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ORIGINAL RESEARCH

Study on Evaluating the Nutritional Status of Preterm Very Low Birth Weight Infants at Discharge

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ABSTRACT

Background: The risk factor that is linked with both the morbidity and mortality is estimated to be low birth weight (LBW). LBW is defined by the World Health Organization as weight at birth less than 2500 g. Therefore this study was carried out to evaluate the nutritional status of preterm very low birth weight infants at discharge.

Materials and Methodology: This study was carried out as a prospective cohort study which was conducted in the Newborn unit of Department of Pediatrics at Maulana Azad Medical College and associated Lok Nayak Hospital, New Delhi. During the study period, which was from April 2009- March 2010, the initial screening and enrolment took place between April 2009 to October 2009. A 130 preterm neonates weighing less than 1500 grams were screened for eligibility. 80 subjects were finally enrolled for the study and 51 completed the complete follow up to 3 months corrected post-natal age.

Results: There was no significant difference with regard to any of the maternal characteristics. In none of the 80 infants enrolled for the study was there any evidence of chorio-amnionitis or chronic illness in mother and none of the mothers were smokers. There was no significant difference for the baseline neonatal characteristics between subjects who completed the study and those who were loss to follow up.

Conclusion: Exclusive breast feeding does not decrease the burden of extra uterine growth restriction among very low birth weight preterm infants. It is possible that the extra uterine growth restriction for weight and length would decrease if the infants were followed for a longer time, which is the limitation of this study.

Keywords: Very Low Birth Weight (VLRW), Newborns, Infants.

INTRODUCTION

Low birth weight (LBW) is a risk factor linked with both infant mortality and morbidity and is used to investigate the conditions for survival and the quality of life of individuals.[1] From past two decades, the survival rate of newborns with LBW has been significantly increased due to advancement of Neonatal Intensive Care Unit (NICU) services. LBW is defined by the World Health Organization as weight at birth less than 2500 g. Overall, it is estimated that

15% to 20% of all births worldwide are LBW, representing more than 20 million births a year.[2] The incidence of LBW especially in developing countries is much higher comparable to developed countries. In India, the prevalence of LBW infants is about 33%, as compared to 4.5% in industrially developed countries.[3] According to UNICEF and WHO, almost 8 million babies are born in India each year wherein almost one third neonates are LBW, this indicates an incidence of 30 percent which is highest in the world i.e. nearly 40 percent of global burden – the highest of any country.[4] According to Indian Statistical Institute Analysis based on data of NFHS–3, the highest percentage of LBW babies was found in the North zone (26.60%) while the least percentage of LBW babies was seen in the north-east zone (13.67%) of India.

Very low Birth Weight infants (VLBW) constitute approximately 4-7% of all live births in India. The mortality in this subgroup is as high as 30% of early neonatal deaths.[5] Amongst survivors the reported rates of extra-uterine growth restriction (EUGR) is variable (28-86%) but unacceptably high. This may have implications for smaller adult stature. The growth potentials of VLBW Indian preterm infants are further compounded by the fact the almost a third of these infants have experienced intrauterine growth retardation. During postnatal growth of preterm infants, as opposed to intrauterine growth during the corresponding periods of gestation, their energy expenditure shifts from growth promoting actions to survival strategies. The result is extra-uterine growth retardation (EUGR).[6] these have resulted in aggressive nutrition interventions to promote postnatal growths to achieve intrauterine growth rates. However, the debatable question is whether intrauterine growth reference standards are appropriate to assess the postnatal growth of preterm infants and whether childhood growth grids created for neonates born at term are appropriate for use for preterm infants once they reach a post-conception age of 40 weeks gestation. Therefore, this study was carried out to evaluate the nutritional status of preterm very low birth weight infants at discharge.

MATERIALS AND METHODOLOGY

This study was conducted as a prospective cohort study which was conducted in the Newborn unit of Department of Pediatrics at Maulana Azad Medical College and associated Lok Nayak Hospital, New Delhi. During the study period from April 2009- March 2010, the initial screening and enrolment took place from April 2009 to October 2009. A 130 preterm neonates weighing less than 1500 grams were screened for eligibility. 80 subjects were finally enrolled for the study. The inclusion criteria that were followed in this study include those reported with intramural live births having birthweight of <1500 g, the parents who were the residents of Delhi during the period of the study and those neonates discharged from the hospital within 3 months. There were certain exclusion criteria that included those new-borns with major congenital malformations, those parents who denied the participation in the study.

Written informed written consent was obtained from the parents of all enrolled subjects. The ethical committee of the institution approved the study. Nutritional status at 3 months postnatal age corrected for gestation as assessed by standard deviations in weight, length and head circumference compared to reference growth standards of Niklasson.[10] The sample size was calculated based on the incidence of EUGR. To detect 30% incidence of EUGR (Extra-uterine Growth Restriction) with a precision of 5% and at a confidence level of 99 % it was estimated that about 25 subjects would be required. Allowing for dropouts during follow up it was decided to enrol at least 50 neonates. Infants were followed up weekly (± 2 days) till 3 months of corrected post-natal age and at each visit they were assessed for their anthropometric status, feeding details (e.g. frequency of feeds, type of feed, mode of feeding,

etc) and details of any morbidity they have experienced (sepsis, acute respiratory illness, diarrhoea and need for hospitalization).

Univariate continuous data were compared using either 't' test or Mann Whitney U test. Proportions were compared using "chi square" or "Fisher exact test". Repeated measures over time were evaluated using ANOVA for repeated measures. A probability of 5% was considered significant. Data were entered into Epi 2000 software and analysed using both Epi 2000 and SPSS analytical software.

RESULTS

Table 1 depicts the baseline maternal characteristics for both the cohort who completed the study and those who were loss to follow up. There was no significant difference with regard to any of the maternal characteristics. In none of the 80 infants enrolled for the study was there any evidence of chorio-amnionitis or chronic illness in mother and none of the mothers were smokers.

The baseline neonatal characteristics of the study population. The birth weight of the enrolled subjects was about 1280 grams and a gestation of about 33 weeks. There was no significant difference for the baseline neonatal characteristics between subjects who completed the study and those who were loss to follow up as depicted in table 2. Table 3 depicts the frequency distribution of morbidities experienced by subjects who were enrolled for the study. The commonest morbidity that the enrolled neonates experienced was sepsis followed by neonatal hyperbilirubinemia and apnea of prematurity. None of the enrolled subjects experienced hypothermia or hypoglycemia. Table -4 tabulates a total of 33 infants who were less than or equal to 32 weeks at enrollment. The mean birth weight of this cohort was 1210 grams and the mean gestation was 30.8 weeks. Of the 33 infants in this gestational age group, 24(72.7%) completed study up to post-conception age of 52 weeks. a total of 33 infants who were less than or equal to 32 weeks at enrollment. The mean birth weight of this cohort was 1210 grams and the mean gestation was 30.8 weeks. Of the 33 infants in this gestational age group, 24(72.7%) completed study up to post-conception age of 52 weeks. The mean length of these infants from birth to 52 weeks post conception age showed a significant increase between these two time points. At birth, 25(75.8%) infants had a length which was below -3S.D of the expected for that age, suggesting that significant proportion of these infants were stunted at birth.

Table 1: Baseline Maternal Characteristics

Variables	Cohort completing the study(n = 51)	Cohort loss to follow up(n = 29)
Age (years)(mean, S.D)	26.6 (3.9)	24.9 (3.5)
Gravida (median, range)	2 (1- 6)	2 (1- 6)
Parity (median, range)	1 (0- 4)	1 (0- 4)
Twins (%)	10 (19)	2 (6.9)
Antenatal care (3 visits)(%)	31 (60.8)	16 (55.2)
Hypertension (%)	12 (23.5)	9 (31)
Antepartum haemorrhage (%)	9 (17.6)	3 (10.3)
Preterm rupture of membranes(%)	15 (29.4)	8 (27.6)
Diabetes mellitus (%)	1 (2)	0
Socioeconomic status (%)		
Upper	0	0
Upper middle	3 (3.9)	0
Lower middle	11 (20.5)	6 (20.7)
Upper lower	37 (75.6)	23 (79.3)
Lower lower	0	0

Maternal weight (kg)(mean, S.D)	52.3 (7.5)	53.3(6.5)
Maternal height (cm)(mean, S.D)	150.1 (5.9)	153.5 (4.2)
Maternal haemoglobin(gm%)(mean, S.D)	10.03 (1.2)	10.3 (0.9)

Table 2: Baseline Neonatal Characteristics

Variables	Cohort completing the study(n = 51)	Cohort loss to follow up(n = 29)
Birth weight (grams)(mean,S.D)	1280.1 (164.1)	1289.8 (145.6)
Gestational age (weeks)(mean, S.D)	32.7 (2.2)	33.5 (1.9)
Sex		
Females (%)	17 (33.3)	15 (51.7)
Males (%)	34 (66.7)	14 (48.3)
Mode of delivery (%)		
Vaginal	40 (78.4)	23 (79.3)
Caesarean	11 (21.6)	6 (20.7)
Apgar (mean, S.D)		
1 minute	8.6 (1.1)	8.5 (1.5)
5 minute	8.8 (0.4)	8.8 (0.5)
Number of neonates requiring Resuscitation at birth (%)	7 (13.7)	3 (10.3)

Table 3: Neonatal Morbidities during hospital stay

Variables	Cohort completing the study(n = 51)	Cohort loss to follow up(n = 29)
Anaemia (%)	1 (2)	0
Apnea of prematurity (%)	4 (7.8)	3 (10.3)
Hyperbilirubinemia (%)	**7** (13.7)	3 (10.3)
Intraventricular hemorrhage	3 (5.9)	0
Respiratory distress syndrome	2 (4)	2 (6.9)
Sepsis	10 (20)	7 (24.1)
Others	3 (6)	1 (3.4)

Table 4: Growth in infants born at <32 weeks

Variables	Post conception age (weeks)				
	Birth (n =33)	**40 weeks (n =27)**	**44 weeks (n =80**	**48 weeks (n =11)**	**52 weeks (n =24)**
Weight (grams)(mean, S.D)	1210.4 (158.6)	2055.1 (387.2)	3013.7 (590.4)	3305 (729.6)	3907 (743.5)
Weight standard deviation (%)					
< -3 S.D	19 (57.6)	25 (92.6)	6 (75)	10 (90.9)	20 (83.3)
-2 to -3 S.D	12 (36.4)	2 (7.4)	2 (25)	1 (9.1)	4 (16.7)
-1 to -2 S.D	2 (6.1)	0	0	0	0
>-1 S.D	0	0	0	0	0
Length (cm)(mean,S.D)	37.7 (1.8)	44.1(1.8)	48.8(2.2)	51.2(2.9)	52(3.7)
Length standard deviation (%)					
< -3 S.D	25 (75.8)	26 (96.3)	7 (87.5)	10 (90.9)	22 (91.7)
-2 to -3 S.D	5 (15.2)	1 (3.7)	1 (12.5)	0	0

-1 to -2 S.D	3 (9.1)	0	0	1 (9.1)	1 (4.2)
>-1 S.D	0	0	0	0	1 (4.2)
Head (cm) circumference (mean, S.D)	26.7 (1.4)	32.3 (1.5)	35.2(1.2)	37.6(3.5)	39.5 (2.5)
Head circumference standard deviation (%)					
< -3 S.D	7 (21.2)	13(48.1)	1(12.5)	4(36.4)	3(12.5)
-2 to -3 S.D	11 (33.3)	10(37)	5(62.5)	1(9.1)	8(33.3)
-1 to -2 S.D	13 (39.4)	3(11.1)	2(25)	4(36.4)	2(8.3)
>-1 S.D	2 (6.1)	1(3.7)	0	2(18.2)	11(45.8)
Triceps skin fold thickness (mm)(mean, S.D)	1.25 (0.15)	1.89(0.39)			2.67 (0.5)

DISCUSSION

It was observed that in the group of infants with a gestation of 32 weeks or less, the proportion of infants who had a weight which was below -3 SD at 3 months of corrected post-natal age was 83% compared to 57.6% amongst infants who had a birth weight below -3S.D. Similarly, when extra uterine growth restriction in terms of length was assessed, it was observed that proportion of infants with length less than -3SD at 3 months corrected post-natal age was around 92% compared to 76% amongst infants with a birth length of less than -3 SD. On the other hand, when the head circumference data was analyzed, it was observed that only 12% of infants had head circumference less than -3 SD at 3 months corrected post-natal age compared to 21% who had a value less than -3 SD at birth.

The data clearly indicates that in this population there was a significant burden of extra uterine growth restriction with regard to weight and length but there was a significant decline in the burden of head growth restriction at 3 months corrected post-natal age. It is noteworthy that little over half the infants with gestation ≤ 32 weeks were growth retarded at birth but the proportion had increased by almost 50% by 3 months corrected post-natal age and with respect to length the growth restriction had increased by around 15%.

A noteworthy study for comparison is that of *Campos*[7] et al who evaluated the growth at discharge of very low birth weight infants and observed that only 18% of small for gestational age babies achieved catch up growth in comparison to 92% catch up growth in very low birth weight born appropriate for gestational age babies. The results of the present study are somewhat similar to that of *Campos*[7] et al indicating that most small for gestational age babies continue to remain growth retarded even at 3 months corrected post-natal age and a larger number of appropriate for gestational age babies showed catch up growth. *Clark*[8] et al evaluated the incidence of extra uterine growth restriction among very preterm babies (23 – 24 weeks at birth) and observed that the proportion of babies whose weight, length and head circumference were less than 10 percentile at 32 weeks post-natal age was 23%, 20% and 13% respectively.

The burden of growth failure observed in the present study is comparable to other studies by *Radmacher*[9] and *Sakurai*[10]. The reason for the higher burden of extra uterine growth restriction at 3 months corrected gestational age in the present study possibly is related to several factors: More than half the infants in the present study were growth restricted at birth for weight, length and head circumference, which in itself could be a major contributor for persistence of extra uterine growth restriction, unlike the other studies published from developed countries, where they received formula milk at discharge, almost all the infants in the present study were largely on breast milk. It is possible that breast milk may not be adequate to achieve adequate catch up growth in extra uterine growth restricted babies especially if they have experienced intrauterine growth restriction, weight and length catch up

takes longer than 3 months corrected post-natal age unlike head growth. Therefore, it is possible that if this cohort had been followed up for a longer period than 3 months corrected post-natal age, the catch with respect to weight and length would have been better and the burden of extra uterine growth restriction with respect to these anthropometric measurements would have been less.

CONCLUSION

The burden of extra uterine growth restriction in the preterm babies between 33 to 36 weeks gestation decreases from birth to 3 months corrected gestation with respect to all three anthropometric parameters. Exclusive breast feeding does not decrease the burden of extra uterine growth restriction among very low birth weight preterm infants. It is possible that the extra uterine growth restriction for weight and length would decrease if the infants were followed for a longer time, which is the limitation of this study.

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