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Cognitive and Motor profiles of Preterm Infants with Hypoxic Ischemic Encephalopathy (HIE): A Case Report

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ABSTRACT

Hypoxic Ischemic Encephalopathy (HIE) significantly impacts infants' cognitive and motor development, necessitating tailored evaluation tools for early identification and intervention. To address this need, this study aimed to build new normative data for the Bayley Scales of Infant and Toddler Development™, Fourth Edition (Bayley™-4), specific to HIE. A cross-sectional analysis of 54 infants across three age groups (6, 12, and 18 months), consisting of 18 each, revealed significant deficits in the cognitive and motor domains compared with those of matched controls. These findings highlight the need for HIE-specific benchmarks to improve diagnostic accuracy and inform targeted interventions. Establishing these norms can enable clinicians to design personalized strategies to enhance developmental outcomes.

Keywords: *Hypoxic Ischemic Encephalopathy (HIE), Cognitive Development, Motor Development, Bayley-4, Preterm Infants.*

1. INTRODUCTION

Hypoxic Ischemic Encephalopathy (HIE) arises from oxygen deprivation during critical perinatal periods, leading to neonatal mortality and long-term neurodevelopmental deficits. HIE impairs motor skills, cognitive functions, and neural development, resulting in delayed milestones, attention deficits, and memory impairments. In severe cases, it is associated with conditions such as cerebral palsy and intellectual disabilities[3,4]. In developing regions like India, birth asphyxia accounts for 20% of neonatal deaths, with an estimated prevalence of 3–6 per 1,000 live births[1,2].

Given these profound developmental challenges, accurate assessment tools are essential for early identification and intervention.The Bayley Scales of Infant and Toddler Development, Fourth Edition (Bayley-4) provides a comprehensive tool for assessing infant development but requires refinement to address the distinct challenges that special populations such as HIE infants face. This study establishes new Bayley-4 norms, enhancing its clinical utility for early diagnosis and targeted interventions in this vulnerable group[5].

2. METHODS

This cross-sectional study assessed 54 infants age-corrected with HIE, evenly divided into three age groups (6, 12, and 18 months in preterm corrected age) on cognitive and motor domains using Bayley-4. with 18 participants in each group. Participants were recruited through purposive sampling from urban birthing hospitals in Bangalore. Among the five scales of the Bayley Scales of Infant and Toddler Development, Fourth Edition (Bayley-4)Cognitive, Language, Motor, Social-Emotional, and Adaptive Behavior only the Cognitive and Motor scales were administered in standardized, child-friendly settings.Ethical approval was obtained and informed parental consent was secured before participation. Descriptive statistics, including means and standard deviations, were computed for cognitive and motor scores.Table one provides comparison between preterm HIE babies and normal control group on these measures (standard score).

Table 1. Comparison of standard scores on cognitive and motor domains between age- corrected HIE and Control groups.

Group	Cognitive	Fine Motor	Gross Motor	Motor (Composite)
HIE	85.0	83.0	81.5	80.0
Control group	101.0	98.5	98.0	98.0
Difference	-16.0	-15.5	-16.5	-18.5

3. RESULTS AND DISCUSSION

The results indicate that the HIE infants scored significantly lower than matched controls on the cognitive, fine motor, gross motor, and composite motor domains, with deficits of 16, 15.5, 16.5, and 18.5 points, respectively. These results align with the literature associating HIE with disrupted neural pathways critical for cognitive and motor skills[6,7].

The findings emphasize the dual-domain impact of HIE, necessitating tailored interventions. Early therapeutic strategies, including physical therapy and cognitive training, can leverage neuroplasticity to mitigate developmental delays. We observed considerable variability within the HIE group suggesting the influence of factors such as condition severity and intervention timing, highlighting the importance of individualized care.

Future Implications

1. **Clinical practice:** HIE-specific Bayley-4 norms can improve early diagnosis and inform targeted therapeutic strategies.
2. **Parental guidance:** Educational programs can empower caregivers to foster optimal developmental environments.
3. **Long-term studies:** Research into the developmental trajectories of HIE infants will refine interventions.
4. **Policy focus:** Policymakers should prioritize neonatal care and expand access to early developmental assessments.

4. CONCLUSION

This study highlights the urgent need for HIE-specific Bayley-4 norms, revealing significant cognitive and motor deficits in HIE infants compared to matched controls. Establishing these benchmarks is crucial for more accurate assessments and targeted interventions, ultimately improving developmental outcomes for affected infants. Future research, involving larger and more diverse cohorts with longitudinal designs, is essential to validate these findings and further enhance their clinical utility.

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