ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 05 | May - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

IDENTIFICATION OF EARLY MARKERS OF CEREBRAL PALSY IN INFANT POPULATION USING APGAR SCORE AND HAMMERSMITH NEUROLOGICAL EXAMINATION - AN OBSERVATIONAL STUDY

Physiotherapy

Dr. Shilpa Khandare Professor, Dr. D.Y. Patil College of Physiotherapy, Pimpri, Pune, Dr. D.Y. Patil Vidhyapeeth, Pimpri, Pune.

Bhargavi Sukey Intern, Dr. D.Y. Patil College of Physiotherapy, Pimpri, Pune, Dr. D.Y. Patil Vidhyapeeth, Pimpri, Pune.

Dhanashree Upganlawar PG student, Dr. D.Y. Patil College of Physiotherapy, Pimpri, Pune, Dr. D.Y. Patil Vidhyapeeth, Pimpri, Pune.

ABSTRACT

Introduction: With 2.94 cases per 1000 children, Cerebral palsy stands as the predominant springtime of life disability in India. This study uses the Hammersmith Neurological Examination and Apgar score to find early markers of cerebral palsy in newborns 0-1 year old. **Method:** The focus of this study was to evaluate newborns who were at a higher risk of having cerebral palsy. For infants 0 to 1 year old, the Hammersmith Neurological Examination was performed and the Apgar score recorded. males) 20 had an optimum score, 37 had a suboptimum score and 5 were predicted to have abnormal outcome (likely Cerebral Palsy). Also, Apgar score at 1 minute was above 7 for 43 infants and below 7 for 19infants. Apgar score for 5 minutes was above 7 for 60 and below 7 for 2 infants. **Conclusion:** Our results indicate different developmental trajectories of infants based on the Hammersmith neurological examination and Apgarscore.And hence, it is advised to set up a standard protocol within the network to track the neurodevelopmental disability and offer early, targeted intervention.

KEYWORDS

Apgar score, Cerebral palsy, Hammersmith Neurological Examination.

1. INTRODUCTION

Among children, cerebral palsy is the most prevalent physical impairment, frequently having an unknown cause. (1) The global prevalence is still high, reaching up to 3.4 per 1000 live births in low- and middle-income nations, despite advances in medical care both before and after birth.Conversely, the birth pervasiveness of cerebral palsy in affluent countries is lower, hovering at 1.5 per 1000 live births as of 2022.(2)

The reported incidence of cerebral palsy in India closely resembles estimates from around the world (3). 58.9% of 2010 saw the autonomous movement of children with cerebral palsy, according to statistics from the Autism and Developmental Disabilities Monitoring Network.

In contrast, 7.8% of these children needed a hand-held mobility device to walk, and 33.3% had little or no walking capacity.(4)

1.1 Cerebral palsy

"Cerebral palsy," known interchangeably as "static encephalopathy" or Little's illness, encompasses a range of conditions affecting movement and posture, stemming from damage or dysfunction in the developing brain.(1)

Cerebral palsy (CP) can be categorized into numerous kinds based on different neuromuscular impairments: (1) spastic CP, (2) ataxic CP, (3) dystonic and choreoathetoid CP, etc. Spastic CP is the most prevalent, followed by dyskinetic (10–15%) and ataxic (less than 5%) CP subtypes.Interestingly, a study looking at 1000 cases of CP in India found that the majority of cases are spastic quadriplegia (61%) and diplegia (22%). (5)

Timely detectionof cerebral palsy (CP) presents a number of challenges for medical professionals and other health workers. These challenges include: 1) the possibility of misinterpreting symptoms for another condition or misdiagnosing a normal outcome; 2) the challenge of accurately identifying impaired motor control and functioning in infants younger than six months of age; 3) a shortage of comprehensive and straightforward recommendations or instruments based on evidence for prompt diagnosis; and 4) insufficient parental awareness of early markers of developmental delay.(6)

1.2 Neuroplasticity and Importance of Early Identification -

Early diagnosis of cerebral palsy is essential because it can lead to targeted, timely intervention that improves the likelihood of receiving appropriate educational and physical support(7).Compared to adults, children have a greater capacity for brain plasticity(8).

1.2.1 Better Neuroplasticity in children –

The introductory years of survival mark a period of rapid brain maturation and growth. As each neuron matures, the number of synaptic connections in the brain rises. Each cerebral cortex cell normally has about 2,500 synapses when it is born. At two or three years old, a baby's synapses are about 15,000 per neuron. As a result, newborns exhibit more neuroplasticity.(9)

1.2.2 Importance of Early intervention –

The knowledge that abilities learned in infancy are critical in forming later competences serves as the foundation for the reasoning behind early intervention. Basic behavioral schemes or patterns that are learned, honed, amalgamated, or integrated into more sophisticated response patterns that help one become more proficient.(10)

The purpose of this research is to use the Hammersmith neurological examination and the Apgar score to find early signs of cerebral palsy in neonates. The body of research on early indicators of cerebral palsy is small, despite the fact that several studies have been conducted in this area. As a result, this research is essential to identifying symptoms as soon as possible in order to reduce the high incidence rates.

2. MATERIALS AND METHOD

This cross-sectional, single-center observational study was carried out in 2022 at Pune's D.Y. Patil Medical Hospital. Both the high-risk outpatient department (OPD) and the inpatient department (IPD) provided newborns for this investigation. The study's target population was newborns who were susceptible to cerebral palsy. Participants were chosen from the high-risk OPD and IPD over a five-month period, from August 2022 to December 2022, based on preset inclusion and exclusion criteria after receiving clearance from the institutional ethical committee.

Infants who met the following inclusion criteria were selected for this study: (1) Age range: 0–1 year; (2) Gender: both male and female; (3) Preterm and full-term infants; (4) High-risk infants; and (5) Infants whose parents gave written agreement. Among the exclusion criteria were babies whose vital signs were never steady. A purposive method was used to obtain the samples.

Informed permission forms were given to all participant parents, who signed them before the participant could begin. After obtaining consent from parents, the sample population's demographic data was gathered. All active participants' Apgar scores were also documented. The Hammersmith Neurological Examination was then given by the lead researcher to newborns who were at risk of cerebral palsy in order to evaluate any early indicators of neurological impairment.

This study was approved by the Ethics Committee of Dr. D.Y Patil College of Physiotherapy [Ethical code – DYPCPT/ISEC/18/2022]

FIG 1: Demonstrating scarf sign

FIG 2: Demonstrating pulled to sit

FIG 3: Demonstrating ventral suspension

2.1 Outcome measures:

2.1.1 Apgar score-

The APGAR score was developed in 1952 by Virginia Apgar as a quick way to assess a newborn's physical condition. This scoring system assigns a number between 0 and 2 to each of the five immediately recognisable characteristics: colour, muscle tone, reflex irritability, heart rate, and respiratory effort. An infant is in good to exceptional condition if their overall score is seven or higher. The values of these five elements are added together to determine the final score. The APGAR score is used to quickly assess the physical health of infants and is given at one and five minutes after birth. It is generally accepted that the five-minute score is a better indicator of survival than the one-minute score.(11)

2.1.2 Hammersmith Neurological Examination

The Hammersmith neurological exam guage newborns' and infants' neurological status.These exams consist of two separate assessments: the 34-item Hammersmith Neonatal Neurological Examination (HNNE), which is administered during the neonatal period, and the 26-item in HINE, which is administered between the ages of 2 and 24 months. Global optimality scores are defined as those that lie between the 90th and 95th percentiles; these scores represent the normal neurological development of healthy infants.(7)

With a maximum score potential of 78, the HIME assesses cranial nerve function (max score 15), posture (max score 18), motions (max score 6), tone (max score 24), and reflexes/reactions (max score 15). For each component, the score ranges from 0 to 3. Assessments are also conducted for behaviour, including asymmetry, and motor developmental milestones. A child born at 28–32 weeks has a median score of 76 (range: 72–78); a baby born at 24-28 weeks has a median score of 73 (range: 69–76.5); at 20–24 weeks, it is 70 (range: 61.5–74); at 16–20 weeks, it is 67.5 (range: 65.5-74); and at 12–16 weeks, it is 67 (range: 62.5–69). Global optimality scores, which indicate typical neurological development, differ across age groups.(12)

3. Statistical Analysis

According to the study "Neurological assessment in infants discharged from a neonatal intensive care unit" by author Domenico M.M. Romeo, the sensitivity of the HIME at 3 months in predicting Cerebral Palsy in the high-risk group was 96%. This information was used to determine the sample size (n=62).

The calculation was done using WINPEPI VERSION 11.38 software, taking into account a Cerebral Palsy prevalence of 3.8% and a confidence interval of 95%, with an acceptable difference of 2-8%.

An Excel spreadsheet was used to organize the data, and pertinent statistical analyses were carried out. Microsoft Excel and MedCalc statistical software version 20.210 were both used for the analysis.

3.1 RESULTS

A total of 62 infants (31 male, 31 female; average age=17.81weeks [SD=15.41]) fulfilled the inclusion criteria.

Table no. 1: Age of all Participants

AGE(IN WEEKS)	MEAN	SD
	17.8129	15.4164

Table no. 2: Gender distribution

GENDER	MALE	FEMALE
	31(50%)	31(50%)

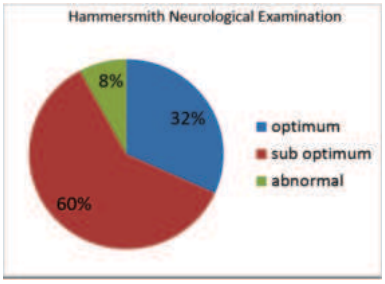

Figure no. 1:

Figure no. 1: The pie chart illustrates that among total (62) infants 32% infants were optimum, 60 % were suboptimum and 8% were predicted to have abnormal outcome (likely Cerebral Palsy)

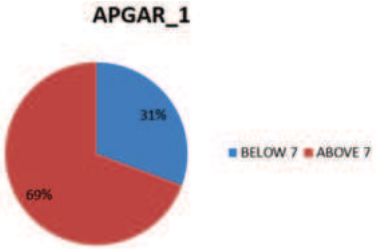

Figure no. 2

Figure no. 2: Indicates that Apgar score was above 7 for 69% and below 7 for 31% infants.

Figure no. 3

FIGURE 3: Indicates Apgar score was above 7 for 97% and below 7 for 3% of samples.

Among the 68% sample population who were categorized as Suboptimum and Abnormal outcome, 73% had caesarean section as their mode of delivery and 40% had low birth weight. Also 35% of sample population had history of oligohydroamnios (mothers), 42% had history of respiratory distress, 42% had history of NICU admission and 9% had history of neonatal jaundice.

4. DISCUSSION

The purpose of this study was to use the HAMMERSMITH NEUROLOGICAL EXAMINATION and the Apgar score to identify early signs of cerebral palsy in neonates.

Almost all babies are given an APGAR vitality index, which ranges

from 0 to 10, at 1, 5, and 10 minutes following birth. The purpose of the Hammersmith Neurological Examination is to assess several neurological features in babies. This study's data came from a tertiary healthcare facility.

The APGAR score at one minute was greater than seven in 69% of the samples and less than seven in 31% of the samples. In 97% of cases, the APGAR score was higher than 7 at 5 minutes, whereas in 3% of cases, it was lower than 7. Remarkably, cerebral palsy risk was increased even with a slight decline in APGAR scores at five minutes (scores of 8 or 9).(13)

Of the sample group classified as having Suboptimal and Abnormal results, 35 percent of the mothers had a history of oligohydramnios. A related study suggests that oligohydramnios, which is characterised by low amounts of amniotic fluid, may indicate inadequate umbilical cord protection, which could result in foetal suffocation from a nuchal cord. The newborn may have distress and long-term brain damage as a result of this illness.(14)

Nine percent of those in the sample had experienced newborn jaundice in the past. Severe hyperbilirubinemia permits unbound bilirubin to cross the blood-brain barrier, impacting critical brain areas including the brainstem, hippocampus, cerebellum, and globus pallidus.The degree of bilirubin exposure and its concentration in the brain determine how much brain damage occurs.(15)

Of the people in the sample, 42% had experienced respiratory discomfort in the past. The pathogenic mechanisms underpinning Hypoxic-Ischemic Encephalopathy (HIE), which results from reduced cerebral blood flow and insufficient oxygen delivery to the brain, may be exacerbated by respiratory distress, according to research.

The poor and abnormal result scores on the HAMMERSMITH NEUROLOGICAL EXAMINATION that were seen in 68% of the population may have been caused by a combination of these variables.(16)

In this regard, this study emphasizes the significance of timely identification of cerebral palsy venturesome individuals and the implementation of focused early therapies tailored to the condition. By taking this method, any difficulties are minimized and infant neuroplasticity is maximized.

5. Limitations

The age distribution of the study population was heterogeneous. For the 8-week age group, optimal scores on the Hammersmith Neurological Examination are not consistently obtained.

6. CONCLUSION

Our results demonstrate the usefulness of Hammersmith neurological scores in identifying term and preterm infants at risk of neurodevelopmental disorders, as they show varying developmental trajectories. In addition, the establishment of a uniform protocol inside the network is essential for elucidating and tracking infants' neurodevelopmental outcomes early on.

7. Ethical consideration

This research was approved by the ethical committee of Dr. D.Y Patil College of Physiotherapy, Pimpri, Pune

Ethical code – **DYPCPT/ISEC/18/2022**

Funding

No grants from governmental, private, or nonprofit funding organizations were given for this research.

Authors' Contribution

Supervision – Dr. Shilpa Khandare
Methodology, Data collection, original draft writing and editing – Bhargavi Sukey

Conflict of interest

According to the writers, they have no competing interests.

Acknowledgements

I am extremely grateful to our principal, Dr. Tushar J. Palekar, Ph.D. for giving me this opportunityI want to express my gratitude to Dr. Shilpa Khandare, my guide, for her unwavering support and encouragement during the study. I am extremely grateful to my friends and colleagues for their help and support throughout this study. We would also thank all the participants and their parents for their co-operation.

REFERENCES:

1. Reddihough DS, Collins KJ. The epidemiology and causes of cerebral palsy. Aust J Physiother. 2003;49(1):7–12.
2. McIntyre S, Goldsmith S, Webb A, Ehlinger V, Hollung SJ, McConnell K, et al. Global prevalence of cerebral palsy: A systematic analysis. Dev Med Child Neurol. 2022 Dec;64(12):1494–506.
3. Chauhan A, Singh M, Jaiswal N, Agarwal A, Sahu JK, Singh M. Prevalence of Cerebral Palsy in Indian Children: A Systematic Review and Meta-Analysis. Indian J Pediatr. 2019 Dec;86(12):1124–30.
4. Ultrasound in Obstetrics and Gynaecology | ScienceDirect [Internet]. [cited 2024 Apr 2]. Available from: https://www.sciencedirect.com/book/9780444518293/ultrasound-in-obstetrics-and-gynaecology
5. (PDF) A Systematic Review on Etiology, Epidemiology, and Treatment of Cerebral Palsy [Internet]. [cited 2024 Apr 2]. Available from: https://www.researchgate.net/publication/ 321112422_A_Systematic_Review_ on_Etiology_Epidemiology_and_Treatment_of_Cerebral_Palsy
6. te Velde A, Morgan C, Novak I, Tantsis E, Badawi N. Early Diagnosis and Classification of Cerebral Palsy: An Historical Perspective and Barriers to an Early Diagnosis. J Clin Med. 2019 Oct 3;8(10):1599.
7. Romeo DM, Ricci D, Brogna C, Mercuri E. Use of the Hammersmith Infant Neurological Examination in infants with cerebral palsy: a critical review of the literature. Dev Med Child Neurol. 2016 Mar;58(3):240–5.
8. Johnston MV. Clinical disorders of brain plasticity. Brain Dev. 2004 Mar;26(2):73–80.
9. The Scientist in the Crib: Minds, Brains and How Children Learn | Request PDF [Internet]. [cited 2024 Apr 2]. Available from: https://www.researchgate. net/publication/232456333_The_Scientist_in_the_ Crib_Minds_Brains_ and_How_Children_Learn
10. 92 org erlyintevrn services.pdf [Internet]. [cited 2024 Apr 2]. Available from: https://niepid.nic.in/92%20org%20erly%20intevrn%20services.pdf
11. https://www.bmj.com/content/360/bmj.k207 [Internet]. [cited 2024 Apr 2]. Available from: https://www.bmj.com/content/360/bmj.k207
12. HINE proforma_07_07_17.pdf [Internet]. [cited 2024 Apr 2]. Available from: https://bpna.org.uk/userfiles/HINE%20proforma_07_07_17.pdf
13. Casey BM, McIntire DD, Leveno KJ. The continuing value of the Apgar score for the assessment of newborn infants. N Engl J Med. 2001 Feb 15;344(7):467–71.
14. King AR, Al Imam MH, McIntyre S, Morgan C, Khandaker G, Badawi N, et al. Early Diagnosis of Cerebral Palsy in Low- and Middle-Income Countries. Brain Sci. 2022 Apr 23;12(5):539.
15. Haataja L, Cowan F, Mercuri E, Bassi L, Guzzetta A, Dubowitz L. Application of a scorable neurologic examination in healthy term infants aged 3 to 8 months. J Pediatr. 2003 Oct;143(4):546.
16. Romeo DM, Apicella M, Velli C, Brogna C, Ricci D, Pede E, et al. Hammersmith Infant Neurological Examination in low-risk infants born very preterm: a longitudinal prospective study. Dev Med Child Neurol. 2022 Jul;64(7):863–70.