Research Article

Growth and development of high risk graduates till one year from a rural neonatal intensive care unit in south India

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Abstract

Background: The studies based on the problems faced by high risk nursery graduates in growth and developments from a rural area are limited. Appropriate follow up program would help in early interventions.

Objective: The objective was to study the outcome of growth and development till one year of age of high risk infants discharged from a secondary level neonatal intensive care unit.

Methodology: A prospective cohort study was conducted by Department of Pediatrics of Dr SMCSI Medical College for a period of 2 years in 47 high risk babies discharged from the neonatal intensive care unit. Physical parameter like weight, length and head circumference was recorded after delivery and at 4th, 8th and 12 months. Assessment of tone and development was done at 4, 8 and 12 months.

Results: Out of the 47 high risk babies, 29 were preterm The mean weight gain was more in preterms which was nonsignificant but they had significant mean length gain. The increments in head circumference and tone abnormalities were more in preterms. Mean Development Quotient (DQ) in term and low birth weight infants were lower.

Conclusions: Preterm had more rate of growth in all anthropometric measurements and a higher development quotient. An appropriate follow-up is a must in the early detection of growth failure and neurodisability to execute an effective early stimulation program.

Keywords: High risk newborn, Hypertonia, Development quotient, Early intervention

1. Introduction

As a result of vast progress in antenatal and neonatal intensive care during the past two decades, an increasing number of extremely preterm and/or seriously ill infants survive. At the same time the number of children with disabilities has increased who need special follow-up. However, despite technological advances for improved neonatal/perinatal care, rates of cerebral palsy and neurodevelopmental handicaps at follow up has not decreased. But the survival of more high risk has increased the number of neonatal intensive care graduates with neurological deficit. Numerous studies have shown that despite substantial improvements in the neonatal mortality, the incidence of chronic morbidities and adverse outcomes among survivors has not declined much. This highlights the need for a follow-up care service that would ensure systematic monitoring of the general health and neurodevelopmental outcomes after discharge from the hospital.

Modern child health care should be able to pick out and rehabilitate, not only children with major disabilities, but also children who have subtle weaknesses in specific developmental areas such as in language, visual-perceptual or motor function. Intervention services should be offered before school age, because later rehabilitation or therapeutic intervention...
may not prevent or repair secondary behavioural problems caused by developmental disorders and lowered self-esteem.

Nationwide studies from USA, South Australia, Sweden, Finland has shown that a proper and appropriate follow-up program would help in early detection of these problems to start interventions early. Among hospital-based preterm populations the occurrence of definite neonatal neurological abnormalities varies from 11% to 40% observed at term age\textsuperscript{3,4} or at preterm age\textsuperscript{5}. In a prospective nationwide survey of 1192 preterm infants Den Ouden \textit{et al}\textsuperscript{6} found that the incidence of neurological abnormalities in 14.1%, obvious neurological dysfunction in 8.1% and suspected neurological dysfunction in 6.1% during the neonatal period. In India the longitudinal studies of Bhargava \textit{et al}\textsuperscript{7}, Anand Pandit \textit{et al}\textsuperscript{8} and a recent study from Goa\textsuperscript{9} have shown that a proper and appropriate follow-up program would help in early detection of these problems.

These data are important to physicians taking care of families with high-risk infants, in order to decrease the `wait-and-see attitude’ and the underestimation of the gravity of parents’ urge to know the prognosis of their baby which will definitely help in the compliance of follow up visits. It is necessary to identify high risk babies and to document the outcome till school age to improve their quality of life\textsuperscript{10}. The documentation about these problems encountered in the high risk neonatal intensive care graduates from a rural area are limited. Hence the study was initiated with the objective to know the growth and development outcome of these babies till one year of age.

2. Materials and methods

The Study was conducted by Department of Pediatrics after getting ethical clearance from the institutional ethical committee of Dr SMCSI Medical College, Trivandrum, Kerala after taking informed consent from parents.

2.1 Study design: A single hospital based prospective cohort study.

2.2 Study population: Our study included consecutive 69 high risk infants who satisfied the selection criteria and they were followed up for 12 months.

2.3 Inclusion criteria: high risk infants who are discharged from NICU.

Risk factors were Low birth weight infants who required NICU admission, Preterms, Blood culture proved Neonatal sepsis , Neonatal meningitis, Neonatal seizures, Meconium aspiration Syndrome, Hyaline membrane disease, Neonatal hypoglycaemia, Intraventricular haemorrhage and Severe birth asphyxia.

2.4 Exclusion criteria: Major congenital malformations

2.5 Growth monitoring

- Weight: Birth weight of the baby was recorded after delivery on a electronic weighing machine with an accuracy of measurement of ±5 gm (± 5gms accuracy) in NICU. On follow up weight of the baby was recorded on a electronic weighing machine at 4\textsuperscript{th}, 8\textsuperscript{th} and 12\textsuperscript{th} months of age.

- Length: Length is measured by Infantometer at 4\textsuperscript{th}, 8\textsuperscript{th} and 12\textsuperscript{th} months of age.

- Head circumference: Head circumference is measured by non-stretchable measuring tape

2.6: Assessment of development and tone-

All infants are screened for Development delay by Trivandrum Development Screening Chart at 4\textsuperscript{th} month, 8\textsuperscript{th} month and by Development Assessment Scale for Indian Infants at 1 year of age. All infants received early stimulation in high risk clinic.

\textit{Trivandrum Development Screening Chart (TDSC):} A vertical line is drawn or a pencil is kept vertically at the level of chrononological age of the child. If the child fails to achieve any item that falls short on the left side of vertical line, the child is considered to have developmental delay\textsuperscript{11}.

\textit{Development Assessment Scale for Indian Infants (DASII):} At 12 months motor and mental age was calculated by DASII. Motor and mental developmental quotient was calculated. Average of both is taken.\textsuperscript{12}

For assessment of tone Amiel-Tysion method is used.

2.7 Statistical analysis:

The data were analyzed using the software SPSS 14.0. Mean, standard deviation and Student t test were used continuous variables. Ch iSquare test was used for nominal variables. A p value below or equal to 0.05 was considered to be statistically significant for a 95% Confidence Interval.
3. Results

In this study 69 high risk neonates were included over a period of 2 years. During this period 47 out of 69 high risk infants were able to complete the follow up till 12 months age. Remaining 19 infants were lost to follow up or referred to another hospital. Among the 29 preterm infants, 18 were females and in the 18 term infants, 5 were females. This gender difference was significant (p value = 0.03). Babies were also classified according to birth weight and gestation (Table 1).

| Table 1: Number of babies according to their maturity |
|-----------------|-----------------|-----------------|-----------------|
|                  | Preterm (%)     | Term (%)        | Total (%)       |
| SGA              | 01 (3.44)       | 06 (33.33)      | 07 (14.9)       |
| AGA              | 28 (96.56)      | 10 (55.55)      | 28 (80.9)       |
| LGA              | 00              | 02 (11.11)      | 02 (4.2)        |
| TOTAL            | 29 (100)        | 18 (100)        | 47 (100)        |

The morbidity pattern of high risk babies is shown in the table 2.

| Table 2: Morbidity Pattern in high risk babies |
|------------------------|
| Morbidity Characteristics | N=47(%) |
| Hyaline Membrane Disease | 14(29.7) |
| Intraventricular Hemorrhage | 7(14.8) |
| Culture proved Sepsis | 8(17) |
| Meconium Aspiration Syndrome | 8(17) |
| Severe Birth Asphyxia | 4(8.5) |
| Hypoglycemia | 4(8.5) |
| Neonatal enterocolitis | 2(4.2%) |

In the first 4 months, preterm babies had more weight gain than term babies which was statistically not significant. But they had statistically significant gain in head circumference and length at 4th month of age when compared with term babies (Table 3).

| Table 3 : Pattern of gain in Weight, Head Circumference and Length |
|------------------------|
| Age | Preterm | Term | Preterm | Term | Preterm | Term |
|     | Mean weight (Mean increment) | Mean HC (Mean Increment) | Mean length (Mean increment) |
| BIRTH | 1756.8 | 2681.4 | 31.31 | 34.88 | 38.96 | 46.5 |
| 4 M | 3967.2 (2210.3)* | 4593.8 (1912.4) | 38.71 (7.4)# | 38.6 (3.7) | 61.41 (22.45)# | 62 (15.5) |
| 8 M | 6200 (1232.7) | 6735.5 (2141.6) | 41.4 (2.7) | 43.2 (4.6) | 68.31 (6.9) | 69.22 (7.22) |
| 12 M | 7888.4 (1688.4) | 8616.6 (1881.1) | 44.3 (2.8) | 45.7 (2.67) | 71.4 (3.9) | 73.11 (3.89) |

*(p value>0.05). # (p value <0.05)

The tone abnormalities of all the babies were evaluated at 4th, 8th and 12th months. The tone abnormalities observed at 4th and 8th month of age is shown in table 4.

| Table 4: Tone abnormalities of babies |
|------------------------|
| Tone | 4th month | 8th month |
|      | Preterm | Term | Preterm | Term |
| Normal | 23 (79.4%) | 15 (83.6%) | 27 (93.10) | 16 (88.9) |
| Hypotonia | 0 | - | 1 (3.45) | 0 |
| Hypertonia | 6 (20.6%) | 3 (16.4%) | 1 (3.45) | 2 (11.1) |
| Total | 29 | 18 | 29 | 18 |
At 12 months of age, 2 term babies and one preterm had hypertonia. None of the differences were significant (p value >0.05). Based on birth weight, at 4 months, hypertonia was observed in 8 Low Birth Weight (LBW) (21.64%) and one normal weight infants (10%). Hypotonia was observed in one LBW (2.7%) infant. At 8 and 12 months, 2 LBW (5.4%) and one normal weight (10%) had hypertonia. Hypotonia was also observed in one LBW baby. Regarding the development of babies, at 4 months, 3 out of 29 preterm (10.3%) infants and 3 out of 18 term infants (16.7%) had delay. At 8th months 2 (6.9%) preterm babies and 2 (11.1%) term babies had development delay. All of them were attending the high risk clinic and went early intervention. At end of 12 months, 2 infants had Development Quotient (DQ) < 70 by DASII who had birth asphyxia. The mean motor DQ in preterm and in term were 93.69 +/- 3.83 and 90.56 +/- 15.08 respectively (fig 1). Mean mental DQ in preterm and term were 94.89 ± 11.66 and 92.14 ± 12.74 respectively. Mean DQ in term infants was lower than in preterm.

**Fig 1: Motor and Mental DQ at 12 months of age as per DASII**

At 4 months, 5 LBW infants (13.6%) and one normal weight infant (10%) had delay. At 8 months, 3 LBW (8.1%) infants and 1 normal weight infants (10%) had delay by Trivandrum Development Screening Chart (TDSC). The mean motor DQ in LBW and in normal weight group were 90.65 ± 11.12 and 92.4 ± 14.23 respectively. Mean mental DQ in LBW and in normal weight group were 92.12 ± 8.25 and 93.55 ± 14.23 respectively. LBW infants had lower developmental quotient than normal weight infants but the difference was not significant.

4. Discussion

A prospective cohort study was done in 47 high risk babies discharged from a secondary neonatal intensive care unit in a rural hospital to observe the growth and development at 12 months of age. The study showed that preterm babies having more weight gain in 1st 4 months than later. According to the study done by Das et. al, the weight gain at 3 month of age was 3978gm and 4259gm in preterm babies and term-SGA babies respectively which was comparable with present study. Similarly in the study done by Capt D Singh et al, at 4 months the net increment in weight was less in preterm babies compared to term small for gestation babies. The sharp deceleration in the rate of weight gain in both the groups after 1st 8 months was probably due to the improper weaning.

Regarding the growth pattern in length, preterm infants had maximum gain in length in first 4 months when compared with term infants. This was comparable with the study done by Capt D Singh et al. The net increase in head circumference was also significantly more in preterms which was also comparable with the study done by Singh et al.

In the study done by Modi et al in 2012, there was significant decline in all three anthropometric parameters from birth to discharge in very low weight (VLBW) babies compared to normal weight babies. The number of babies with tone abnormalities decreased in 8th and 12th month. This decrease may be due to the active interventions received in the high risk clinic during their follow up visits. Also transient tone abnormalities are reported in preterm babies.

Two term babies with birth asphyxia had low development quotient at 12 months of age which was also seen in follow-up studies of asphyxiated survivors by Tandon et al. According to Sukumaran et. al. the developmental delay (14.4%) and developmental disabilities (15.6%) were higher in high risk new born babies when compared to normal at one
In our study the mean DQ was low in term babies. According to Deshpande TV et al, very low DQ scores have been observed with smaller head circumference. In the review of Hack and Fanaroff about neuro cognitive outcome after very preterm birth, term infants had lower development quotient of motor scale than preterm. In the study done by Modi et al, mean DQ at 12 months was significantly lower in VLBW infants.

With respect to birth weight, 8.1% of low birth weight infants had development delay. In the study done by Bhatia et al 19.1% of IUGR infants had developmental delay. In the study done by Procianoy, et al, mean mental and motor indices varied from 78 to 80. Mukhopadhyay, et al also reported the mean mental and motor quotients of 80.4 and 77.2 at 18 months of age. Our study had higher indices which may be due to lesser number of extreme premature babies.

5. Conclusion

The study gives insight that all high risk infants have to be assessed periodically in high risk follow up clinics, irrespective of their birth weight or gestational age. LBW, prematurity and asphyxia are important etiological factors of developmental delay for both preterm and full-term high risk infants. Prevention of LBW outcome of pregnancy is a matter more of antenatal care and awareness. A proper and appropriate follow-up program are helpful in early detection of growth failure problems and neurodisability thus paving way for early interventions in the high risk neonatal nursery graduates. This would probably form the best captive population for providing early stimulation.

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