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Original Research Article

Clinical Profile of Patients with Cerebral Palsy

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Abstract

Background: Cerebral palsy (CP) is one of the most common causes of chronic childhood disability and results from non-progressive injury to the developing brain. It is frequently associated with multiple neurological, developmental, nutritional, and musculoskeletal comorbidities that significantly affect functional outcome and quality of life. Identification of etiological factors and associated disabilities is essential for early intervention and rehabilitation planning.

Aim: To comprehensively investigate the clinical profile, etiological factors, and associated disabilities in children with cerebral palsy.

Materials and Methods: This cross-sectional observational study was conducted from January 2023 to December 2023 among children with cerebral palsy attending physiotherapy clinics, rehabilitation centers, and the Departments of Pediatrics and Neurology at Sardar Vallabhbhai Patel Institute of Medical Sciences and Research and SCL Hospital, Ahmedabad. A total of 90 children aged 1–12 years diagnosed with cerebral palsy were included using consecutive sampling. Detailed demographic, antenatal, intranatal, postnatal, developmental, and clinical information was collected using a predesigned proforma after obtaining informed consent from caregivers. Clinical classification of cerebral palsy, Gross Motor Function Classification System (GMFCS) grading, associated disabilities, comorbidities, nutritional assessment, and treatment details were evaluated. Data were analyzed using descriptive statistical methods.

Results: The majority of children belonged to the age group of 2–5 years, with a mean age at diagnosis of 4.21 ± 2.58 years. Male predominance was observed (64.4%). Spastic cerebral palsy was the most common subtype (76.7%), with quadriplegia (30%) and diplegia (28.9%) being the predominant forms. Delayed cry at birth (58.9%), low birth weight (40%), prematurity (32.2%), and severe birth asphyxia (40%) were the major etiological factors. NICU admission was required in 83.3% of children. Most children belonged to GMFCS Levels 3 and 4, indicating moderate to severe functional disability. Epilepsy was the most common associated disability (50%), followed by contractures (30%), feeding difficulties (25.6%), and severe acute malnutrition (25.6%). Physiotherapy was being received by 86.7% of children, while 61.1% were on antiepileptic medications.

Conclusion: Spastic cerebral palsy was the predominant subtype among affected children, and perinatal factors such as birth asphyxia, prematurity, and low birth weight were major etiological contributors. A high prevalence of associated disabilities and nutritional problems was observed. Early identification, multidisciplinary rehabilitation, nutritional support, and improved antenatal and neonatal healthcare services are essential to reduce disease burden and improve functional outcomes in children with cerebral palsy.

Keywords: Birth asphyxia; Cerebral palsy; Comorbidities; Developmental delay; Epilepsy; GMFCS; Low birth weight; Prematurity; Rehabilitation; Spastic cerebral palsy.

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Introduction

Cerebral palsy (CP) is the most common cause of chronic motor disability in children and is defined as a group of permanent disorders affecting the development of movement and posture, causing activity limitation, which are attributed to non-progressive disturbances occurring in the developing fetal or infant brain [1]. The motor disorders of cerebral palsy are often accompanied

by disturbances of sensation, cognition, communication, perception, behavior, epilepsy, and secondary musculoskeletal problems [2]. CP remains an important neurological and rehabilitative challenge because of its lifelong impact on physical functioning, education, social integration, and quality of life. Globally, the prevalence of cerebral palsy is estimated to range between 2 and 3 per 1000 live births, although rates vary across countries depending on neonatal survival and quality of perinatal healthcare services [3]. Improvements in neonatal intensive care have increased survival of preterm and low birth weight infants, but have also contributed to increased survival of infants at high risk for neurodevelopmental impairment [4]. In developing countries such as India, inadequate antenatal care, birth asphyxia, neonatal infections, prematurity, and delayed neonatal interventions continue to contribute significantly to the burden of cerebral palsy [5].

Cerebral palsy is classified on the basis of the predominant neuromuscular abnormality into spastic, dyskinetic, ataxic, hypotonic, and mixed forms. Spastic cerebral palsy is the most common subtype and accounts for nearly 70–80% of all cases [6]. In the present study, spastic CP constituted 76.7% of the cases, with quadriplegia and diplegia being the most common subtypes. Similar findings have been reported by Singhi et al. and Serdaroglu et al., who observed predominance of spastic CP in their study populations [4,7].

The etiological spectrum of cerebral palsy is multifactorial and includes antenatal, intranatal, and postnatal risk factors. Antenatal factors such as maternal infections, pregnancy-induced hypertension, drug exposure, multiple gestation, and family history of neurological disorders may predispose to cerebral palsy [8]. Intranatal risk factors including birth asphyxia, delayed cry at birth, prematurity, low birth weight, and difficult labor are strongly associated with CP development [5]. In the present study, delayed cry at birth was observed in 58.9% of cases, while low birth weight and prematurity were seen in 40% and 32.2% of children respectively.

Postnatal complications such as neonatal seizures, meningitis, encephalitis, sepsis, hypoglycemia, hyperbilirubinemia, and hypoxic ischemic encephalopathy also contribute significantly to neurological injury leading to cerebral palsy [9]. In this study, NICU admission was required in 83.3% of children, with severe birth asphyxia being the most common indication. These findings emphasize the importance of effective neonatal resuscitation and early intensive care services.

Children with cerebral palsy commonly suffer from multiple associated disabilities and comorbidities including epilepsy, speech problems, hearing impairment, visual deficits, feeding difficulty, contractures, scoliosis, malnutrition, and behavioral problems [10]. In the present study, epilepsy was observed in 50% of children, while feeding difficulty and contractures were present in 25.6% and 30% of cases respectively. Nutritional impairment was also highly prevalent, with severe acute malnutrition observed in 25.6% of children. Such comorbidities significantly affect rehabilitation outcomes and functional independence.

Assessment of functional disability using tools such as the Gross Motor Function Classification System (GMFCS) helps in determining disease severity and rehabilitation requirements. In the present study, the majority of children belonged to GMFCS Levels 3 and 4, indicating moderate to severe motor impairment. Early diagnosis and multidisciplinary intervention including physiotherapy, nutritional rehabilitation, speech therapy, and caregiver support are therefore essential for improving long-term outcomes in children with cerebral palsy.

The present study was conducted to comprehensively evaluate the clinical profile, etiological factors, and associated disabilities among children with cerebral palsy attending tertiary care hospitals, physiotherapy clinics, and rehabilitation centers. The primary objectives of the study were to assess the demographic and clinical characteristics of children with cerebral palsy, identify important antenatal, intranatal, and postnatal etiological factors associated with cerebral palsy, and determine the prevalence of associated disabilities and comorbidities such as epilepsy, speech impairment, hearing impairment, visual deficits, feeding difficulties, contractures, malnutrition, and behavioral problems. The study also aimed to classify cerebral palsy according to type, topographical involvement, and Gross Motor Function Classification System (GMFCS) level in order to assess the spectrum of functional disability. The justification for conducting this study lies in the fact that cerebral palsy remains one of the leading causes of chronic childhood disability in developing countries like India, where preventable perinatal and neonatal risk factors such as birth asphyxia, prematurity, low birth weight, neonatal infections, and inadequate maternal healthcare continue to contribute significantly to disease burden. Early recognition of risk factors and associated disabilities is essential for timely intervention, rehabilitation, and prevention of long-term complications. Furthermore, limited regional data are available regarding the clinical spectrum and associated comorbidities of cerebral palsy in Gujarat, emphasizing the need for local epidemiological evidence. The future outcomes of

this study may help improve early diagnosis and referral systems, strengthen antenatal and neonatal care practices, promote multidisciplinary rehabilitation strategies, guide healthcare planning for children with special needs, and provide baseline data for future large-scale studies aimed at improving the quality of life and functional outcomes of children with cerebral palsy.

Materials and Methodology

The present study was conducted as a cross-sectional observational study in the Department of Pediatrics, Neurology, physiotherapy clinics, and rehabilitation centers associated with Sardar Vallabhbhai Patel Institute of Medical Sciences and Research and SCL Hospital, Ahmedabad. The study was carried out over a period of 12 months from January 2023 to December 2023.

The study population consisted of children diagnosed with cerebral palsy attending the pediatric neurology outpatient department, physiotherapy clinics, rehabilitation centers, and inpatient services during the study period. Consecutive sampling technique was used, and all eligible children presenting during the study duration were included in the study. A total of 90 children with cerebral palsy were enrolled after obtaining informed written consent from parents or caregivers.

Children aged 1 to 12 years with a confirmed clinical diagnosis of cerebral palsy and whose parents or caregivers consented to participate in the study were included. Children with other neurological disorders such as autism spectrum disorder, myopathy, muscular dystrophy, progressive neurological disorders, cognitive behavioral disorders, psychiatric illness, and non-central causes of motor deficits were excluded from the study.

After obtaining informed consent, detailed data were collected from parents or caregivers using a predesigned and pretested proforma. Demographic details including age, sex, socioeconomic status, parental education, and occupation were recorded. Socioeconomic status was classified according to the Modified Kuppuswamy Classification. Educational status of parents was categorized according to the Indian education system.

Detailed antenatal, intranatal, and postnatal histories were obtained to identify etiological and risk factors associated with cerebral palsy. Antenatal history included maternal complications, drug exposure, antenatal visits, infections, and family history of neurological disorders. Intranatal history included place and mode of delivery, delayed cry at birth, prematurity, birth weight, and twin delivery. Postnatal history included neonatal intensive care unit (NICU) admission, birth asphyxia, hypoglycemia, sepsis, meningitis, neonatal jaundice, respiratory distress syndrome, and other neonatal complications.

Comprehensive clinical evaluation of each child was performed. Anthropometric measurements including weight, height, body mass index (BMI), and head circumference were measured using standard methods by the primary investigator. Nutritional assessment was carried out using Z-scores for children less than 5 years and BMI classification for children above 5 years of age. Nutritional status was categorized into normal nutrition, undernutrition, moderate acute malnutrition (MAM), and severe acute malnutrition (SAM).

Detailed developmental assessment was performed in all children including gross motor, fine motor, language, and personal-social developmental milestones. Developmental delay and developmental age were assessed clinically by the investigator. Cerebral palsy was classified according to the predominant neurological type into spastic, dyskinetic, ataxic, hypotonic, and mixed types. Spastic cerebral palsy was further subclassified into diplegic, hemiplegic, and quadriplegic forms based on anatomical involvement.

Functional disability was assessed using the Gross Motor Function Classification System (GMFCS). The diagnosis of cerebral palsy was based on the presence of non-progressive motor impairment originating during fetal life or early infancy along with abnormal neurological examination findings and developmental delay.

Associated disabilities and comorbidities including epilepsy, speech impairment, hearing impairment, visual impairment, feeding difficulties, behavioral problems, contractures, scoliosis, hip subluxation, anemia, and malnutrition were also evaluated. Treatment details including physiotherapy, occupational therapy, antiepileptic medications, and other supportive therapies were recorded.

All collected data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were represented as frequency and percentage. The results were presented in the form of tables, charts, and graphs for interpretation and comparison with previously published studies.

Results

A total of 90 children with cerebral palsy aged between 1 and 12 years were included in the present study. The majority of children were diagnosed between 2–5 years of age (57.8%), with a mean age at diagnosis of 4.21 ± 2.58 years. Male predominance was observed, accounting for 64.4%

of the study population. Most children belonged to the lower middle socioeconomic class (51.1%), and a considerable proportion of mothers had only primary education. Among the etiological factors, delayed cry at birth was the most common intranatal risk factor and was present in 58.9% of children. Low birth weight was observed in 40% of cases, while prematurity was present in 32.2%. NICU admission was required in 83.3% of children, and severe birth asphyxia was noted in 40% of cases. Ventilatory support or CPAP requirement was observed in 71.1% of neonates, indicating significant neonatal morbidity. Spastic cerebral palsy was the predominant subtype and accounted for 76.7% of all cases. Among the spastic forms, quadriplegia (30%) and diplegia (28.9%) were the most common patterns of involvement. Most children belonged to GMFCS Level 3 (43.3%) and Level 4 (35.6%), indicating moderate to severe motor disability and functional limitation.

Associated disabilities and comorbidities were highly prevalent. Epilepsy was the most common associated disability and was observed in 50% of children. Contractures were present in 30% of cases, while feeding difficulties and severe acute malnutrition were each observed in 25.6% of children. Speech problems, hearing impairment, visual impairment, scoliosis, hip subluxation, anemia, and bed sores were also identified in varying proportions.

Nutritional assessment revealed a high burden of undernutrition, with severe acute malnutrition observed in 25.6% of children and only 21.1% having normal nutritional status. Physiotherapy services were being utilized by 86.7% of children, and 61.1% were receiving antiepileptic medications as part of long-term management. Overall, the study demonstrated that spastic cerebral palsy was the most common subtype, and preventable perinatal and neonatal factors such as birth asphyxia, prematurity, and low birth weight were major contributors. A high prevalence of associated disabilities, nutritional impairment, and functional limitation was observed, emphasizing the need for early diagnosis, multidisciplinary rehabilitation, nutritional support, and strengthening of maternal and neonatal healthcare services.

Table 1: Socio-demographic Profile of Children with Cerebral Palsy

Variable	Frequency (n=90)	Percentage (%)
Age at Diagnosis		
<2 years	13	14.4
2–5 years	52	57.8
5–10 years	22	24.4
>10 years	3	3.3
Mean age at diagnosis	4.21 ± 2.58 years	—
Gender		
Male	58	64.4
Female	32	35.6
Socioeconomic Class		
Lower	6	6.7
Lower middle	46	51.1
Upper lower	10	11.1
Upper middle	28	31.1
Mother's Education		
Illiterate	19	21.1
Primary	48	53.3
Secondary	20	22.2
Graduate	3	3.3
Father's Education		
Illiterate	5	5.6
Primary	16	17.8
Secondary	35	38.9
Graduate	31	34.4
Postgraduate	3	3.3

Table 2: Etiological and Perinatal Factors in Children with Cerebral Palsy

Variable	Frequency (n=90)	Percentage (%)
Antenatal Factors		
Antenatal complications	19	21.1
Drug exposure during pregnancy	6	6.7
Inadequate antenatal visits	17	18.9
Family history of neurological disorder	15	16.7
Intranatal Factors		
Normal vaginal delivery	47	52.2
LSCS	43	47.8
Delayed cry at birth	53	58.9
Preterm birth	19	21.1
Extremely preterm	10	11.1
Low birth weight	36	40.0
Twin delivery	10	11.1
Postnatal Factors		
NICU admission required	75	83.3
Severe birth asphyxia	36	40.0
Hypoglycemic seizures	13	14.4
LBW with prematurity	10	11.1
Meconium aspiration syndrome	8	8.9
RDS	5	5.6
Ventilation/CPAP required	64	71.1

Table 3: Clinical Profile and Associated Disabilities in Children with Cerebral Palsy

Variable	Frequency (n=90)	Percentage (%)
Type of Cerebral Palsy		
Spastic CP	69	76.7
├ Diplegia	26	28.9
├ Hemiplegia	16	17.8
├ Quadriplegia	27	30.0
Dystonic CP	12	13.3
Ataxic CP	9	10.0
GMFCS Classification		
Level 2	15	16.7
Level 3	39	43.3
Level 4	32	35.6
Level 5	4	4.4
Associated Problems		
Epilepsy	45	50.0
Primary movement difficulty	31	34.4
Speech problem	7	7.8
Hearing impairment	3	3.3
Visual impairment	3	3.3
Behavioural problem	1	1.1
Associated Comorbidities		
Contracture	27	30.0
Feeding difficulty	23	25.6
Severe acute malnutrition	23	25.6
Anaemia	7	7.8
Bed sore	3	3.3
Scoliosis	3	3.3
Hip subluxation	2	2.2

Table 4: Treatment and Rehabilitation Profile of Children with Cerebral Palsy

Variable	Frequency (n=90)	Percentage (%)
Physiotherapy given	78	86.7
Physiotherapy not given	12	13.3
On antiepileptic drugs (AEDs)	55	61.1
Not on AEDs	35	38.9
Normal nutritional status	19	21.1
Undernourished	28	31.1
Moderate acute malnutrition	7	7.8
Severe acute malnutrition	23	25.6

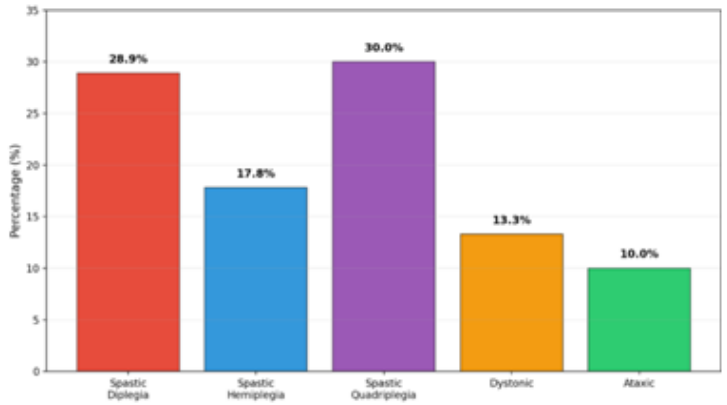

Figure 1: Distribution of Types of Cerebral Palsy

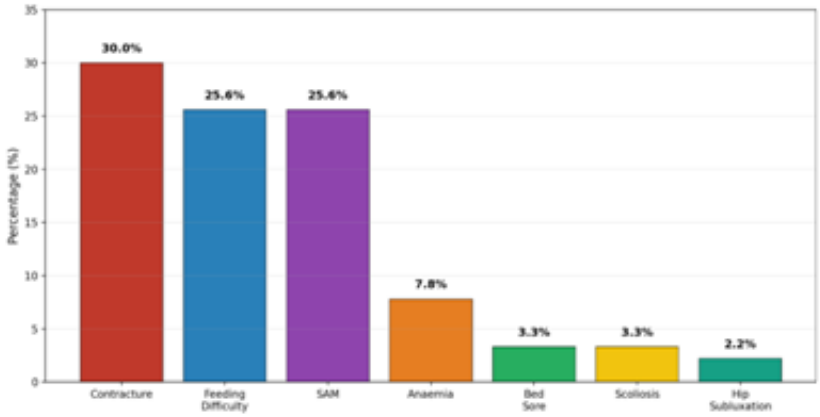

Figure 2: Major Associated Comorbidities in Cerebral Palsy

Discussion

Age at Diagnosis: In the present study, the majority of children with cerebral palsy were diagnosed between 2–5 years of age (57.8%), with a mean age at diagnosis of 4.21 ± 2.58 years. Similar findings were reported by Kumar et al., where 44% of children were diagnosed between 2–5 years of age [11]. Singhi et al. reported earlier diagnosis in a large proportion of children, with 50.2% diagnosed before 2 years of age, reflecting improved awareness and early neurological screening [4].

Soumya et al. observed a mean age at diagnosis of 5.8 years, which was slightly higher than the present study [12]. Delayed diagnosis in developing regions may be related to poor awareness regarding developmental milestones and delayed referral to rehabilitation services.

Gender Distribution: Male predominance was observed in the present study, with males constituting 64.4% of the cases and females 35.6%. Similar male predominance was reported by Singhi et al. (67.5%) [4], Soumya et al. (64.4%) [12], and Kumar et al. (78%) [11]. Serdaroglu et al. also observed a higher prevalence among males in their Turkish population study [7]. This gender difference may be related to increased biological vulnerability of male infants to hypoxic and perinatal brain injury.

Socioeconomic Status: In the present study, the majority of children belonged to the lower middle socioeconomic class (51.1%). Das et al. reported

that 56% of children with cerebral palsy belonged to lower socioeconomic groups [13].

Gowda et al. similarly observed higher prevalence among economically disadvantaged families [5]. Lower socioeconomic status may contribute to poor antenatal care, nutritional deficiencies, delayed diagnosis, and inadequate access to rehabilitation services.

Antenatal Risk Factors: Antenatal complications were present in 21.1% of children in the present study, while inadequate antenatal visits were reported in 18.9% cases. Singhi et al. reported antenatal complications in 25% of cases [4], while Soumya et al. observed similar findings in 26% of children [12]. Family history of neurological disorders was noted in 16.7% of cases in this study compared with 18% reported by Soumya et al. [12]. These findings emphasize the role of antenatal surveillance and maternal healthcare in reducing neurological complications.

Intranatal Risk Factors: Delayed cry at birth was observed in 58.9% of children in the present study. Similar findings were reported by Singhi et al. (49.2%) [4] and Soumya et al. (44%) [12]. Low birth weight was seen in 40% of children in this study, compared with 20.4% in Singhi et al. [4], 22% in Soumya et al. [12], and 36% in Das et al. [13]. Prematurity was observed in 32.2% of cases in the present study, which was higher than findings reported by Gowda et al. (15%) [5] and Sharma et al. (25.4%) [14]. These findings suggest that perinatal hypoxia, prematurity, and low birth weight remain important preventable causes of cerebral palsy in developing countries.

Postnatal Risk Factors and NICU Admission: NICU admission was required in 83.3% of children in the present study, with severe birth asphyxia being the leading indication (40%). Soumya et al. reported NICU admission in 55.5% of children [12]. Birth asphyxia was reported in 45.3% of cases by Singhi et al. [4] and 78% by Kumar et al. [11]. Malnutrition was observed in 45.6% of cases in Singhi et al. [4] and 47% in Gowda et al. [5], which is comparable to the high nutritional burden observed in the present study. These findings highlight the importance of neonatal resuscitation, intensive neonatal monitoring, and nutritional rehabilitation.

Nutritional Status: Severe acute malnutrition (SAM) was observed in 25.6% of children in the present study, while only 21.1% demonstrated normal growth. Singhi et al. reported malnutrition in 50.6% of children with cerebral palsy [4], while Gowda et al. observed malnutrition in 47% of cases [5]. Feeding difficulties, swallowing dysfunction, and recurrent infections may contribute significantly to undernutrition in CP children.

Types of Cerebral Palsy: Spastic cerebral palsy was the most common subtype in the present study, accounting for 76.7% of cases. Quadriplegia (30%) and diplegia (28.9%) were the predominant spastic forms. Similar predominance of spastic CP was reported by Serdaroglu et al. (83%) [7], SCPE study (85.7%) [15], Sharma et al. (77.9%) [14], and Das et al. (80%) [13].

Hemiplegia constituted 17.8% in the present study compared to 33% reported by Serdaroglu et al. [7]. The higher proportion of quadriplegic CP in Indian studies may be due to severe birth asphyxia and inadequate neonatal intensive care facilities.

GMFCS Classification: Most children in the present study belonged to GMFCS Level 3 (43.3%) and Level 4 (35.6%), indicating moderate to severe functional disability. Das et al. reported that 74% of children belonged to Levels 3 and 4 [13], while Gupta et al. observed 60% of children within these levels [16]. These findings indicate a substantial burden of functional limitation requiring long-term physiotherapy and rehabilitation.

Associated Disabilities and Comorbidities: Epilepsy was the most common associated disability in the present study, affecting 50% of children. Contractures were present in 30%, feeding difficulties in 25.6%, and severe acute malnutrition in 25.6% of cases. Similar findings were reported by Odding et al., who emphasized epilepsy and musculoskeletal deformities as major comorbidities associated with CP [10].

Singhi et al. also reported high prevalence of feeding difficulties and malnutrition [4]. These associated disabilities significantly increase caregiver burden and negatively affect quality of life.

Physiotherapy and Antiepileptic Drug Use: In the present study, 86.7% of children were receiving physiotherapy, while 61.1% were on antiepileptic drugs. Early physiotherapy intervention is essential for improving mobility, posture, and prevention of deformities. Previous studies by Gowda et al. [5] and Sharma et al. [14] also emphasized the importance of multidisciplinary rehabilitation and seizure control in improving functional outcomes and reducing disability progression.

Conclusion

The present cross-sectional observational study demonstrated that cerebral palsy predominantly affected male children and was most commonly diagnosed between 2–5 years of age. Spastic cerebral palsy was the most frequent subtype, with quadriplegic and diplegic forms accounting for the majority of cases. Perinatal and neonatal factors such as delayed cry at birth, low birth weight, prematurity, severe birth asphyxia, and NICU

admission emerged as important etiological contributors.

A high prevalence of associated disabilities and comorbidities including epilepsy, contractures, feeding difficulties, malnutrition, speech impairment, and functional limitation was observed among affected children. Most children belonged to moderate to severe GMFCS levels, indicating substantial long-term disability requiring continuous rehabilitation. The study highlights the significant burden of preventable perinatal factors and associated disabilities among children with cerebral palsy and emphasizes the need for early diagnosis, multidisciplinary rehabilitation, nutritional support, physiotherapy, and comprehensive long-term care to improve functional outcomes and quality of life.

Limitations: The present study had certain limitations. It was conducted at a single tertiary care center and rehabilitation setup, which may limit generalizability of the findings to the wider population. The cross-sectional design restricted long-term follow-up and assessment of progression of disabilities and rehabilitation outcomes. The sample size was relatively small, which may have limited subgroup analysis of different cerebral palsy types and associated comorbidities. Some historical details regarding antenatal and perinatal events depended on parental recall and may therefore be subject to recall bias. Advanced neuroimaging, genetic evaluation, and standardized neuropsychological assessments were not uniformly available for all children.

Recommendations

Early identification of developmental delay and high-risk neonates should be strengthened through routine developmental screening and improved neonatal follow-up services. Antenatal, intranatal, and neonatal healthcare services should be improved to reduce preventable causes such as birth asphyxia, prematurity, and neonatal infections. Multidisciplinary rehabilitation including physiotherapy, occupational therapy, speech therapy, nutritional rehabilitation, and psychological counseling should be initiated at the earliest possible stage for children with cerebral palsy. Community awareness programs should be conducted to improve early healthcare-seeking behavior and reduce delayed diagnosis. Large multicentric longitudinal studies with long-term follow-up are recommended to better understand functional outcomes, quality of life, and rehabilitation effectiveness in children with cerebral palsy.

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