5 min and clinical signs of asphyxia have included. For the control group; term newborn infants with Apgar score >7 at 5min and uneventful clinical course during the first 3 days of life has included. Exclusion criteria- Infants with gestational age <37 weeks, perinatal infection, congenital anomalies or metabolic disorders and those who did not complete the developmental follow up have excluded for both groups.

Forty eight BA infants and fifty normal infants- age and weight matched have taken up for the study.

2.2. Early Intervention

EI had initiated for high risk infants right from the neonatal period after the babies became stable. EI applied to BA infants, in order to arouse their actions and eventually giving them a normal experience of development through interaction with the mother and nature[7]. The individually adjusted program had described to the parents (especially to the mother) who had trained and received programs elaborated for their infants. These programs include complete schedules to improve elementary sensorimotor patterns, individualized care plans centered on the infant behavioral, mother child interaction, extending to vision hearing feeding and vocalization.

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Stimulation had given for at least one hour a day according to the infant feeding and sleep- time schedules. Infants assigned to the experimental group received proper EI.

2.3. Denver developmental screening test (DDST)
The Denver Developmental Screening Test an easy clinically useful tool for the early identification of infants with developmental delay[15]. The test comprised of 125 items divided into four domains: gross motor, fine motor/adaptive, personal social, and language. The levels of achievement have scored as advanced, ok /pass, caution and fail depending on the age line[16]. Infants have reviewed every month. All infants in studied and control groups have subjected to complete physical and developmental assessment every four months and followed up for one year.

III. Data Analyses
In order to examine the effectiveness of EI therapy, it has proposed to use multivariate statistical procedure known as testing the equality of mean vectors using Hotellings T square statistic to compare the magnitude of the domains among the treated BA infants and normal infants. For comparison of the mean values for the four domains in both groups, descriptive statistics have applied [17]

IV. Results
The developmental assessments have taken from BA infants who have exposed to EI treatment regularly from birth as well as from normal infants, every four months till one year of age. To examine the efficacy of EI treatment in improving the developmental outcome of BA infants four different domains namely gross motor(X1) fine motor/adaptive(X2) personal social(X3) and language(X4) have taken. To compare the magnitude of these domains among the treated BA infants and normal infants, the comparison of the four domains between the two groups have simultaneously done using Multivariate statistical procedures i.e. testing the equality of mean vectors using Hotellings T square statistic. The null hypothesis tested is H0: m (1) = m (2). It means that the mean vectors of the four domains do not differ significantly between the treated BA infants and normal infants. The same developmental assessments have carried out at 4th 8th and 12th month of age. The results obtained had given in Table1.

Table 1- Results of the equality of mean vectors of both groups

Age of infants	Hotellings T^2	F statistic	Significance
4th month	1.577	49.425	p=0.000
8th month	0.683	15.881	p=0.000
12th month	0.389	9.043	p=0.000

From the above table the following conclusions can be drawn,

For the data obtained at 4th month, the value of hotelling T2 is 1.57 with a corresponding F value

49.425. The relative significance p value=0. Since the p value is less than 0.05 the hypothesis H0 was getting rejected. It implies that there is a significant difference in the average values of the four different domains between the treated BA infants and normal infants. Similarly in the 8th and 12th month also there is a significant difference with respect to the four domains.

From the values of the descriptive statistics of the four domains, it may be observed that for BA infants who are under EI the average values of their domains are somewhat smaller compared with that of normal infants. The mean and S.D values of four domains of the treated BA and normal infants at 4th, 8th and 12th months had given in Table 2.

Table 2- The mean and S.D values of treated BA infants and normal infants 4th month

Domains	Treated BA infants		Normal infants	
	Mean	S.D	Mean	S.D
X_1	2.0262	0.655	3.3958	0.4942
X_2	2.0258	0.662	3.3946	0.4978
X_3	2.0253	0.673	3.3750	0.5309
X_4	2.0246	0.681	3.3542	0.5655

8th month

Domains	Treated BA infants		Normal infants	
	Mean	S.D	Mean	S.D
X_1	2.5833	0.871	3.666	0.476
X_2	2.5823	0.890	3.520	0.507
X_3	2.5219	0.896	3.509	0.504
X_4	2.5208	0.898	3.500	0.503

12th month

Domains	Treated BA infants		Normal infants	
	Mean	S.D	Mean	S.D
X_1	3.104	1.036	3.875	0.334
X_2	3.020	0.999	3.833	0.376
X_3	2.854	0.989	3.750	0.437
X_4	2.675	0.934	3.562	0.483

Where X_1=Gross motor, X2= Fine motor/adaptive, X3= Personal social and X4=Language domains

The S.D values are more pronounced among the treated BA infants in comparison with that of normal infants. The inference drawn was the variations in the domains are more for treated BA infants and the mean values for the four domains are smaller for BA treated infants when compared with that of normal infants. The mean values for BA infants gradually increase over periods of treatment. This brings out the effect of intervention over the treated BA infants. The mean value of the four domains has been getting narrowed between the two groups of infants with the increase in the duration of treatment by 4th, 8th and 12th month. This implies the effectiveness of treatment over the BA infants.

V. Discussion
We studied the effects of intensive EI in selected sample of high risk infants from neonatal period to 12 months of age. We found a better performance in the EI infant group and narrowing in the developmental outcome by one year in comparison with that of normal infants. The study suggests a positive effect of EI in the developmental outcome of BA infants.

A large prospective Perinatal Project and case control study which had done in Western Australia shown that more than 10% of CP cases were related to BA[18]. At neonatal follow up clinics, a large proportion of infants with developmental delays or CP retrospectively have a history of BA[19].

An early intervention program (EIP) could improve the neurodevelopmental outcomes in survivors of birth asphyxia[20]. Follow- up evaluations as long as 18 years have shown significant positive effects for those who received EIP during the first two years of life on measures of intelligence, reading comprehension, mental health and self-esteem[20]. Studies in developed countries and a few in developing countries show the EIP can improve child's development[21, 22].

Very early treatments are intervention provided for infants who are at risk for neuromotor disorders and treated as soon as possible to minimize future handicaps[23]. In this study we initiated EI right from the neonatal period itself and continued till one year of life.

In the present study, gestational age especially term infants has a significant association with BA. There was no significant relationship between BA and birth weight. Aired[24] reported that infants with intrauterine growth retardation play a significant role in occurrence of severe asphyxia. The 5 minute Apgar scores were significantly lower in BA infants than normal infants which are in agreement with Casey[25] report.

The magnitude of the observed four domains in this study differs significantly between the treated BA and normal infants even as the babies are ageing. Variations in the S.D

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values of the domains are more in the treated BA infant. It shows the differing impact of the intervention over the affected infants.

Even though, the mean values for the four domains are smaller for the BA treated infants when compared with the normal infants. The mean values of the four domains are getting narrowed between the two groups over the period of study at 4th 8th and 12th month. This brings out the impact of treatment and its effectiveness on BA infants.

In summary any infant who suffered with an episode of asphyxia should be monitored closely for developmental difficulties: to determine the presence of developmental delays as early as possible and the signs of coming disability, ensuring the provision of appropriate services and support to the infant and their family. The EI depends on the severity of the primary insult and the type of stimulation. We conclude that it is beneficial to treat the BA infants at the earliest to improve their developmental outcome.

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