



RESEARCH ARTICLE

The Emergence of Deafness, Blindness, Cerebral Palsy, and Mental Retardation among very low birth weight (VLBW) Infants, aged 21-24 Months

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Abstract

Purpose: The study aims to assess the emergence of deafness, blindness, cerebral palsy, and mental retardation among very low birth weight (VLBW) infants, aged 21-24 months.

Methods: A study was conducted with a total of 123 premature Saudi infants, who were recruited from King Khalid University Hospital. The association among demographic factors and neurodevelopmental morbidities were identified with the help of regression analysis.

Results: A significant relationship between deafness and cerebral palsy was found. However, there was no significant relationship between retinopathy of prematurity and intraventricular hemorrhage. Furthermore, maternal education plays a positive role in the neurodevelopment of preterm newborns.

Conclusion: This study has concluded that there has been significant relationship between cerebral palsy and deafness in preterm infants with very low birth weight. On the contrary, there was no significant relationship found between intraventricular hemorrhage and retinopathy of prematurity.

Keywords: Blindness, Cerebral Palsy, Deafness, Neonatal Care, Neonatal Morbidity

Abbreviations: **BPD:** Bronchopulmonary Dysplasia, **AAP:** American Academy of Pediatricians, **ROP:** Retinopathy of Prematurity, **HIE:** Hypoxic Ischemic Encephalopathy, **PPHN:** Persistent Pulmonary Hypertension, **PDA:** Patent Ductus Arteriosus

Introduction

The primary cause of neonatal morbidity and mortality is the preterm birth of an infant [1]. Developments in perinatal care have enhanced the chances of survival of preterm low birth weight infants of gestational age of less than 25 weeks. Although, the survival rate has increased, the chances of neonatal morbidity and neurodevelopment impairment have also augmented and increased. On the other hand, the lower the gestational age and the birth weight of the preterm infant; the higher the infants' likelihood of suffering from major neonatal morbidity [2].

The disabilities occur due to the improper development of the infant or poor functioning of nervous system. The limitations that are manifested during infancy or early stage of childhood include cognition, vision, behavior, and hearing. There are the modalities that these disabilities are traced in the early stage of neurodevelopment. However, the cognitive disabilities among

infants and children includes mental retardation as well as it further leads to the learning disabilities. Moreover, distress and chronic stress usually leads to psychological changes, which further result in causing physical distress, psychiatric disorder, and psychological distress [3].

Early years of childhood are important for language development and communication because during this time the brain is at its highest capacity to go about structural changes in regard to external stimulation and is termed as neural plasticity [4]. According to American Academy of Pediatricians (AAP), there are 2% to 3% of infants with developmental disabilities. In most of the cases, no definite cause is ever found. Intellectual disabilities can be further classified as mild, moderate, severe, and profound; and this is done on the basis of various intellectual disabilities. Mental disability is usually result of genetic disorders; for instance, Down syndrome. In case of infants, the genetic disorders are usually detected at an

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early stage. It is due to certain physical or facial characteristics that alert the parents or the clinician.

Experts, who are always associated with disabled children, believed that in such cases early intervention pays off immensely [5]. Not much work has been done in order to investigate the outcome of early intervention for children, who are deaf and blind. However, various studies illustrated that, the early identification and intervention for hearing loss, proved out to be beneficial for infants as it enhances their language skills [6]. Continued ill-health of the mother can lead to further morbidities or disabilities and can negatively impact baby’s health. Whereas, these complications and consequences are not much focused upon in various countries in low-income countries. Families situated in Middle Eastern regions complain about isolation and lack of community resources to help them in improving their child’s abilities. One of the main reasons behind the lack of awareness or medical care is that there are no health professionals or researchers available in such regions. In most cases, these disabilities also come forward due to the mother’s depressive state [7]. The aim of the present study is to assess the relationship between Retinopathy of Prematurity and Intraventricular hemorrhage as well as the relationship between deafness and cerebral palsy.

Methods

A total of 123 premature Saudi infants, with birth weight less than or equal to 1500 grams & gestation less than equal to 32 weeks were recruited. These infants that were chosen for the study were from the King Khalid University Hospital in which these premature infants were delivered. The study was approved from the ethics committee. The analysis was done on the basis of neurological and developmental assessment, along with medical and social history. It was done in order to determine functional and neurodevelopmental outcomes among infants. The neurologic examinations were performed by certified physicians, who had been well trained in this department. The neurological assessment included the evaluation of strength reflex, angles as well as posture. The demographics include age, gender, and gestation age and body weight. The factors examined included were maternal education, birth weight, early-onset sepsis, late-onset sepsis, grades 3 to 4 IVH/PVL, Bronchopulmonary Dysplasia (BPD), Retinopathy of Prematurity (ROP), Hypoxic Ischemic Encephalopathy (HIE), Persistent pulmonary hypertension (PPHN), Patent ductus arteriosus (PDA).

During the first four weeks of life, Intraventricular hemorrhage (IVH) is usually detected by head ultrasound during first four weeks of life. Moreover, it is graded in accordance with Papile’s classification. Periventricular echogenicity, which is noticed on the head ultrasound and is performed at any time during the NICU stay, is known as Preventricular Leucomalacia (PVL). Retinopathy of Prematurity (ROP) is detected during routine retinal examination. Furthermore, Patent Ductus Arteriosus (PDA) is established through an echocardiography with signs of left-to-right shunting. Bronchopulmonary Dysplasia (BPD) refers to the requirement of oxygen at 36 weeks, corrected age.

Table 1: Gestational Age of the study participants

Gestational age	Number	Percent
26	3	2.4
27	6	4.9
28	25	20.3
29	23	18.7
30	36	29.3
31	14	11.4
32	11	8.9
34	3	2.4
35	1	0.8
38	1	0.8
Total	123	100

The data were analyzed to evaluate the impact of morbidities on various neurodevelopmental disabilities like blindness, deafness, cerebral palsy (CP) and mental retardation (MR). Severe mental retardation syndrome includes optic atrophy, microcephaly, that further results in impaired vision, defect in hearing, seizures, restricted movements of large joints and spasticity. The study examined the influence of maternal education and early intervention on BINS at 21 to 24 months infants. Maternal education is considered as one of the strongest determinants that ensures infant survival in developing countries. The statistical analysis was done to assess maternal education and its association with disabilities. BINS was classified into two different groups. First group was low and the other group was taken as moderate (Mod) and high. However, ‘Low’ illustrated that no further follow-up is required; whereas, ‘high’ suggested that further developmental testing is necessary. Descriptive statistics were calculated using mean and standard deviation. Spearman rank correlation analysis was done to find the correlation between Retinopathy of Prematurity and Intraventricular hemorrhage. Chi square test was done to find the association deafness and cerebral palsy. P<0.05 was considered as statistically significant (Table 2).

Table 2: Association between Deafness and CP

	CP (No)	CP(Yes)	Total
Deafness (No)	120(98.4%)	2(1.6%)	122
Deafness(Yes)	0 (0.0%)	1 (100%)	1
Total	120	3	123

Results

The total number of neonates who were examined in the study were 123. Out of the total, newborn females totaled 53 (43.1%). The mean (SD) of the gestation age in weeks was 29.65 (1.82). Amongst the total number of neonates, the lowest gestational age of preterm infants was 26 weeks and the highest gestational age was 38 weeks. Apart from this, the premature neonates that had a gestational age of 28 weeks were 25 (20.3%) infants. Similarly, the preterm neonates that had a gestational age of 30 weeks were 36 (20.3%) infants and were the highest number of infants in that particular classification group (Table 1). Among the 123 mothers, 85 (69.1%) were educated. The

correlation between ROP and IVH was examined and found that spearman, $s\ rho\ r=0.145\ p=0.109$ which is not statistically significant.). The association between Deafness and Cerebral Palsy was found to be statistically significant

(Chi-square=40.38, $P<0.001$)

Discussion

The results revealed that there is significant relationship between Deafness and Cerebral Palsy. However, there was no significant relationship between Retinopathy of Prematurity (ROP) and Intraventricular hemorrhage (IVH). The results are consistent with the study conducted by Neubauer et al. (2008), in which it was discovered that the proportion of disabilities has increased with decreasing gestational age of the newborn. Infants having high grade intraventricular hemorrhage, neonatal seizures, necrotizing enterocolitis and bowel perforation were at a significant risk for developing and enduring major impairment [8].

In a study conducted by Wilson-Costello et al. (2007), modern therapies that were incorporated with regard to low birth weight infants were compared to traditional therapies that were provided to low birth weight infants in the previous two decades. The comparison features were the rate of survival and death with and without impairment and the therapies that were provided. The population comprised of 496 low birth weight infants born (2000-2002), 1749 neonates that were born (1982-1989) and 233 newborns born (1990-1999). The findings revealed that between 1990 and 1999, survival rate has increased from 49% to 68%, but so did neonatal morbidity. Therefore, it leads to survival without impairment as well as survival with impairment [9].

The therapy modification between 2000-2002 included a reduction of postnatal steroid use. Apart from this, antenatal steroid use was increased. It was observed that there were no changes in the rate of lung disease. In addition, there was found to be a decrease in morbidities; such as, severe intraventricular hemorrhage (IVH) and early-onset sepsis (EOS) and late-onset sepsis (LOS). With therapeutic care, the rate of neurodevelopmental impairment has reduced from 35% to 23%. More specifically, the rate of cerebral palsy reduced from 13% to 5%. It was concluded that there was significant reduction in the neurodevelopment impairment in neonates with very low birth weight between 2000-2002 as compared to a decade early. The improved outcomes and the increase in the survival rate of newborns with low birth weight were due to modern therapies that were being provided. These included both perinatal and neonatal factors. However, despite the use of postnatal steroids, the lung condition of the infants showed no improvement [10]. Many studies revealed that maternal education has a positive impact on neurodevelopmental outcome among very low birth infants. The results conducted by Voss et al. (2012) revealed that the maternal educational background was directly associated with the intellectual growth of pre-term infants. Low maternal educational background was connected to reduced composite intelligent

quotient of pre-term kids, who were between the ages of 10-13 years old during the study [11-14].

Conclusion

The preterm birth of an infant can be the cause of neonatal morbidity and mortality. Preterm neonates with a very low birth weight have an increased risk of suffering from neurological, sensory, development, and functional morbidity. The neurodevelopment of all very low birth weight newborns must be monitored and the relevant therapies must be incorporated to ensure and optimize their survival. Some morbidities are directly associated with long-term outcomes of the development of preterm infants. This study has concluded that there is a significant relationship between Deafness and Cerebral Palsy in infants. On the contrary, there was no significant relationship found between Intraventricular hemorrhage (IVH) and Retinopathy of Prematurity (ROP). Additionally, maternal education played a significant role in the development of preterm newborns. However, more studies must be conducted in relation to preterm babies and neonatal morbidity and mortality to get further insights into the causes of morbidities, suffered by preterm babies with very low birth weight.

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