

# The role of Thompson score of term newborns in predicting neuromotor outcome at 1 year of age



Subham Puhan<sup>1</sup>, Saugata Chaudhuri<sup>2</sup>

<sup>1</sup>Senior Resident, Department of Pediatrics, Maharaja Krushna Chandra Gajapati Medical College and Hospital, Berhampur, Odisha, <sup>2</sup>Assistant Professor, Department of Neonatology, IPGME&R, SSKM Hospital, Kolkata, West Bengal, India

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## ABSTRACT

**Background:** The mortality rate is approximately 20% and the frequency of neurodevelopmental sequelae in surviving newborns is approximately 30% in perinatal asphyxia; hypoxic-ischemic encephalopathy (HIE) is brain dysfunction due to lack of oxygen and blood supply to the brain. **Aims and Objectives:** This study was conducted to predict the pattern of neuromotor outcome as early as 3 months using Hammersmith Infant Neurological Examination (HINE) in term hypoxic babies and its relation with the Thompson score (HIE score). **Materials and Methods:** One-hundred twenty four term newborns with hypoxic babies were admitted to the neonatal care unit from January 2021 to August 2021. Thompson scoring was done on admission and subsequently reviewed. Discharged babies were followed up at 3 months, 6 months, and 1 year of age. A neurological examination (HINE) was done in this high-risk follow-up clinic. Maximum Thompson score was correlated with neurological score at various months. The earliest predictability of neurological examination was done at 3 months and was correlated with the neurological examination done at 12 months. **Results:** The correlation between the Thompson score and the 3-month score is  $-0.65$  indicating a strong negative association between the two measurements. The correlation between 3 months and 6 months and 1-year neurological scores was moderately associated with each other. **Conclusion:** The maximum Thompson score was significantly higher in the mortality group compared to the discharged group. Thompson score has a significant correlation with the 3, 6, and 12-month neurological scores examined by HINE. The 3-month neurological outcome has a very significant correlation with the 1-year outcome.

**Key words:** Thompson score; Hypoxic-ischemic encephalopathy; Neuromotor outcome, Hammersmith infant neurological examination

## INTRODUCTION

Leading cause of early neonatal mortality is perinatal asphyxia.<sup>1</sup> The risk of cerebral palsy in survivors of perinatal asphyxia is very high as compared to general population.<sup>2</sup>

Hypoxic-Ischemic Encephalopathy (or HIE) is a non-specific term for brain dysfunction caused by a lack of blood flow and oxygen to the brain. HIE score (THOMPSON SCORE) is a clinical tool comprising of a

set of clinical signs associated with CNS dysfunction. It is used to assess status of a child following birth asphyxia. In this scoring system a score 0 is normal & max score is 22 which signifies worst possible status of HIE. In contrast to the Sarnat scale, the Thompson score did not require categorization of severity of encephalopathy, but rather relied on a simple numeric score to describe the peak severity of encephalopathy. By design, the Thompson score did not require specific training or depend on the availability of advanced technologies.<sup>3</sup> Hammersmith infant neurological examination (HINE) is a standardized

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### Address for Correspondence:

Dr. Saugata Chaudhuri, Assistant Professor, Department of Neonatology, IPGME&R, SSKM Hospital, Kolkata, West Bengal, India.

Mobile: +91-9477036563. E-mail: saugata.dr@gmail.com

neurological examination for infants adjusted age 2-24 months. The HINE evaluates nerve function, movement, reflexes and reactions, posture and tone. It can help clinicians to identify movement disorder including cerebral palsy. Early prediction by various neuromotor examinations like Hammersmith or Amiel-Tison score can help them for their early intervention.

The identification of motor dysfunction in early months of life is very crucial as it can influence the motor and cognitive development in later life and more importantly the timely intervention can attenuate the progression and severity of later impairment. In the present study they will review the neuromotor outcome of term perinatal asphyxia infants at 3 months, 6 months and 1 year at high-risk baby follow up clinic in tertiary care hospital.

### Aims and objectives

#### Aim

To predict the pattern of neuromotor outcome using HINE in term HIE babies.

#### Primary objective

- To estimate the neuromotor disability of the term HIE
- Predictability of Thompson score in estimating neuromotor outcome.

#### Secondary objective

- To predict the neuromotor outcome of the surviving hypoxic babies by earliest neurological examination at 3 months.

## MATERIALS AND METHODS

This is a prospective observational cohort study involving term perinatal asphyxia babies admitted to our neonatal unit during the above study period (December 14<sup>th</sup>, 2020–March 31<sup>st</sup>, 2021). Each enrolled term HIE infant was followed up for 1 year till March 2022 in the high-risk follow-up clinic.

### Exclusion criteria

Preterm <37 weeks gestation, respiratory depression due to any causes, major congenital malformation, acute bilirubin encephalopathy, encephalopathy due to hypoglycemia or meningitis, and intracranial hemorrhage.

Gestational age was determined by a combination of first-trimester USG or expected date of confinement and new Ballard scoring. Birth weight was taken using an electronic weight scale with an accuracy of plus or minus 5 g.

### Instrument and procedure

HINE is encompassed in 26 items assessing tone, motor pattern, spontaneous movement reflexes, cranial nerve

function, and visual and attention behavior. It is used in infants between 2 and 24 months. We selected term newborn babies (more than 37 weeks) admitted to this institute with a history of perinatal asphyxia. HIE staging (Thompson scoring) had been done on admission and subsequently reviewed. All the babies were managed in the neonatal intensive care unit (NICU) and special newborn care unit according to the standard protocol. The subsequent outcome in the form of mortality and morbidity during discharge was recorded. These discharged babies followed up at 3 months, 6 months, and 1 year at our high-risk baby clinic. Hammersmith Neurological Examination had been done in this high-risk follow-up clinic and according to their neurological status, early stimulation therapy had been done by a physiotherapist. Subsequently, we correlated between maximum Thompson score in NICU along with the Hammersmith score at various months. We also correlated the earliest predictability of a neurological examination done at 3 months with the neurological examination done at 12 months.

### Ethical consideration

Approval of the Institutional Ethics Committee had been obtained. EIC memo no. BCH/ME/PR/2462/A on 9.12.2020. Parents/guardian consent had been obtained.

### Data analysis

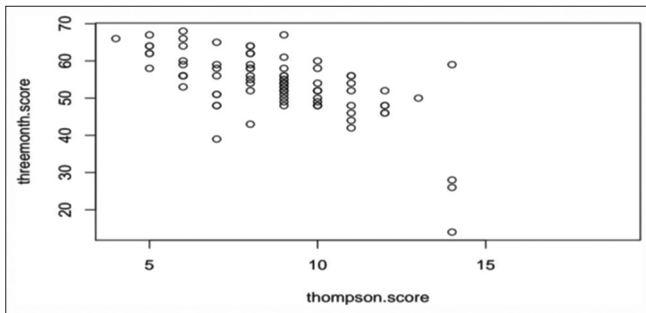
Linear correlation was computed among two variables using Pearson correlation then a linear regression model was used to predict the response variable for a co-variety. Statistical software R was used here.

## RESULTS

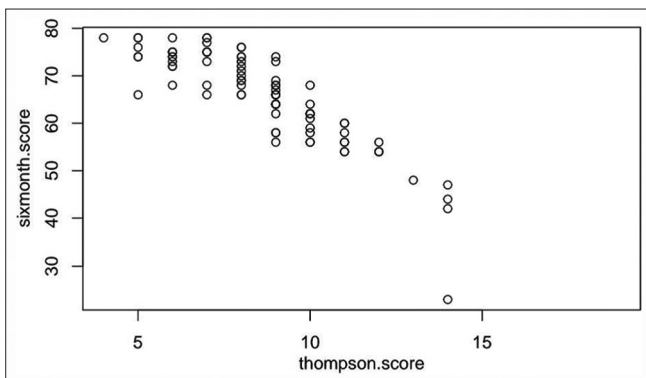
Out of 124 term babies of HIE babies, 29 babies succumbed and 95 babies survived. In the mortality group, the mean maximum Thompson score (Mean±SD) of patients was  $17.5862 \pm 0.7800$  (in weeks). In the discharged group, the mean maximum Thompson score (Mean±SD) of patients was  $9.0842 \pm 2.5585$  (in weeks). The distribution of the mean maximum Thompson score with discharged/death was statistically significant ( $P < 0.0001$ ).

The correlation between the Thompson score and the 3-month score is  $-0.65$  which indicates a strong negative association between the two measurements. It means the more the Thompson score, the less the HINE score (Figure 1). That is the poor neuromotor outcome. The higher the Thompson score, the worse the neuromotor outcome.

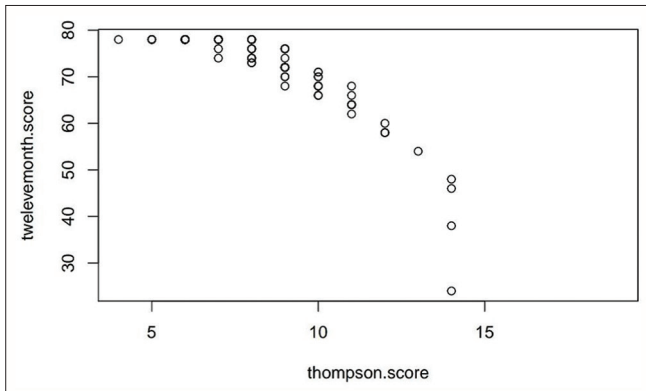
The correlation between Thompson score and 6 months HINE (Figure 2) and also between Thompson score and 12 months HINE (Figure 3) showed strong negative correlation.



**Figure 1:** Correlation between 3 months Hammersmith neurological examination and Thompson Score



**Figure 2:** The correlation between Thompson score and 6 months Hammersmith Infant Neurological examination -0.87

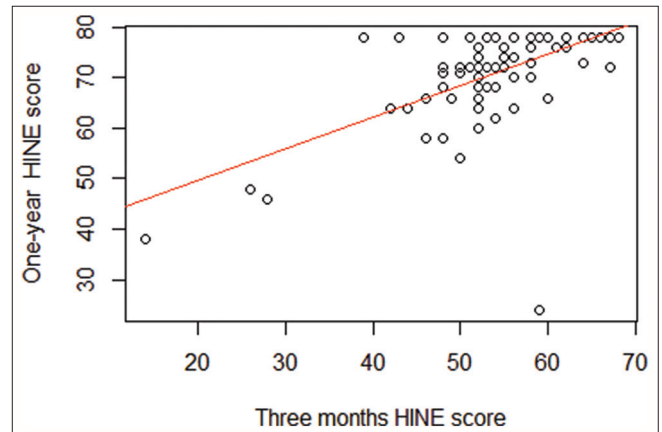


**Figure 3:** Correlation between 12-month Hammersmith infant neurological examination score and Thompson score

The correlation between 3 months and 6 months HINE scores is 0.57, which indicates that these two measurements are moderately associated.

The correlation between 3-month and 1-year HINE scores turns out to be 0.58, which indicates that these two measurements are moderately associated (Figure 4).

The statistical test for the null hypothesis of zero correlation returns a very small  $P=0.007$ . This value indicates that the zero-correlation hypothesis is rejected at a 1 and 5% level of significance. Therefore, we can conclude that the 3-month



**Figure 4:** Correlation between 3 months and 12 months Hammersmith infant neurological examination score

HINE score and 1-year score are significantly positively correlated. The 3-month HINE score can be used to predict the score for the 1-year HINE score. The following plot shows the linear regression prediction line of a 1-year HINE score based on a month's HINE score (Figure 5).

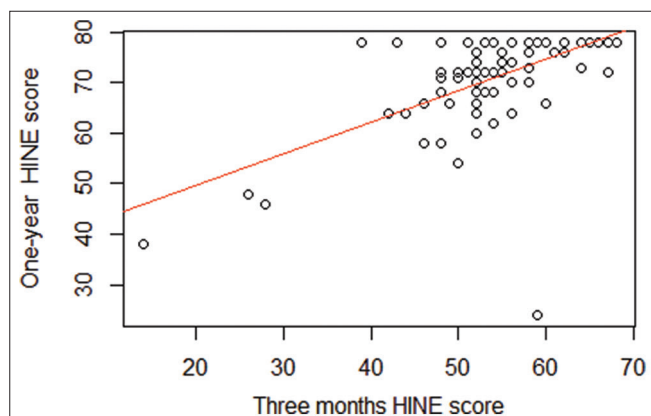
The correlation between the 6-month HINE score and the 1-year HINE score is 0.92, which indicates a very high positive correlation between the two measurements. Therefore, the 6-month score is a very strong predictor of the 1-year HINE score. This finding is in line with the literature on the study of the 6-month and 1-year HINE measurements.

We also study the relationship between the Thompson score and the status of the babies. It turns out that the correlation between the Thompson score and converted status shares a high negative correlation ( $-0.81$ ). This indicates that the baby with a higher Thompson score has a lower chance of survival.

## DISCUSSION

In the present study out of 124 babies, 29 babies were kept on prolonged ventilation and they succumbed due to ventilator related complications. We observed that maximum Thomson score was significantly higher in the mortality group ( $17.5862 \pm 0.7800$ ) compared to discharged group ( $9.0842 \pm 2.5585$ ) and this mean difference is statistically significant ( $p < 0.001$ ) similar to Bhagwani DK et al study.<sup>5</sup>

88 babies attended the follow up clinic at 3 months had mean HINE score 53.76 and were undergone early stimulation therapy. Out of 86 babies attended the follow-up clinic at 6 month, 33 babies had suboptimal HINE ( $< 65$ ). Out of 84 babies attended the 12 months, 31 babies had suboptimal HINE ( $< 73$ ). 12 babies had diplegic Cerebral Palsy and 2 babies had Quadriplegic Cerebral Palsy.



**Figure 5:** R regression between 3-month and 1-year Hammersmith infant neurological examination

We got significant correlation between the severity of Hypoxic Ischaemic Encephalopathy (examined by Thomson score) with the neuromotor outcome (examined by HINE scoring) at 3, 6 and 12 months of age. Similar findings were found by Shrestha et al.<sup>6</sup>

We got significant correlation among 3, 6 and 12 months neuromotor examination similar to the other 2 studies.<sup>7</sup> So poor neuromotor outcome can be predictable as early as 3 months of life and early stimulation based on that can support those babies.

### Limitations of the study

The study was conducted during the COVID-19 period. Hence, the number of cases was not sufficient to conclude. Again due to the COVID era, we did not get all the 95 babies during follow-up. Still, we got 92.63% babies. Only motor development was stressed, and cognitive assessment was not done. Again, 1-year follow-up is not adequate for the conclusion.

### CONCLUSION

The risk of neuromotor impairment is directly proportional to the severity of HIE. It can be assessed as early as 3 months of life so that we can start early stimulation to prevent gross impairment.

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#### Authors Contribution:

**SP**- Concept and design of the study, collected all the documents, and performed the procedures; **SC**- Guide of SP in preparation of concept and design of the study and also in preparation of the manuscript.

#### Work attributed to:

Dr. B C Roy PGIPS, West Bengal, India.

#### Orcid ID:

Dr. Saugata Chaudhuri - <https://orcid.org/0000-0003-2565-9250>  
 Dr. Subham Puhan - <https://orcid.org/0009-0009-5950-7280>

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