

## Original Research Article

# Neurodevelopment and growth outcome at one year in babies born at term to mothers having pregnancy induced hypertension

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### ABSTRACT

**Background:** Hypertensive disorder in pregnancy remains an important cause of perinatal morbidity and mortality. Being small for gestational age (SGA) may be associated with poor neurodevelopmental outcomes compared to being appropriate for gestational age (AGA). The aim of this paper is to evaluate neurodevelopmental scores as well as growth monitoring in SGA and AGA infants born at term to PIH mothers followed till one year of age.

**Methods:** This is a prospective, observational, hospital-based study, conducted in a tertiary care mother and child institute in Andhra Pradesh, South India.

**Results:** Two hundred babies born at term to PIH mothers are included in the study and are followed up over a period of 12 months. Data is analyzed using Statistical Package for Social Sciences (SPSS). Growth retardation is seen in 12 % of term, SGA and 3.5% of term, AGA babies. SGA babies have a statistically significant correlation (p value = 0.02) in physical growth compared to AGA babies. Neurodevelopmental delay is present in 30% of SGA babies and 5% of AGA babies. The association between SGA and neurodevelopmental disability is statistically significant (p value <0.01).

**Conclusions:** Pregnancy induced hypertension has a statistically significant effect on neurodevelopment and physical growth of a child when followed up to 12 months of age, in SGA babies, more so in VLBW babies. Early intervention programmes through medical, developmental, neuromotor, neurosensory interventions and other stimulation programs, might help in reducing the burden of the disease as well as improving the quality of life.

**Keywords:** AGA, Neurodevelopment, Pregnancy induced Hypertension, SGA, VLBW

### INTRODUCTION

Hypertension is the most common medical problem encountered in pregnancy and remains an important cause of fetal/infant morbidity and mortality. Nearly 10-15% of pregnancies will be complicated by hypertension.<sup>1</sup> PIH mothers have a higher incidence of neonatal morbidity compared to those with normal blood pressure. Hypertensive disorders of pregnancy predispose women to acute or chronic uteroplacental insufficiency

resulting in ante or intrapartum anoxia that may lead to fetal death, IUGR and /or preterm delivery.<sup>2</sup>

One of the largest prospective studies which analysed the neonatal outcome in pregnant women with preeclampsia and hypertension showed that the incidence of fetal growth restriction was 48% and 21%, preterm birth was 51% and 15%, and neonatal intensive care admission was 35% and 12% respectively (Chappell et al).<sup>3</sup> There is now a greater chance of survival for high risk babies, so the

focus has been shifted from mere survival to quality of life among survival. Hence the motor and mental development of these neonates to be closely monitored. Developmental assessment is necessary to make an early diagnosis of defects of vision, hearing and other mental and physical handicaps.<sup>4</sup> Anthropometry measures variations in physical dimensions. Early detection is essential for early intervention.<sup>5</sup> Thus early identification of neuro developmental disorders is important for the prevention of a disability and helping the child to make most of his potential. The aim of this study is to assess the neurodevelopmental and physical outcome of term infants born to mothers with pregnancy induced Hypertension.

## METHODS

This is a prospective, observational, hospital-based study conducted in a large tertiary care unit in coastal Andhra Pradesh, South India. Data is collected from babies born to PIH mothers over a period of one year from June 2016 to May 2017.

Neurodevelopment and physical growth follow up of these babies is done periodically at 3, 6, 9 and 12 months of age. Development was assessed by Denver Development Screening test (DDST-II) and neurological examination was performed by Amiel-Tison.<sup>6,7</sup>

Standard interpretation was followed for DDST assessments to assign normal, abnormal and questionable cases. In neurological examination, cerebral palsy (CP) was diagnosed if the baby had spastic diplegia or hemiplegia or quadriplegia and suspect was assigned when mild hypotonia was persisting at 1 year. Growth assessment is done by periodic measurement of weight, length, weight for length and head circumference. IAP modified WHO growth standard charts are used to plot the growth.<sup>8</sup>

### Inclusion criteria

Babies born at term to mothers with pregnancy induced Hypertension (BP more than or equal to 140/90mm of Hg on two occasions at least 6 hours apart) were included in the study.

### Exclusion criteria

- Chronic hypertension: hypertension diagnosed before pregnancy and/or diastolic pressure  $\geq 90$  mm Hg and/or on antihypertensive medications each before the 20 weeks of gestation uncomplicated by de novo proteinuria
- Preeclampsia women with development of de novo proteinuria ( $\geq 0.3g/24h$ ).
- Preeclampsia superimposed on chronic hypertension: the criterion for chronic hypertension is met along with the criteria for preeclampsia.<sup>9</sup>

- Mothers with any other risk factors like Diabetes mellitus, anemia, heart diseases and endocrinological disorders
- Babies with severe birth asphyxia, congenital abnormalities, requiring ventilatory support, or those having seizures are also excluded
- Babies born preterm are also not included in the study.

Blood pressure is taken with a standard mercury sphygmomanometer using phase 1 and 5 of the Korotkoff sounds for systolic and diastolic pressure respectively.

All results are analysed and expressed in all babies as well as in 2 Subgroups: Subgroup 1 (AGA) and Subgroup 2 (SGA). Subgroup analysis is also done in SGA babies by categorizing them into LBW and VLBW. A small for gestational age (SGA) is defined as a new-born infant with a birth weight below the 10th percentile according to WHO child growth standards. Appropriate for gestational age (AGA) is defined as the birth weight between the 10<sup>th</sup> and 90<sup>th</sup> percentiles for the infant's gestational age and sex. LBW (Low birth weight) is defined as a birth weight (BW) below 2500 gm, very low birth weight (VLBW) is defined as BW below 1500g.<sup>10</sup>

Data is analysed using Statistical Package for Social Sciences (SPSS). Chi-Square test has been applied to find the significance of study parameters.

## RESULTS

A total of 311 babies were born at term gestation to mothers with PIH during the study period. Of these, 68 were excluded based on exclusion criteria. 43 infants were eventually lost to follow up.

**Table 1: Distribution of cases according to birth weight.**

| Birth weight | No. of cases | Percentage (%) |
|--------------|--------------|----------------|
| SGA          | 58           | 29             |
| AGA          | 142          | 71             |

Among the 200 infants studied, 29% (n=58) of babies are born small for gestational age (Table 1). The remaining 71% (n=142) are appropriate for gestational age.

**Table 2: Birth weight of babies.**

| Birth weight   | No. of cases | Percentage (%) |
|----------------|--------------|----------------|
| $\geq 2.5$ kg  | 142          | 71             |
| 1.5- 2.49 kg   | 47           | 23.5           |
| $\leq 1.49$ kg | 11           | 5.5            |

Among the 58, SGA babies, 11 babies are Very Low birth weight range while the remaining 47 are in the Low birth weight range (Table 2).

**Table 3: Physical growth and outcome in SGA vs AGA babies.**

| Birth weight | Growth delay | Normal growth |
|--------------|--------------|---------------|
| SGA          | 7            | 51            |
| AGA          | 5            | 137           |
| Total        | 12           | 188           |

Chi square: 5.3348; p value: 0.02093

In the present study, growth delay is seen in 12 babies (6%). In the SGA group, out of 58 cases, 51 had normal growth at the end of 1 year and 7 cases had growth delay. Among the 58 in the SGA group, 47 babies fall in the LBW category and 11 babies in VLBW category. In the VLBW group the growth delay is seen in 57.1% which is highly statistically significant as compared to 6.3% in the LBW group. Table 3 depicts the difference in growth retardation among SGA (12%) vs AGA (3.5%).

**Table 4: Physical growth and outcome in LBW vs VLBW babies.**

| Birth weight | Growth delay | Normal growth |
|--------------|--------------|---------------|
| LBW          | 4            | 7             |
| VLBW         | 3            | 44            |
| Total        | 7            | 51            |

Chi square: 7.5498; p value: 0.006002

This difference is statistically significant (P value 0.02). Further, growth retardation seems to be more strongly associated (p value <0.01) with a birth weight of <1500g, VLBW (Table 4).

**Table 5: Neurodevelopmental outcome in SGA vs LGA babies.**

| Birth weight | Neurodevelopmental disability | No disability |
|--------------|-------------------------------|---------------|
| SGA          | 18                            | 40            |
| AGA          | 7                             | 135           |
| Total        | 25                            | 175           |

Chi square: 5.3348; p value: 0.020903

**Table 6: Neurodevelopmental outcome in VLBW vs LBW babies.**

| VLBW/LBW | Neurodevelopmental Disability | Normal Development |
|----------|-------------------------------|--------------------|
| VLBW     | 7                             | 4                  |
| LBW      | 11                            | 36                 |
| Total    | 18                            | 40                 |

Chi square: 6.7411; p value: 0.009

Neurodevelopmental disability is seen in 12.5 % (n=25) babies in the total study group. This disability is statistically significant (P value <0.01) in SGA babies (30%) compared to AGA babies (5%) (Table 5). Further, this disability seems to be more strongly associated (P

value <0.01) with a birth weight of <1500 g, VLBW (Table 6).

## DISCUSSION

Maternal hypertension is a leading cause of maternal, fetal and neonatal mortality and morbidity. The effects of hypertension are seen in the immediate neonatal period and also affect the normal development of a child in all aspects. Chronic uteroplacental insufficiency may be attributed to the cause of intrauterine growth retardation in the babies born to hypertensive mothers.

The incidence of SGA in the study group is 29%. A study done by Haelterman E et al showed an incidence of 20 % SGA babies born to pre eclamptic mothers.<sup>11</sup> Another study done by Eskenazi B et al showed an incidence of SGA babies as 27.8% which is comparable to the present study.<sup>12</sup> Study done by Nadkarni et al has reported the incidence of LBW as 51.7%.<sup>13</sup>

Many of the studies done considered even the preterm babies in their studies. Prematurity itself would have significant effects on the growth of a child. We have excluded preterm babies from our study, while some studies have included them, that being the reason for higher incidence of SGA babies.

In the present study, 243 babies born to PIH mothers were followed up for the assessment of neurodevelopmental outcome and physical growth. 200 cases had a regular follow up at pre-determined intervals, only which were considered as study group. In the present study, growth delay is seen in 12 babies (6%).

Growth delay in the SGA group is 12% as compared to only 3.5% in the AGA group. In the VLBW group the growth delay is seen in 57.1% which is highly statistically significant as compared to 6.3% in the LBW group. This huge difference could be explained based on a JIPMER study which showed that babies with birth weight less than 1.25 kg showed delayed catch up growth even after 8 months and still lag behind the controls considerably at 1 year of age.<sup>14</sup>

Also in the present study, the number of babies in VLBW group are considerably low compared to LBW group which could explain the large variations. The incidence of growth delay is only 3.5% in AGA group which is on par with other similar studies.

In the aspect of neurodevelopmental outcome at the end of one year, out of 58 babies in the SGA group 30% had some form of delay at the end of one year. This is comparable to Chiswick et al study in which 35% had some form of delay in development.<sup>15</sup>

Among the SGA babies, developmental delay is present in 63.63% of the VLBW babies and 23% of LBW babies.

This huge difference could again be explained by the smaller number of individuals in the VLBW group.

Major neurological sequelae are seen in 12% of the SGA group in the present study whereas study from KEM, Pune showed major neurological sequelae in only 6.8%.<sup>16</sup> Though the NICHD trial did not report the outcomes separately in SGA babies, Gutbrod et al reported long-term developmental outcomes in VLBW SGA babies at 20 months.<sup>17,18</sup> They found SGA babies had poor head growth, early developmental delay and later language problem. Pune study also reported that AGA babies show earlier catch up than SGA babies and at 6 years SGA had lowest IQ scores.<sup>19</sup> However, we did not find such difference which probably can be explained due to shorter duration of study.

In the present study, outcome in hypertensive disorders of pregnancy in terms of increased incidence of SGA is noted. Because of SGA, there is increased incidence of neuro developmental and growth delay in babies born to PIH mother. So early and adequate control of blood pressure in pregnant women is recommended.

The high incidence of developmental and growth delay in SGA babies born to PIH mothers, may be due to delay in catch up growth, so a longer follow up is recommended. Efforts to improve the factors influencing catch up growth, like nutrition and an adequately stimulating environment may help in optimizing the growth outcome of these infants.<sup>20</sup>

## CONCLUSION

Pregnancy induced hypertension has a statistically significant effect on neurodevelopment and physical growth of a child when followed up to 12 months of age, in SGA babies, more so in VLBW babies. Early intervention programmes through medical, developmental, neuromotor, neurosensory interventions and other stimulation programs, might help in reducing the burden of the disease as well as improving the quality of life.

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