Section: Paediatrics

Original Research Article

NEURODEVELOPMENTAL OUTCOME OF PRETERM BABIES IN A TERTIARY CARE HOSPITAL

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Abstract

Background: Preterm birth has several causes, including antepartum haemorrhage, mechanical causes, hormonal changes, bacterial infection and inflammation. Aim: The study aims to analyse the long-term neurodevelopmental outcome of successfully discharged preterm babies admitted in NICU (GVMCH) for up to 1 year and to know the magnitude of neurodevelopmental disability in preterm. **Materials and Methods:** This Prospective cohort study was conducted at the Department of paediatrics, Government Vellore Medical College and Hospital, A Tertiary Level Hospital in Vellore, from March 2020 to June 2020. One hundred preterm babies born between 28 weeks to 37 weeks and successfully discharged were enrolled in this study. Preterm babies between 28 to 37 weeks and outborn babies referred in the first 24 hours of life were included. **Result:** In the present study, 54% were males, and 46% were females. Most mothers of neonates were in the age group of 26 to 30 years (48%). 58% were normal vaginal delivery, and 42% were LSCS deliveries. 42% had a birth weight of less than 1.75 kg. 52% had anaemia, and 68% had undernutrition. 16% had gestational diabetes mellitus, 31% had pregnancy-induced hypertension, 6% had multiple gestations, and 12% had Antepartum haemorrhage. 42% received oxygen therapy, and 58% did not. 32% had a growth delay, and 68% had no delay. There is a statistically significant association in gestational age, birth order, birth weight, and neonatal risk factors between retinopathy of prematurity, growth delay, and developmental delay. **Conclusion:** Improved perinatal care, development assessment, parent involvement, and early intervention can reduce the incidence of neurodevelopmental delays.

INTRODUCTION

Preterm birth is typically defined as a birth that occurs before the 37th week of pregnancy. Preterm birth has several causes, and the pathophysiology that causes it is mainly unclear; nevertheless, predisposing maternal, foetal, and placental variables have been found.[1] Antepartum haemorrhage or abruption; mechanical causes such as hyper uterine distension and cervical incompetence; hormonal changes; and bacterial infection and inflammation are the most common of these.[2]

Preterm birth risk factors have been identified in epidemiologic research as maternal age of fewer than 17 years or more than 35 years, underweight, overweight pre-pregnancy BMI, and small stature. Preterm birth rates vary by geography and ethnic origin, although they are consistently higher among low and middle-income countries. Physical and emotional stress and smoking have been linked to an increased risk of preterm birth, as has a previous preterm birth.[3] Environmental factors connected to birth, quality of care services, and nurturing constraints due to maternal psychosocial impacts of preterm birth also influence preterm babies' survival and developmental results. Partnerships between experienced health providers and empowered parents who can actively participate in caring for their preterm and sick newborn babies are essential for human capital development. In low-income countries, institutional deliveries have risen over time.

Preterm birth is a leading cause of mortality and morbidity in infants and children. Premature birth affects an estimated 11.1 percent of all births worldwide, with Europe having the lowest proportion (6.2 percent).[4] The yearly birth rate in Italy was over 552,000 in 2008, with preterm very low birth weight infants (VLBWi) accounting for 1% of the total.[5] With the same percentage of VLBW, the yearly birth number has reduced to 420.000 in 2019. Approximately 5–10% of all VLBWi have

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substantial movement abnormalities (cerebral palsy, CP), and 25–50% have cognitive, behavioural, or attention problems.[6] The burden of these impairments and disabilities can be enormous, both on the individuals and families affected and on public health care resources, especially given the long-term consequences.

Aim

The study aims to analyse the long-term neurodevelopmental outcome of successfully discharged preterm babies admitted in NICU (GVMCH) for up to 1 year and to know the magnitude of neurodevelopmental disability in preterm.

MATERIALS AND METHODS

This Prospective cohort study was conducted at the Department of paediatrics, Government Vellore Medical College and Hospital, A Tertiary Level Hospital in Vellore, from March 2020 to June 2020.

One hundred preterm babies born between 28 weeks to 37 weeks and successfully discharged were enrolled in this study. Preterm babies between 28 to 37 weeks born in Government Vellore medical college and hospital, Vellore, and outborn babies referred in the first 24 hours of life were included.

Birth asphyxia, major congenital malformations, dysmorphism, intrauterine infections, and babies requiring surgery were excluded.

Anthropometry, developmental assessment by DDST, tone assessment by Amiel-Tison, vision ROP screening, and hearing assessment by OAE and BERA were done during every follow-up.

Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) were used to analyse the study's data. Frequency and percentage presentations of demographic data were made. The t-test and the chi-square test were used for analyses. The results were thought to be statistically significant at the 0.05 level.

RESULTS

In the present study, 54% were males, and 46% were females. Most mothers of neonates were in the age group of 26 to 30 years (48%). The mean age is 28.62, and the standard deviation is 3.24. 49% of neonates had a gestational age of fewer than 34 weeks, and 51% had a more than 34 weeks gestational age. The mean gestational age is 35.88 weeks, and the standard deviation is 2.23. 58% were normal vaginal delivery, and 42% were LSCS deliveries.

About 24% of neonates were born in the first order. 42% had a birth weight of less than 1.75 kg. The mean birth weight is 2.01 kg, and the standard deviation is 0.86. 52% had anaemia, and 68% had undernutrition [Table 1].

Table 1: Demographic data of the study

		Frequency	Percentage
Gender	Male	54	54
	Female	46	46
Age in years	≤20	6	6
	21-25	24	24
	26-30	48	48
	>30	22	22
Gestational age in weeks	≤34 weeks	49	49
	>34 weeks	51	51
Mode of delivery	NVD	58	58
	LSCS	42	42
Order of birth	1st order	24	24
	More than order 1	76	76
Birth weight	≤1.75 kg	42	42
	>1.75 kg	58	58
Nutritional disorders	Anaemia	52	52
	Undernutrition	68	68

Table 2: Distribution of risk factors and other complications in the study

		Frequency	Percentage
Risk factors	Gestational diabetes mellitus	16	16
	Pregnancy-induced hypertension	31	31
	Multiple gestations	6	6
	APH	12	12
	Apnoea	64	64
	RDS	36	36
	Hyperbilirubinemia	52	52
	Sepsis	14	14
	IVH	2	2
Complications	Organ dysfunction	10	10
	Ventilation requirement	21	21
Oxygen therapy	Yes	42	42
	No	58	58
Delay of growth	Yes	32	32

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	No	68	68
Developmental delay	Yes	12	12
	No	88	88
Tone assessment	Normal	72	72
	Hypotonic	22	22
	Hypertonic	6	6
Retinopathy of prematurity	Yes	12	12
	No	88	88
Hearing	Normal	96	96
	Abnormal	4	4

16% had gestational diabetes mellitus, 31% had pregnancy-induced hypertension, 6% had multiple gestations, and 12% had Antepartum haemorrhage. 64% had apnea, 36% had RDS, 52% had hyperbilirubinemia, 14% had sepsis, and 2% had an intraventricular haemorrhage.
21% required ventilation, and 10% had organ dysfunction. 42% received oxygen therapy, and 58% did not. 32% had a growth delay, and 68% had no delay. 72% had normal tone, 22% had hypotonia, and 6% had hypertonia. 12% had developmental delay, 12% had retinopathy of prematurity, and 4% had abnormal hearing assessment [Table 2].

Table 3: Association between risk factors and retinopathy of prematurity

		With ROP	Without ROP	P-value
Gestational age	≤ 34 weeks	10	39	0.01
	>34 weeks	2	49	
Mode of delivery	NVD	8	50	0.51
	LSCS	4	38	
Birth order	1st order	9	15	0.0001
	>1 order	3	73	
Birth weight	≤ 1.75 kg	10	32	0.001
	>1.75 kg	2	56	
Maternal risk factors	Yes	10	55	0.15
	No	2	33	
Neonatal risk factors	Yes	11	53	0.01
	No	1	35	

There is a statistically significant association between gestational age, birth order, birth weight, neonatal risk factors and retinopathy of prematurity (P<0.05) [Table 3].

Table 4: Association between risk factors and growth delay

Maternal risk factors		Growth delay	No Growth delay	P-value
Gestational age	≤ 34 weeks	20	29	0.06
	>34 weeks	12	39	
Mode of delivery	NVD	18	40	0.80
	LSCS	14	28	
Birth order	1st order	15	9	0.0001
	>1 order	17	59	
Birth weight	≤ 1.75 kg	22	2	0.0001
	>1.75 kg	10	66	
Maternal risk factors	Yes	22	43	0.58
	No	10	25	
Neonatal risk factors	Yes	22	42	0.49
	No	10	26	

There is a statistically significant association between birth order, birth weight, and growth delay (P<0.05) [Table 4].

Table 5: Association between risk factors and development delay

Risk factors		Development delay	No development delay	P-value
Gestational age	≤ 34 weeks	10	39	0.01
	>34 weeks	2	49	
Mode of delivery	NVD	8	50	0.51
	LSCS	4	38	
Birth order	1st order	9	15	0.0001
	>1 order	3	73	
Birth weight	≤ 1.75 kg	10	32	0.001
	>1.75 kg	2	56	
Maternal risk factors	Yes	10	55	0.15
	No	2	33	
Neonatal risk factors	Yes	11	53	0.01
	No	1	35	

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There is a statistically significant association between gestational age, birth order, birth weight, neonatal risk factors and developmental delay (P<0.05) [Table 5].

DISCUSSION

Preterm birth is associated with significant morbidity and mortality. This study was done to analyse the long-term neurodevelopmental outcome of preterm babies. During the study period of one year corrected for gestational age, 100 babies were followed at one month, three months, six months, nine months and one year corrected for gestational age. In the present study, 49% of neonates had a gestational age of lower than 34 weeks, and 51% had a more than 34 weeks gestational age. This high percentage of preterm deliveries <34 weeks in our centre is due to an increased number of high-risk mothers and newborns delivered in primary and secondary health centres from nearby 4 to 5 districts. Gestational age is the single major determinant of worse neurological outcomes, including developmental delay, ROP, and Growth delay with statistically significant association (P-value<0.05).

Most mothers of neonates were in the age group of 26 to 30 yrs (48%).58% were born by normal vaginal delivery, and 42% were LSCS deliveries. These preterm babies and their neurodevelopmental outcomes are analysed and followed up at one month, three months, six months, nine months and one year of corrected for gestational age. Of these, 30% had Tone abnormalities, 12% had developmental delay, 12% had Retinopathy of prematurity, and 4% had an abnormal hearing assessment. In the present study, 12% of babies had developmental delay, and 10% of babies with developmental delay were born before 34 weeks of age, with a statistically significant association between gestational age and developmental delay (P<0.05). Low gestational age and birth weight are significant danger factors in ROP. In this study, 12% of babies had ROP with a statistically significant association between gestational age, birth weight and retinopathy of prematurity (P<0.05). The impact of PDA and BPD on ROP has been shown in a few events in past studies.[7] The presence of PDA has likewise been considered comparable to the advancement of ROP.

The EPIPAGE study reported survival rates without neurodevelopmental impairment at two years of corrected age of 48.5%, 90.0%, and 97.5% for infants born at 22–26, 27–31, and 32–34 weeks of gestational age, respectively. The overall rate of CP at 24–26,27–31, and 32–34 weeks' gestation was 6.9%, 4.3% and 1.0%, respectively.8 Similarly, in our study, the developmental delay was 10% in those babies born before 34 weeks of gestation, whereas developmental delay was only 2% in babies born after 34 weeks of gestation. In a cohort of consecutive extremely preterm infants born before 27 weeks of gestation in Sweden between 2004 and 2007 and evaluated at 30 months of corrected age, 42% of children had no disability, 31% had mild disability, 16% had moderate disability, and 11% had severe disability. CP was present in 7%. Moderate or severe overall disability decreased with increased gestational age at birth.[9]

In our study, overall disabilities, including a growth delay, developmental delay, retinopathy of prematurity and hearing abnormalities, are low in those babies born at high gestational ages. The Victorian Infant Collaborative Study Group assessed neurodevelopmental outcomes at 24 months of corrected age of infants born at gestational age 22–27 weeks in Victoria in 1991 and 2005. It showed a rate of CP of 11% and 9.8%, respectively.6 In our study, babies born with lower gestational ages, 34 weeks, had an increased risk of developmental delay compared with only 2% developmental delay with GA >34 weeks with statistical significance (p-value <0.05). Do et al.[10] (2019) in Vietnam, preterm babies at two years had poor cognitive, language and motor development compared to healthy term babies. This could indicate that NDD among preterm babies does not change much after infancy without effective corrective interventions.

Preterm babies may experience intraventricular haemorrhage, hypoxic-ischemic encephalopathy or seizures, which raise the risk of developmental disabilities, including motor and speech, among these children. Sudhir et al,[11] concluded that the very preterm babies showed considerable lag in growth and development at one year of age when compared to their older counterparts. Since the very preterm babies showed catch-up growth around the middle and later part of the year, efforts to improve the longer follow-up of these babies, nutritional status and adequately stimulating environment will help in optimizing the growth outcome of these babies. In our study, there is more developmental delay and growth delay in babies born at lower gestational ages, with 20%.

CONCLUSION

The incidence of neurodevelopmental delay was significantly high with lower gestational ages and associated risk factors. Most developmental delays go undetected in the early years of life. Improved perinatal care, early assessment of development by appropriate tools, emphasizing the parent's involvement and early intervention at the grass root level will reduce the incidence of developmental challenges in this vulnerable group. More studies are to be conducted in future so that early diagnosis can be made and effective intervention can be started.

Limitation

Shorter time for follow-up, even at one year, some minor morbidities will not manifest, especially cognition defects. Some outcomes are overestimated

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that will disappear due to the brain's plasticity over time, and catch-up growth has not attained at one year corrected for gestational age.

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