Student's Journal of Health Research Africa
Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.912
Original article

A CROSS-SECTIONAL STUDY OF USING DENVER DEVELOPMENTAL SCREENING TEST II FOR DETECTING CEREBRAL PALSY EARLY IN YOUNG CHILDREN AND NEONATES AT PATNA MEDICAL COLLEGE AND HOSPITAL, PATNA, BIHAR.

Saumya Singh[a], *Manisha Kumari*[a*], *Bhupendra Narain*[b]
[a]*Senior Resident, Department of Pediatrics, P.M.C.H., Patna, Bihar, India.*
[b]*Associate Professor, Department of Pediatrics, P.M.C.H., Patna, Bihar, India*

Abstract

Objectives

This study aimed to assess and identify developmental delays in infants using the Denver Developmental Screening Test (DDST-II), examining potential contributing factors and offering recommendations for effective interventions.

Methods

The study employed a prospective cross-sectional design, enrolling 111 infants aged 0 months to 2 years attending a tertiary care center for 2 years. Denver Developmental Screening Test (DDST-II) was administered, and infants were followed up for three consecutive months to assess developmental milestones and potential contributing factors.

Results

In the study encompassing 111 infants, 6.4% demonstrated delayed development, 7.8% exhibited doubtful delays, and 85.8% were considered normal. Notably, 25% of cases with developmental concerns had a history of preterm birth, 35% were of low birth weight, and 30% were delivered via cesarean section. Furthermore, 100% detection rates for delayed development were observed in infants aged 13-24 months.

Conclusion

The current study underscores a notable prevalence of developmental delays among infants, emphasizing the critical importance of early detection and intervention. The multifactorial nature of contributing elements, including preterm birth and low birth weight, highlights the complexity of developmental challenges. The study's findings contribute valuable insights into developmental patterns, supporting the need for broader research and targeted interventions.

Recommendation

The study recommends further research with larger and more diverse samples to enhance generalizability. Additionally, exploring the effectiveness of tailored interventions for developmental delays is crucial for optimizing infant development.

Keywords: Developmental Delays, Infants, Denver Developmental Screening Test (DDST-II), Early Intervention
Submitted: 2023-12-09 Accepted: 2023-12-09

Corresponding Author: *Manisha Kumari*[a,*]
Senior Resident, Department of Pediatrics, P.M.C.H., Patna, Bihar, India.
Email address: drmanishahailley@gmail.com

Introduction

Cerebral palsy denotes a collection of developmental disorders affecting movement and/or posture, resulting in limitations or disability in activities [1]. These issues stem from injuries to the developing brain. In India, a mere 1.4 % to 2.4 % of children under the age of three exhibit abnormal developmental milestones, and unfortunately, they often go unnoticed and are not promptly referred for crucial early intervention [2]. Swift intervention is deemed essential for averting severe and lasting functional impairments.

The presence of delays in development can act as an indicator of conditions such as neurological palsy, cognitive challenges, and various intellectual difficulties [3]. These conditions stem from a variety of causes, leading to diverse clinical presentations based on the nature of the insults, often occurring in combinations. Symptoms include challenges in posture maintenance, gait, and rigidity or fatigue, along with low muscle tone in

the limbs [4]. Associated problems may encompass different forms of learning disabilities, seizures, issues with feeding, growth, and impairments in vision and hearing.

These insults disrupt the normal early neurodevelopmental process and result from maternal or neonatal diseases, including prenatal and neonatal hypoxia, bleeding in the ventricles, leukomalacia, prematurity, reduced weight at birth, shock, infections, genetic predisposition, and abnormalities in metabolism. Despite advanced investigations, the exact etiology remains elusive in 15 % of cases [5]. The diagnosis of cerebral palsy follows a convention of exclusion and is not attributed unless the causal mechanism is in operation before the child's third birthday, even though the actual diagnosis may be established later on [6].

Over two decades, the nervous system undergoes development, typically concluding by age 7 [5]. It is imperative to emphasize early diagnosis and intervention within the first year for conditions such as cerebral palsy, mental retardation, or learning disabilities [5]. While the impact of early rehabilitation on symptom severity remains inconclusive, its significant role in supporting child-parent relationships, caregiving, and confidence cannot be overstated [7]. This not only prevents neglect but also mitigates neurological injury and addresses abnormal movement patterns, contributing to an overall improvement in the quality of life.

Despite a developmental surveillance program assessing risk, only 50% of diagnosed cases exhibit high-risk factors, highlighting the need for prompt identification in the remaining cases for optimal outcomes. This study, therefore, aims to underscore the crucial role of early detection and intervention in enhancing the overall well-being of children facing neurological conditions.

Materials and Methods

Study design

A prospective cross-sectional study was conducted.

Study setting

The study carried out at Patna Medical College and Hospital (P.M.C.H.), Patna, Bihar, India, from September 2020 to August 2022 uses DDST II to assess developmental milestones in 111 children aged 0 to 2 years and to evaluate the test's efficacy for diverse developmental screening. This tool is mentioned as a convenient alternative for busy office practices, especially for screening babies aged 0 months to 2 years in clinics.

Participants

The study included 111 children ranging from 0 to 2 years of age.

Inclusion criteria

The study's inclusion criteria encompassed healthy infants aged 0 months to 2 years visiting a tertiary care center for routine vaccination and check-ups. Enrolment was facilitated randomly through numbers allotted by computer. Monthly follow-ups occurred over the next three months.

Exclusion criteria

Exclusion criteria involved babies with pre-existing diagnoses of cerebral palsy, distorted facial traits, chromosomal or congenital irregularities, diseases, or those failing to attend follow-up sessions.

Study size

Data collection and analysis

In the study, a systematic method was employed for the administration and analysis of the developmental assessments. A vertical line, connecting age ranges on the upper and lower lines, was drawn, allowing the evaluation of 12 to 15 specific tasks for each age group. The assessments are presented graphically, indicating ages at which 25 %, 50 %, 75 %, and 90 % of children perform each task. This visualization allows a comparison of a child's development with others from birth to two years.

The analysis criteria involved determining normalcy based on the position of the line relative to percentiles, and identifying delays or uncertainties within specific age ranges. The study's application showcased the reliability of this method as a developmental screening tool involving 111 children at a tertiary care center.

Bias

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation from the nurses who collected the data.

Statistical Analysis

Normalcy is determined if the line cuts to the right of the 50th percentile and delayed if it falls to the left of the 25th percentile mark. Doubt arises if it falls between the 25th and 50th percentiles inside the box.

Ethical consideration

The study protocol was approved by the ethic committee and written parental informed consent was obtained before the study.

Results

Student's Journal of Health Research Africa
Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.912
Original article

Participants

The study enrolled a cohort of 111 infants, including 65 males and 46 females, who completed a thorough 3-month follow-up. Initially, 250 infants who were born to pregnant women in the <34 gestational period were enrolled in this study. Among these, 21 patients with congenital cardiac diseases and metabolic disorders and 19 with pre-existing cerebral palsy were excluded. From the remaining 210 patients, the data of 80 patients were incomplete. Another 12 patients could not be contacted after a hospital stay while 7 patients refused to attend control visits as shown in figure 1. These infants exhibited an average birth weight of 2950 grams and an average gestation period of 37.5 weeks, providing a well-rounded representation of diverse developmental backgrounds. Over 54.9 % of the pregnant women had used steroids during their antenatal period. A notable portion of the neonates were diagnosed with respiratory illness (22.5 %), bronchopulmonary dysplasia (17.1%), and sepsis (27.0%) during hospitalization. In the post-natal period, therapeutic interventions such as oxygen support, mechanical ventilation, caffeine, antibiotics and steroid therapy were also administered as shown in Table 1.

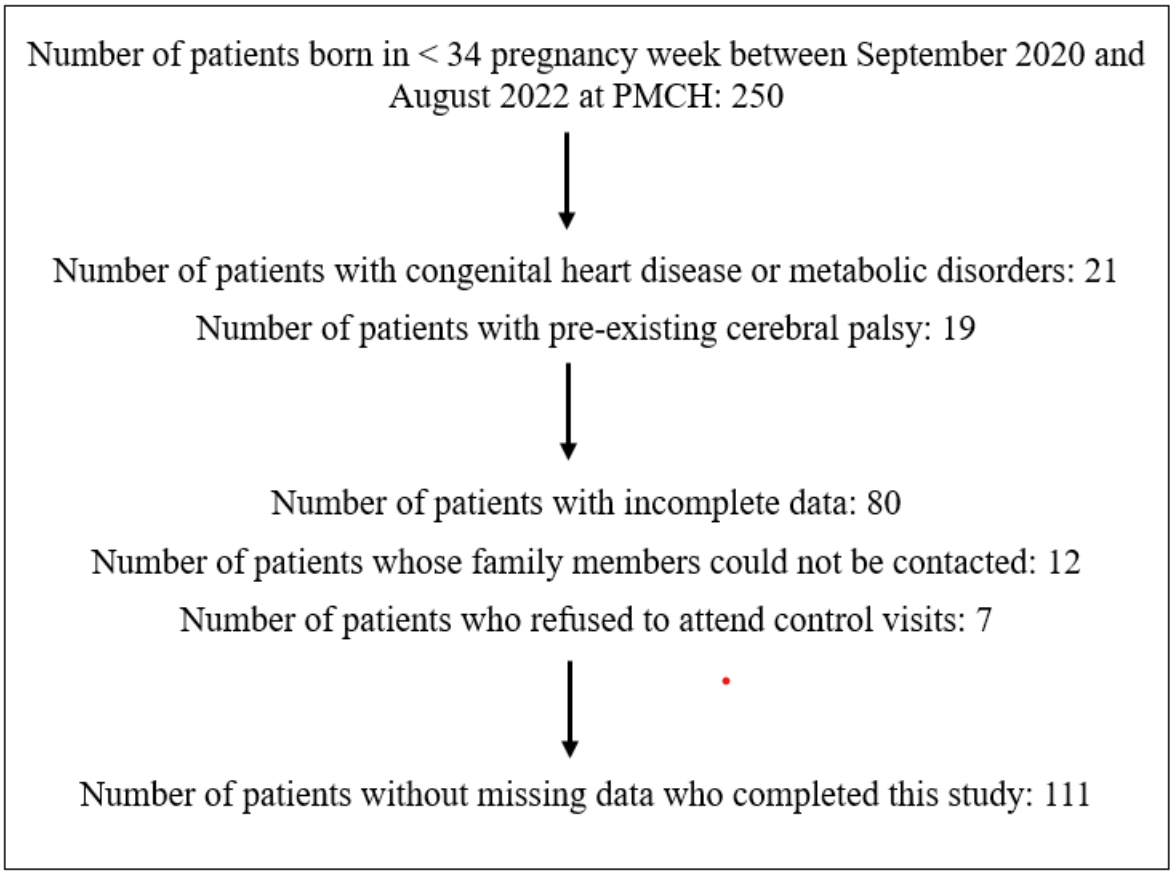

Figure 1: Flow diagram of the study

Table 1: Prenatal, neonatal, and post-natal features during hospitalization in neonatal period

	Mean	**Lower and upper limits**
Birth weight, g	1519.3	526-2350
Gestational weeks	**n**	**%**
25 to 26	14	12.5 %
27 to 28	7	6.2 %
29 to 30	21	18.8 %
31 to 32	47	42.8 %
33 to 34	22	19.7 %
Antenatal steroid use	61	54.9 %
Mode of delivery, caesarean	87	78.3 %
Diagnosis during hospitalization		
Respiratory distress syndrome	25	22.5 %
Bronchopulmonary dysplasia	19	17.1 %
Sepsis	30	27.0 %
Treatments administered after admission		
Oxygen support	91	81.9 %
Mechanical ventilation	52	46.8 %
Caffeine	56	50.4 %
Antibiotics	96	86.4 %
Steroid therapy – once	20	18.0 %
Steroid therapy – twice	10	9.0 %

Table 2: Neurodevelopmental Impairment Detection Rates across Corrected Age Groups Utilizing Traditional Criteria of DDST-II

Corrected age (months)					
		0 to 6 (n=27)	**7 to 12 (n=46)**	**13 to 18 (n=23)**	**19 to 24 (n=15)**
Cognition					
Socially-oriented	Normal	27	43	20	12
	Abnormal	0 (0)	3 (6.9 %)	3 (14.3 %)	3 (22.2 %)
Language					
Perceptive communication	Normal	27	43	22	15
	Abnormal	0 (0 %)	3 (6.9 %)	1 (7.1 %)	0 (0 %)
Language	Normal	27	41	14	9
	Abnormal	0 (0 %)	5 (10.3 %)	9 (42.9 %)	6 (44.4 %)
Motor					
Gross motor	Normal	27	32	9	9
	Abnormal	0 (0 %)	14 (31 %)	14 (64.3 %)	6 (44.4 %)
Fine motor-adaptive	Normal	27	45	17	12
	Abnormal	0 (0 %)	1 (0.34 %)	6 (28.6 %)	3 (22.2 %)
Total					
DDST-II	Normal	27	20	0	0
	Abnormal	0 (0 %)	26 (56.5 %)	23 (100 %)	15 (100 %)

Discussion

Exploring potential contributing factors to delayed and doubtful development, the study scrutinized various aspects. In the current study, 25 % of cases reported a history of preterm birth, 35 % were classified as low birth weight, and 30 % were delivered through caesarean operation. Additionally, 5 % of cases demonstrated delayed cry, emphasizing the multifaceted nature of the observed developmental challenges. Despite associations,

35 % of infants with developmental concerns lacked historical evidence suggesting perinatal insult, adding complexity to identifying specific causative factors.

Considering corrected ages at 6-month intervals, the DDST-II assessment revealed that the highest detection rates for 'cognition (socially-oriented) and language' were between 19 and 24 months. For "gross motor" and "fine motor", the highest detection rates were observed between 13 and 18 months (Table 2). This thorough examination provides nuanced insights into early childhood development, laying a foundation for further research and interventions.

Furthermore, the study unveiled a notable prevalence of developmental delay among infants, a concern that went undetected during the post-natal period until screening was initiated. The observed incidence, nearly three times higher than expected contrasts sharply with reported rates of 1.4 to 2.4 % in India [7, 8]. This discrepancy may arise from potential under-reporting in rural areas, where limited awareness and inadequate prognostic facilities could contribute to overlooking developmental concerns. This underscores the critical importance of timely detection and intervention for affected children.

In a broader investigation involving 2111 children aged 0 to 5 yrs, 45.1 % exhibited abnormal developmental screening results [9]. Another study performed an in-depth analysis and identified factors such as delayed commencement of newborn crying, breastfeeding issues, caesarean delivery, and injuries during birth to be significantly associated with progressively abnormal outcomes on the DDST II [9]. Another study focusing on 35 children from birth to 2 years reported that 68.6% demonstrated normal development. However, in the remaining 31.4 %, items categorized as "delay" or "attention" and "risk" or "untestable" indicated potential neuropsychomotor impairment [10].

Abnormal pregnancy intervals and prolonged menstrual cycles emerge as noteworthy considerations, broadening the understanding of potential contributors to developmental challenges [11, 12]. The nutritional and hormonal milieu during conception and early gestation is another critical aspect in the development of cerebral palsy [11, 12].

Regarding the clinical manifestations of Cerebral Palsy (CP) in India, two comprehensive studies outlined the prevalence of spastic quadriplegia in 61%, spastic diplegia in 22%, dyskinetic features in 8%, and miscellaneous types in the remaining cases [13, 14]. This diversity in clinical types underscores the heterogeneous nature of CP presentations within the Indian context.

Conclusion

The study focussing on early detection of cerebral palsy in infants and young children using DDST-II highlights a significant prevalence of developmental delays among infants, emphasizing the need for early detection and intervention. The multifaceted nature of contributing factors, including preterm birth and low birth weight, underscores the complexity of developmental challenges. The Denver Developmental Screening Test (DDST-II) proves valuable in identifying delays, especially between 13-24 months, offering crucial insights for tailored interventions. Despite challenges in pinpointing specific causative factors, the findings emphasize the importance of comprehensive developmental assessments. This study contributes to the broader understanding of early childhood development, paving the way for targeted research and interventions.

Limitations

The study's limitations include a small sample size, potential regional bias, and a short follow-up duration. While valuable, reliance on DDST-II and limited intervention analysis cautions against broad generalizations. Moreover, there may be a potential recall bias in obtaining historical data on perinatal factors, as participants may not accurately recall details. Additionally, the sample may not be fully representative of the broader population, particularly in rural areas with limited awareness, potentially underestimating the prevalence of developmental delay.

Recommendations

The study recommends broadening sample diversity, extending follow-up durations, and exploring causal relationships for a comprehensive understanding. Additionally, assessing intervention efficacy and improving perinatal history accuracy are crucial for enhancing future research.

Generalizability of the study

The generalizability of this study may be limited due to potential underreporting in rural areas and the specific population studied. Caution should be exercised when extending findings to broader populations with differing sociodemographic characteristics and healthcare access.

Acknowledgements

To all the participants and parents for their support and cooperation

List of Abbreviations

CP - Cerebral Palsy

DDST – Denver Developmental Screening Test

Source of funding

No source of funding.

Conflict of interest

No conflict of interest.

References

1. Consensus report of International workshop on definition and classification of Cerebral Palsy, Bethedsa, 2004.
2. Kaur P, Chavan BS, Lata S, Kaur A, Tinku S, Arora Y et al. Early intervention in developmental delay.

Indian journal of paediatrics 2006; 73; 405-408
3. Cochrane database syst rev 2012 dec12; cd005495pub3.
4. MKC Nar, Babu George, K Padma, N Potty, Elizabeth KE, Jeyaseelan L. Developmental Evaluation Clinic – CDC Experience, Indian journal of paediatrics, 2009; 112-119
5. Villagomez AN, Muñoz FM, Peterson RL, Colbert AM, Gladstone M, MacDonald B, Wilson R, Fairlie L, Gerner GJ, Patterson J, Boghossian NS, Burton VJ, Cortés M, Katikaneni LD, Larson JCG, Angulo AS, Joshi J, Nesin M, Padula MA, Kochhar S, Connery AK; Brighton Collaboration Neurodevelopmental Delay Working Group. Neurodevelopmental delay: Case definition & guidelines for data collection, analysis, and presentation of immunization safety data. Vaccine. 2019; 37(52):7623-7641.
6. Novak I, et al., Early, Accurate Diagnosis and Early Intervention in Cerebral Palsy: Advances in Diagnosis and Treatment. JAMA Pediatr. 2017;171(9):897-907.
7. Korzeniewski, S.J., Slaughter, J., Lenski, M. et al. The complex aetiology of cerebral palsy. Nat Rev Neurol 2018; 14 (9): 528–543.
8. Patel DR, Neelakantan M, Pandher K, Merrick J. Cerebral palsy in children: a clinical overview. Transl Pediatr. 2020; 9: S125-S135.
9. Shahshahani S, Vameghi R, Azari N, Sajedi F, Kazemnejad A. Validity and Reliability Determination of Denver Developmental Screening Test-II in 0-6 Year-Olds in Tehran. Iran J Pediatr. 2010;20(3):313-322.
10. Moraes MW, Weber AP, Santos Mde C, Almeida Fde A. Denver II: evaluation of the development of children treated in the outpatient clinic of Project Einstein in the Community of Paraisópolis. Einstein (Sao Paulo). 2010;8(2):149-153.
11. Nelson KB, EllenbergJH1986, Am J Dis Child; 1039: 1031-38
12. Torfs et al., 1990, J Pediatr; 116:615-619. 11. Singhi Pratibha et. al., Types of Cerebral palsy in northern india. 2002, J Trop Pediatr 48(3):162-166.
13. Frankenburg WK, Dodds JB. The Denver developmental screening test. J Pediatr. 1967;71(2):181-191.
14. Screening infants and young children for developmental disabilities. Am Acad of Pediatr Committee on Children with Disabilities. Pediatrics. 1994;93(5):863-5.

Publisher Details

Publishing Journal: Student's Journal of Health Research Africa.
Email: studentsjournal2020@gmail.com or admin@sjhresearchafrica.org

(ISSN: 2709-9997)

Publisher: SJC Publisher Company Ltd
Category: Non-Government & Non-profit Organisation
Contact: +256775434261(WhatsApp)
Email: admin@sjpublisher.org
Website: https://sjpublisher.org
Location: Wisdom Centre Annex, P.O. BOX. 113407 Wakiso, Uganda, East Africa.