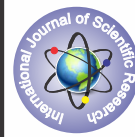


## Evaluation of physical growth and neurodevelopmental outcome of low birth weight NICU graduates at one year of age in a south india teaching hospital.



### Pediatrics

**KEYWORDS:** follow up, Low birth weight, neurodevelopmental outcome, physical growth.

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### ABSTRACT

*The neonatology has improved a lot in last century and it is now becoming synonymous with care of low birth weight babies. Several studies have reported high incidence of growth failure and poor neurological function outcome during infancy and childhood of these low birth weight babies[1].*

*Aims and objective of the study: To assess the physical growth and neurodevelopment of low birth weight babies admitted to NICU during December 2014 to July 2015 at 1 year of age and to study the factors influencing the physical growth and neurodevelopmental outcome in these babies.*

*Method: The present study was a prospective hospital based study involving all low birth weight babies who were admitted to NICU of ASRAM hospital, a tertiary care center, Eluru, West Godavari District, Andhra Pradesh during the study period.*

*Observation: Out of 59 NICU graduates weighing less than 2500 grams at birth were enrolled in this study. Among them 23.7% were ELBW, 47.5% were VLBW and 28.8% were LBW babies with birth weight >1500 grams. All babies weight and length at one year of age was <50th percentile and around 30% of LBW babies had <5th percentile weight and length at one year of age. When neurodevelopmental outcome was assessed under various domains, the most common impairment found was language delay (23.7%) followed by vision impairment (32.2%). The least effected domain is social and adaptive development.*

*Conclusion: Though intensive care has improved survival of LBW babies, physical growth as well as neurodevelopmental growth lags behind in almost 1/3<sup>rd</sup> cases.*

### INTRODUCTION

Babies with birth weight of less than 2,500grams, irrespective of the period of gestation are classified as low birth weight (LBW) babies. About 28% of babies in India are LBW [2]. VLBW and ELBW infants are at higher risk of poor growth and neurodevelopmental outcomes, due to associated adverse perinatal risk factors and postnatal morbidities. Low birth weight is also a major determinant of malnutrition during infancy because over 40% of LBW babies are malnourished at one year of age [2]. The neurodevelopmental sequelae of birth asphyxia are three times more common in LBW babies compared to their normal weight counterparts [2]. The present study was undertaken to evaluate the antenatal and perinatal factors and their correlation with physical and neurodevelopmental outcome at 1 year of age in low birth weight babies so that early screening of high risk infants is possible to identify the infants with neurodevelopmental disabilities at the earliest and can be provided with early stimulation and rehabilitation to improve functional capabilities.

### AIMS AND OBJECTIVES OF THE STUDY

To assess the physical growth and neurodevelopment of low birth weight NICU graduates at 1 year of age who were admitted to NICU of ASRAM hospital, a tertiary care center, Eluru, West Godavari District, Andhra Pradesh during December 2014 to July 2015

**METHODOLOGY:** Hospital based prospective study. Cases were enrolled between December 2014 and July 2015 and the various antenatal, perinatal and postnatal factors thought to influence the growth and neurodevelopmental outcome were recorded in a predesigned proforma and were asked to come for follow up clinics at pre decided intervals, viz, birth weight < 2000 grams: weekly for one month, 2000-2500 grams: fortnightly for one month, later at 3<sup>rd</sup> month, 6<sup>th</sup> month, 9<sup>th</sup> month and 12<sup>th</sup> month. Since WHO charts are likely to over diagnose underweight and stunting in a large number of apparently normal children [4] in the developing countries such as India, NCHS charts were used in the present study for physical growth assessment and Trivandrum developmental screening charts

and DASII kit for developmental screening and detailed neurodevelopmental assessment respectively. **Inclusion criteria:** Neonates (both inborn & outborn) with birth weight < 2500 grams, admitted to NICU of AlluriSita Rama Raju Academy of Medical Sciences and discharged successfully. **Exclusion criteria:** Infants with major congenital anomalies and syndromic features.

**Sample size:** 59 low birth weight NICU graduates (42 inborn and 17 outborn)

### Statistical Analysis:

Data was analysed using SPSS 16. Chi square test was used to analyse the association between various risk factors and neurodevelopmental outcome. Significant figures: + Significant (P value: 0.05 < P < 0.10)\* Moderately significant (P value: 0.01 < P ≤ 0.05) \*\* Strongly significant (P value: P ≤ 0.01).

### RESULTS

The study was conducted from December 2014 to July 2016 at department of pediatrics in AlluriSita Rama Raju Academy of Medical Sciences (ASRAMS), Eluru. A total of 59 low birth weight babies who were admitted in NICU of ASRAM Hospital during December 2014 and July 2015 were included as study group after taking consent from parents.

In the present study group, 52.5% babies were males, 47.5% were females and based on origin of subjects, 71.2% were inborn babies, 28.8% were outborn babies.

In the present study, 47.5% belong to VLBW (1000-1500 grams), 28.8% belong to LBW (1500-2500 grams) and the remaining 23.7% belong to ELBW (<1000 grams). 59.3% of them belong to SGA group whereas 40.7% belong to AGA group. Among these 42.2% babies belong to gestational age 32-36 weeks whereas 41% babies fall in 28-32 weeks group, 13.5% babies were <28 weeks and 3.3% were >36 weeks.

In the present study group, 41% babies had tachycardia during perinatal period, 29% had bradycardia whereas 27.1% babies had APGAR <6 at 5 minutes of life. Among various maternal risk factors, PIH was the most common one observed (46%).

**Growth parameters – Weight at 1 year age**

Weight at 1 year age (Percentiles)	n (%)
< 5 <sup>th</sup> P	19 (32.2%)
5 <sup>th</sup> – 25 <sup>th</sup> P	31 (52.5%)
25 <sup>th</sup> – 50 <sup>th</sup> P	9 (15.3%)
Total	59 (100%)

**Growth parameters – Length at 1 year age**

Length at 1 year age (Percentiles)	n (%)
< 5 <sup>th</sup> P	18 (30.5%)
5 <sup>th</sup> – 25 <sup>th</sup> P	38 (64.4%)
25 <sup>th</sup> – 50 <sup>th</sup> P	3 (5.1%)
Total	59 (100%)

**Growth parameters-Head circumference at 1 year age**

HC at 1 year age (Percentiles)	n (%)
< 5 <sup>th</sup> P	11 (18.6%)
5 <sup>th</sup> – 25 <sup>th</sup> P	48 (81.4%)
25 <sup>th</sup> – 50 <sup>th</sup> P	0
Total	59 (100%)

**Developmental outcome at one year age**

Variable	n (%)
Gross motor delay	9 (15.2%)
Fine motor delay	7 (12%)
Language delay	14 (23.7%)
Social delay	5 (10.2%)
Vision impairment	6 (32.2%)
Hearing impairment	13 (22%)
DQ < 70%	21 (35.6%)

When neurodevelopmental outcome was assessed under various domains, the most common impairment found was language delay (23.7%) followed by vision impairment (32.2%). The least effected domain is social and adaptive development.



**Developmental outcome at one year age**

**Factors affecting growth at one year of age**

Factors	n (%)	Growth < 5 <sup>th</sup> P	P value
<b>Birth weight groups</b>			
ELBW (<1000g)	14 (23.7%)	10	0.000**
VLBW (1000-1500g)	28 (47.5%)	9	
LBW (1500-2500g)	17 (28.8%)	0	
SGA	35 (59.3%)	16	0.007**
AGA	24 (40.7%)	3	
Maternal illness (PIH)	27 (46%)	10	0.465
APGAR at 5 min < 6	16 (27.1%)	8	0.074
HIE stage 2	12 (20.3%)	9	0.000**
RDS	28 (47.5%)	15	0.001**
IVH	3 (5%)	2	0.190

Metabolic disturbances	11 (18.6%)	6	0.079
Sepsis	21 (35.6%)	12	0.002**
NEC	7 (11.8%)	6	0.001**
Ventilation	19 (32.2%)	12	0.000**
Antibiotics	33 (56%)	15	0.014*
Parenteral nutrition	41 (69.5%)	19	0.000**

Statistically significant correlation was observed for all variables except for PIH, IVH, metabolic complications and APGAR at 5 min. This could be due to small sample size and varied incidence rates of the risk factors in present study.

**Factors affecting DQ at one year of age**

Factors	n (%)	DQ <70%	P value
<b>Birth weight groups</b>			
ELBW (<1000g)	14 (23.7%)	10	0.002**
VLBW (1000-1500g)	28 (47.5%)	9	
LBW (1500-2500g)	17 (28.8%)	0	
SGA	35 (59.3%)	16	0.012*
AGA	24 (40.7%)	3	
Maternal illness (PIH)	27 (46%)	10	0.448
APGAR at 5 min < 6	16 (27.1%)	8	0.008**
HIE stage 2	12 (20.3%)	9	0.000**
RDS	28 (47.5%)	15	0.501
IVH	3 (5%)	2	0.930
Metabolic disturbances	11 (18.6%)	6	0.449
Sepsis	21 (35.6%)	12	0.002**
NEC	7 (11.8%)	6	0.035*
Ventilation	19 (32.2%)	11	0.000**
Antibiotics	33 (56%)	13	0.004**
Parenteral nutrition	41 (69.5%)	13	0.009**

Statistically significant correlation was observed for all variables except for PIH, RDS, IVH and metabolic complications. This could be due to small sample size and varied incidence rates of the risk factors in present study.

**DISCUSSION**

In the present study out of 59 LBW babies included 59.3% of babies were SGA and 40.7% were AGA. According to birth weight 23.7% were ELBW and 47.5% were VLBW. Higher incidence of ELBW babies (23.7%) and the higher number of SGA babies in the present study group was probably due to higher incidence of antenatal risk factors. The trend in present study is comparable to the results of MModi, *et al*[4]

In the present study 71.2% of the babies had history of maternal illness. Among all, 46% babies had mothers with PIH. The other illnesses observed were GDM in 12%, PPRM in 13.5% cases, and oligohydramnios in 10.2% cases. Incidence of PIH to mothers of study group is comparable to that in study done by M Modi, *et al*[4]. The major disability risk is increased by PIH[5].

Out of 59 babies, 16 babies (27.1%) had APGAR<6 at 5 min; of which 12 babies (20.3%) had HIE. Out of these 12 babies, 3 manifested features of spastic cerebral palsy before 12 months age.

In a study done by M Modi, *et al*[4], VLBW infants had lower Z-scores for weight, length and HC as compared to babies with normal birth weight. This suggests that most VLBW infants suffer intrauterine growth failure, possibly due to adverse perinatal factors. Among such infants, 47% were found to be SGA, which is similar to other reports in Indian infants [4,6]. The incidence of growth restriction was higher in present study, standing at 59.3%. This could be due to differences in socio-economic factors, ethnic variation or perinatal morbidities in present study.

In present study incidence of sepsis was 35.6%. This is higher than 15.2% incidence found worldwide[7,8]. This increase can be explained by the other risk factors like prematurity, birth asphyxia & interventions[9,10] required in these babies and also the small

number of patients in present study.

In the present study, growth of all the babies was equated as percentiles of NCHS charts. Both weight and height were affected in 1<sup>st</sup> year of life. About 30.5% (18/59) of babies had weight and height <5<sup>th</sup> percentile. Head circumference was <5<sup>th</sup> percentile in (11/59) babies 18.6%. It is clearly evident from the present study that AGA babies had a better rate of growth as compared to their SGA peers. According to S Baburaj, *et al.*, preterm AGA babies had more weight gain than the term SGA babies during the first 4 months [11]. Regarding the growth pattern of length, preterm infants had maximum gain in length in first 4 months when compared to term infants in studies done by S Baburaj, *et al.* [11] and Capt. D Singh, *et al.* [12]. The present study showed a similar growth trend in initial 5 months.

In present study, the head growth was poor in SGA babies as compared to their AGA peers. Similar results were reported by S Baburaj, *et al.* [11] and Capt. D Singh, *et al.* [12]. Gutbrod, *et al.* [13] reported that SGA babies had poor head growth, early developmental delay and later language problems. Studies have shown that unlike SGA infants born at term, preterm/SGA infants show limited or no catch up growth at least through 1<sup>st</sup> 12 months of life. This correlates well with the data of the present study.

In the present study, ROP and refractive error was noted in 19 babies (32.2%). In a study done in Delhi and Modi, *et al.* [4] reported incidence of 5%. The incidence of ROP in India varies from 20-57% is < 1500 grams.

In present study incidence of hearing impairment was 22%. The incidence of hearing defects in LBW with birth weight 1500-2500 grams, VLBW and ELBW was 5.8%, 17.8% and 50% respectively.

Language delay was common problem noted with frequency of 23.7% overall. It was more common in ELBW 57.1% than VLBW 14.3% and LBW (1500-2500gm) 11.8%. Second common was gross motor delay as seen in 15.3% of cases. Incidence was higher in ELBW 35.7% as compared to VLBW 10.7% and LBW babies (1500-2500gm) 5.9%.

The fine motor skill delay was seen in 11.9% among the study group. The incidence was 28.6% in ELBW, 7.1% in VLBW and 5.9% in LBW babies (1500-2500gm).

Social delay was seen in 8.5% cases in present study group, with the highest incidence in ELBW 21.4% as compared to 3.6% in VLBW and 5.8% in LBW babies (1500-2500gm).

Overall assessment showed DQ < 70% in 21 infants (35.6%) which correlates statistically well with 16 infants with APGAR at 5 min < 6 (27.1%)

This data correlates well with developed countries. Mc Cormice, *et al.* reported neurodevelopmental sequelae in 17% VLBW babies. Similar findings were noted by Bhargava, *et al.* [16] Verbal skills were achieved late, more commonly in ELBW group where incidence was 30.8% as compared to VLBW group (18.9%). Of all 12 cases of speech delay (21.1%) only 3 were associated with hearing impairment. Thus 25% of patients with speech delay had hearing impairment. MKC Nair, *et al.* [20] reported that the most common impairment seen in ELBW and VLBW infants at 18-30 months age is cognitive impairment [16].

M Modi, *et al.* [5] reported that VLBW infants had poor long-term neurodevelopmental outcomes [17, 18].

In present study, ELBW babies with developmental quotient is < 70 in mental and motor development seen in 39.25% and 21.4% respectively, which were similar to NICHD trial results.

In NICHD trial [20] 25% of ELBW babies had abnormal neurological

examination with mental developmental index and psychomotor developmental index of < 70 seen in 37% and 29% babies respectively.

The incidence of cerebral palsy was 5% (3/59) in present study. This can be explained by a small size of the data, less ex-utero transfer, proper & timely resuscitation, low incidence of complications in neonatal period like hypoglycemia & IVH. Also, early intervention played the key role in improving outcome.

Globally incidence of CP is between 6-10%. Lorenze, *et al.* showed CP in 12% of < 26 weeks and 85% of < 800 grams survivors [21]. The most common disability in that study was mental retardation, found in 14% of < 26 weeks & < 800 grams survivors. In Pune, low birth weight study by Chaudhari & Pandit founded mental retardation in 5% and CP in 4.8%, however their subjects were low risk than many of the western studies [14].

However, it is clear that proper neonatal care and early intervention in these low birth weight neonates has changed the outcome.

**Conclusion:** Weight and length at one year of age of study population was < 50<sup>th</sup> percentile and around 30% of LBW babies had < 5<sup>th</sup> percentile weight and length at one year of age and 81.4% of babies head circumference was between 5<sup>th</sup> and 25<sup>th</sup> percentile. When neurodevelopmental outcome was assessed under various domains, the most common impairment found was language delay (23.7%).

**Conflict of interest:** Nil

**Permission from IRB:** Yes

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