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Early Intervention Strategies and Long-Term Functional Outcomes in Children with Cerebral Palsy: A Prospective Cohort Study.

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ABSTRACT

Cerebral Palsy (CP) presents challenges in motor function and daily living for affected children. Early intervention is an important for lowering its impact and enhancing long-term outcomes. A prospective cohort study was conducted with 50 children (aged 1-6 years) diagnosed with CP. Patients underwent baseline assessments and were enrolled in a one-year early intervention program tailored to their needs. Functional outcomes were evaluated using standardized measures. Significant improvements were observed in motor function, activities of daily living, and caregiver-reported outcomes over the intervention period. Early intervention strategies play a vital role in improving long-term functional outcomes for children with CP. Tailored interventions initiated early in development can lead to meaningful gains in motor function and overall quality of life.

Keywords: Cerebral Palsy, Early Intervention, Motor Function, Functional Outcomes.

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INTRODUCTION

Cerebral Palsy (CP) presents significant challenges in motor function and daily living for affected children [1]. Early intervention strategies play an important role in lowering the impact of CP and enhancing long-term functional outcomes. Our prospective cohort study aims to investigate the effectiveness of early interventions in children diagnosed with CP, focusing on their functional abilities and quality of life over time [2]. CP, a heterogeneous group of permanent disorders affecting movement and posture, often manifests in infancy or early childhood. Despite its non-progressive nature, CP requires comprehensive and tailored interventions to address motor impairments and associated comorbidities effectively. Timely therapeutic interventions, such as physical therapy, occupational therapy, and assistive technology, aim to optimize developmental trajectories and minimize secondary complications [3].

Understanding the relationship between early interventions and long-term functional outcomes is crucial for optimizing treatment protocols and improving the overall well-being of children with CP. Our study aims to contribute valuable insights to inform clinical practice and enhance the quality of care for this population [4, 5].

METHODOLOGY

A prospective cohort design was employed to investigate the impact of early intervention strategies on the long-term functional outcomes of children diagnosed with Cerebral Palsy (CP). The study involved a sample of 50 children diagnosed with CP, aged between 1 and 6 years, from pediatric clinics, by using purposive sampling technique. Recruitment occurred over a period of three months, with eligibility criteria including a confirmed diagnosis of CP.

Following inclusion, baseline assessments were conducted to characterize the patients' demographic information, CP subtype, severity, and functional status using standardized assessment tools such as the Gross Motor Function Classification System (GMFCS) and Pediatric Evaluation of Disability Inventory (PEDI). Subsequently, patients were enrolled in a comprehensive early intervention program tailored to their specific needs, including physical therapy, occupational therapy, speech therapy, and assistive technology interventions. The duration of the intervention program spanned one year, with regular sessions scheduled based on individualized treatment plans.

Throughout the study period, patients' progress was monitored through regular follow-up assessments conducted every three months, comprising standardized measures of motor function, activities of daily living, and quality of life. Additionally, provided subjective feedback on the perceived effectiveness of the intervention program and any observed changes in their child's functional abilities.

Data analysis was conducted using appropriate statistical methods to examine the association between early intervention strategies and long-term functional outcomes in children with CP, considering factors such as age, CP subtype, and baseline functional status.

RESULTS

Table 1: Demographic Characteristics

Characteristic	Frequency (%)
Gender (Male/Female)	60/40
Age (years)	4.5 ± 1.2
CP Subtype	
- Spastic	70
- Dyskinetic	15
- Ataxic	10
- Mixed	5

Among children diagnosed with cerebral palsy, spastic subtype is the most prevalent, accounting for 70% of cases, while dyskinetic subtype constitutes 15% of cases.

Table 2: Baseline Functional Status of Patients

Assessment Tool	Mean ± SD/Percentage (%)
Gross Motor Function Classification System (GMFCS)	
- Level I (Walks without Limitations)	20
- Level II (Walks with Limitations)	30
- Level III (Walks Using a Hand-Held Mobility Device)	25
- Level IV (Self-Mobility with Limitations)	15
- Level V (Transported in a Manual Wheelchair)	10
Pediatric Evaluation of Disability Inventory (PEDI)	
- Self-Care Domain	65 ± 10
- Mobility Domain	55 ± 12
- Social Function Domain	70 ± 8

In the Gross Motor Function Classification System (GMFCS), the distribution of children with cerebral palsy varies across levels, with 20% classified at Level I (able to walk without limitations), 30% at Level II (walking with limitations), 25% at Level III (using a hand-held mobility device for walking), 15% at Level IV (experiencing self-mobility limitations), and 10% at Level V (relying on manual wheelchair transportation). Additionally, the Pediatric Evaluation of Disability Inventory (PEDI) assesses functional abilities across domains, with children demonstrating an average score of 65 ± 10 in the self-care domain, 55 ± 12 in the mobility domain, and 70 ± 8 in the social function domain. These metrics offer insights into the range and severity of functional impairments experienced by children with cerebral palsy, guiding interventions and support strategies tailored to their specific needs.

Table 3: Longitudinal Changes in Motor Function (GMFM-88 Scores)

Time Point (Months)	Mean ± SD
Baseline	55 ± 10
3	60 ± 12
6	65 ± 15
9	70 ± 18
12	75 ± 20

Over the course of a year-long study, children with cerebral palsy showed improvement in functional abilities as indicated by increasing mean scores from baseline (55 ± 10) to 12 months (75 ± 20). The progression demonstrates a positive trend in functional outcomes over time, with notable variability reflected in the standard deviations across different time points.

Table 4: Caregivers Perceptions of Intervention Effectiveness

Time Point (Months)	Percentage (%) Reporting Improvement
3	80
6	85
9	90
12	95

The percentage of children with cerebral palsy reporting improvement in functional abilities consistently increased over the course of the study, from 80% at 3 months to 95% at 12 months. This trend suggests a favorable response to interventions or therapies implemented during the study period, with a higher proportion of patients experiencing positive changes in their functional outcomes as time progressed.

DISCUSSION

The findings of this study focus light on the critical role of early intervention strategies in improving long-term functional outcomes for children diagnosed with Cerebral Palsy (CP). Our results suggest that a tailored intervention program, initiated early in development and sustained over a one-

year period, can lead to significant improvements in motor function, activities of daily living, and caregiver-reported outcomes [6].

One of the key observations from our study is the heterogeneity of CP subtypes and the varying degrees of functional impairment among patients. This underscores the importance of individualized interventions that address the specific needs and challenges associated with each subtype. Our findings align with previous research highlighting the effectiveness of early interventions in optimizing motor function and minimizing the impact of CP-related disabilities [7].

The baseline functional assessments revealed a wide range of functional abilities among patients, reflecting the diverse nature of CP presentations. Despite this variability, our intervention program demonstrated consistent improvements across all levels of functional impairment, as evidenced by longitudinal changes in motor function scores (GMFM-88). This suggests that early intervention efforts can have a positive impact across the spectrum of CP severity, from mild to severe functional limitations [8].

The significant improvements observed in motor function over the course of the intervention period are particularly encouraging. Previous studies have emphasized the importance of targeting motor impairments early in development to promote optimal motor skill acquisition and prevent secondary complications such as contractures and deformities [9]. Our findings support these assertions, suggesting that early and sustained intervention efforts can lead to meaningful gains in motor function, ultimately enhancing the overall quality of life for children with CP [10].

Furthermore, the positive perceptions of intervention effectiveness provide additional support for the value of early intervention programs in addressing the complex needs of children with CP. Caregivers play a crucial role in supporting their child's development and facilitating access to necessary interventions and services. The high levels of satisfaction reported by caregivers in our study underscore the importance of a family-centered approach to care, which emphasizes collaboration between healthcare providers and families in decision-making and goal-setting processes [11].

While our findings highlight the potential benefits of early intervention strategies, several limitations should be considered. Relatively small sample size of our study may limit the generalizability of our findings to broader populations of children with CP. Future research with larger, more diverse samples is needed to confirm and extend our findings. Additionally, the one-year duration of our intervention program may not capture the full extent of long-term outcomes beyond the study period.

Another important consideration is the potential influence of confounding variables, such as concurrent therapies or environmental factors, on study outcomes. While efforts were made to standardize the intervention protocol and minimize extraneous influences, future research should explore the impact of specific intervention components and dosage on treatment outcomes.

CONCLUSION

In conclusion, our study provides valuable insights into the effectiveness of early intervention strategies in improving long-term functional outcomes for children with CP. By targeting motor impairments early in development and employing a multidisciplinary approach to care, we can enhance the overall quality of life for children with CP and empower them to reach their full potential.

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