

The Children with Cerebral Palsy: Clinical Features and Causes

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Abstract

Background: Cerebral palsy (CP) is a heterogenous permanent neurological disorder that is caused by a non-progressive damage to the developing brain. In this disorder, injury or malformation occurs in the growing central nervous system which eventually will affect the development of motor function and body posture before, during, or shortly after birth.

Objective: To estimate and highlight the status of demographic and clinical characteristics of cerebral palsy in children at Sulaymaniyah province which has significant walking disorders.

Patients and Methods: In this study (118) ambulatory patients with cerebral palsy who attended the health care and consultation clinic at Children Rehabilitation Center (CRC) in Sulaymaniyah province. The primary data were studied according to: gender distribution, patient age, types of delivery, and age of presentation of the CP disorder. Additionally, the conditions at birth such as asphyxia, kernicterus, types of cerebral palsy, full-term, and pre-term were studied. Finally, the Gross Motor Function Classification System (GMFCS) of cerebral palsied children was identified.

Results: Our data showed that females tend to be more affected by CP than males with a ratio of (65:53). The range of ages was between half a year and 12 years (mean of 7.5 years). The highest range appearance of cerebral palsy was between the ages of (12-24) months with a percentage of (58.47%). A delayed milestone was the most common presenting among CP types (41.53%). In comparison to the other CP types, the spastic type was the most common (59.32%). The most prevalent subtype of CP was the spastic hemiplegia (40%). 66.10% of patients were born with vaginal delivery. The majority of the patients were born with asphyxia (31.36%) followed by kernicterus direct antepartum. Sixty-seven (56.78%) mothers were using medications during pregnancy. Forty-eight of parents were consanguine marriage. According to the GMFCS results, most of the CP patients were in the level III and level IV with 27.12%, 25.42% respectively; the major motor disability in children with spastic hemiplegia varied from level I to III.

Conclusion: We deduced that it is difficult to estimate and clarify the exact cause and risk factors associated with the cerebral palsy disorder. However; we found spastic hemiplegia is the most common clinical pattern of CP due to its high prevalence of birth asphyxia. Using medicine during pregnancy will increase a chance of CP to occurs, for further investigation, the case-control study should be employed within the cohort study.

Keywords: Ambulatory CP Child, Delayed milestones, Convulsion, Asphyxia, Outcomes, Sulaymaniyah province.

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Introduction

It is well-known that the term “Cerebral” refers to the brain and “Palsy” means a lack of control in muscles [1]. As described by Rosenbaum : “Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior, by epilepsy, and by secondary musculoskeletal problems” [2]. These disorders are credited to non-progressive unsettling influences within the creating fetal brain, modification in fetal improvement, pathologic intrauterine forms, or considered as rashness complications [3].

Spasticity is the foremost common sort of motor disturbance; epilepsy, mental retardation, vision and hearing impairment are the most common associated problems [4]. CP is a static neurologic condition that occurs before the completion of cerebral development. Because brain development continues during the first two years of life, cerebral palsy can result from brain injury occurring during the prenatal, perinatal, or

postnatal periods [5]. The most unfavorable brain accidents that put infants born preterm at high threat for CP are excessive intra-ventricular hemorrhage (IVH) and cystic periventricular leukomalacia (c-PVL) [6]. The analysis for neurodevelopmental outcomes of infants after a severe hemorrhage or c-PVL depends on the localization and quantity of the lesion [6]. Complications like low delivery weight, asphyxia at the start, untimely separation of the placenta, and ordinary fetal position had been associated with this disease. If a mother or infant suffers from any of these associated conditions, it does not mean it will result in CP, rather it means higher prevalence of CP [7].

Congenital malformations, fetal boom limit, multiple gestations, untreated maternal hypothyroidism, perinatal stroke, and thrombophilia have been all identified as risk factors for CP [3]. Although the reasons for congenital cerebral palsy are not acknowledged within the majority of instances, there may be an evidence that elements present during the prenatal length play a distinguished function [8]. Twins also have a better frequency of malformations and CP than singletons [3]. In approximately 10

to 20 percent of patients, cerebral palsy is received postnatally particularly because of brain harm from bacterial meningitis, viral encephalitis, hyperbilirubinemia, child abuse, road traffic accident or fall from height [5]. The CP prevalence occurs in 2.5% in step with thousand live births globally, and this abnormality varies with its involvement distribution like hemiplegia, diplegia, and adjustments with age and surgery [9].

Due to the lack of specific diagnostic criteria for CP, variations in these specific incidence rates are evident. Some studies have been done to investigate all possible risk factors and report a general incidence rate for the CP. Here, we estimated the risk factors and causes of cerebral palsy in ambulatory children in order to highlight the important criteria related to the CP syndrome.

Patients and Methods

This study has been conducted on patients who were admitted to the Children Rehabilitation Center (CRC) in Sulaymaniyah province from the first of June 2016 to the end of November 2019. For gathering the medical information on the CP patients, a questionnaire was filled with the assistance of parents and the birth enlistment record division. The study was formed concerning only those children with CP who were born in the province during that period. Clinical features and incidence ratio of 118 children (65 females: 53 males) with CP were diagnosed and studied. The age range of CP patients was between (0.5 – 12) years. The consanguinity between partners and

some fundamental criteria such as gravidity, parity, and abortion were taken into account.

The gender, age of the patients, types of delivery, status at birth especially birth asphyxia and kernicterus postnatally, types of cerebral palsies with the period's appearance of the disease, prematurity, and full-term born were all reviewed and studied. Furthermore, some associated medical abnormalities like mental retardation, microcephaly head, hearing complications with impaired vision, persistent chest infections problems, and epilepsy were investigated. The intellectual ability and associated medical impairments were collected from the medical record and data registrations.

The Gross Motor Function Classification System (GMFCS) was used for classifying the functional impairment and acuteness types of CP. The “GMFCS is a five-level pattern recognition system with level I describing the best gross motor abilities possible and Level V the worst. GMFCS levels I-II descriptions refer to walking without and with limitations, whereas GMFCS levels III-V descriptions refer to walking with a mobility device through to being transported in a wheelchair” [6]. For classification of the CP types, subtypes (topographic), limb distribution, and motor impairment; we utilized the Surveillance of Cerebral Palsy in Europe [6].

Statistical analysis

Mean and percentage results, figures, and tables were obtained using Excel and MATLAB package.

Results

For clarity and simplicity purposes, we have summarized all estimated data in tables and as shown below.

Table (1): Types of cerebral palsies. The spastic type is the most common among all other types, while the Choreo-athetoid type is the least common one

Type of CP	Number of patients	Percentage (%)
Spastic	70	59.32
Ataxic	19	16.10
Hypotonic	14	11.86
Mixed	8	6.78
Chorio- athetoid	7	5.93
Total	118	100

Table (2): Topographical distribution of motor impairment of the CP patients. The hemiplegic CP is the most common and quadriplegic CP comes in the second- order then diplegic one

Spastic CP	Number of patients	Percentage (%)
Hemiplegic	28	40.00
Quadriplegia	24	34.29
Diplegic	18	22.86
Total	70	100

Table (3): Results of the CP involvement distribution according to their ages. The most period for the appearance of the CP symptoms is between 12-24 months due to the development of the brain continually

Range of age in month	Number of patients	Percentage (%)
6- 11	27	22.88
12-24	69	58.47
Greater than 24 month	22	18.46
Total	118	100

Table (4): Type of delivery of the CP patients. Though most of the CP patients were born with normal delivery, but they ended with CP symptoms that might be a result of some other conditions

Mode of birth	Number of patients	Percentage (%)
Normal delivery	78	66.10
Cesarean section	34	28.81
Forceps delivery	6	5.08
Total	118	100

Table (5): Disparities between male and female, full-term and preterm born with mothers using medicine and non-medication during the pregnancy. The affected CP females were slightly higher than in males. The full term born is about twice in comparison with preterm born. Number of mothers who were using the medicine during the pregnancy is higher than those who did not use it

	Number of patients	Percentage (%)
Female	65	55.08
Male	53	44.92
Full term	78	66
Pre term	40	34
Using medicine during pregnancy	67	56.78
Using not medicine during pregnancy	51	43.22

Table (6): Mother's complications during pregnancy and their obedience to antenatal care. The majority of mothers do not have any diseases during pregnancy. Twenty-one mothers had diabetic and thirteen mothers had preeclampsia toxemia

	Number of patients	Percentage (%)
Attend antenatal care regularly	84	71.19
Diabetic mother	21	17.80
Preeclampsia toxemia	13	11.02
Total	118	100

Table (7): Clinical features and relevant abnormalities of the CP patients. The delayed milestone is the highest rate comparing to some other associated abnormalities. The second major abnormality is the convulsion

Relevant abnormalities	Number of patients	Percentage (%)
Delayed milestones	49	41.53
Convulsion	23	19.49
Difficulty in swallowing	12	10.17
Hearing and visions problems	10	8.47
Disable to move one hand and hand preference	9	7.36
Recurrent chest infection	8	6.78
Epilepsy	7	5.93
Total	108	100

Table (8): Number of children with their percentage they had with the condition time's birth. Birth asphyxia, kernicterus, and low birth weight were the most conditions at birth respectively. About 21.19% percent of the CP patients had no condition at birth, but they ended with this symptom, those CP patients may affect prenatal or perinatal periods

Condition at birth	Number of patients	Percentage (%)
Birth asphyxia	37	31.36
No condition at birth	25	21.19
Kernicterus	21	17.80
Low birth weights	19	16.10
Microcephaly	12	10.17
Twins or Triples	4	3.39
Total	118	100

Table (9): GMFCS results of the CP children. According to the functional classification, most of the CP patients were falling in levels III, V and IV

GMFCS	Number of patients	Percentage (%)
Level I	6	5.08
Level II	17	14.41
Level III	32	27.12
Level IV	30	25.42
Level V	33	27.97
Total	118	100

Discussion

Spastic CP was the predominant type in this study. Our data showed that 60% of all patients had this type which is the same percentage reported by some previous studies [10,11]. It followed by ataxic type (16.10%). The most prevalent subtype of the spastic cerebral palsy among the children was the spastic hemiplegia (40% of seventy patients). While our data showed that the most range of age presentations of the CP is (12-24) month (58.47%), other studies showed that the highest rate of the age distribution of CP has happened in patients with age (7-12) month [10,11]. The clinical findings in some affected children appear to evolve and the affected children may exhibit some different

distributions of involvement at different ages [10].

In our study, the majority of the CP patients was delivered by a normal vaginal delivery followed by a cesarean section and forceps delivery which agrees with the results documented in some previous studies [10,11]. However; the cesarean section is well simplified for the baby from difficult labor especially for the primigravida in some women and cord contortion around the neck or hands which helps minimizing the chance for the CP occurrence. Those children suffer from brain-damage in the prenatal period or could occur intrapartum or antepartum [12]. While our results showed that there is a slight

predominance of females as shown in Table (5), other studies showed that males were the predominant [10,11]. This could be due to that some of the patients were living outside the city (rural areas) who may not be registered by CRC- Sulaymaniyah or by chance in that period the born females were more than males.

The full terms born (66%) were higher than those born with pre-terms (34%), this is the same as in other previous studies [10,11]. From all full-term born, twenty percentages of the patients had asphyxia at birth and kernicterus postnatal; this might be a reason for accruing the CP in those children. A previous study [3] confirmed that the risk factor of CP is gestational age subordinate, and it is much more predominant among preterm neonates, particularly those who were greatly untimely. The mothers were using the medicine during pregnancy higher than those who were not using it showed in Table (5). Most of the mothers were using the tonics, multi-vitamin and sometimes analgesic like Paracetamol. Few of the mothers were using Thyroxine medication and antibiotics. It seems that using the medicine during pregnancy increases the chance of CP occurrence. A study has found a link between a certain class of antibiotics and a higher incidence of cerebral palsy and epilepsy [13,14]. While the findings have led some scientists to caution against the use of certain antibiotics during pregnancy, leaving infections untreated continues to be considered a higher risk for unborn children [14].

71% of mothers have attended the consultation clinic but still had born with CP rather than normal. The reasons for this could be this: though there is advanced equipment available for the early diagnoses of the CP but those clinical consultations do not have adequate facilities for the fetal management or those CP patients may be affected during the birth or postnatally. Twenty-one (17.80%) of mothers were diabetic during pregnancy, those CP patients could be related to the congenital malformation or any relevant factor associated with the development of CP. There is a previous study that investigated the correlation between different pre-birth issues and CP pathogenesis [4]. Regarding maternal disorders during pregnancy, our study showed that mothers of 13 (11%) patients with CP had a history of preeclampsia which agrees with the study that has done in [15]. "Preeclampsia is associated with an increased risk of cerebral palsy in term infants, but this association does not seem to exist in preterm infants" [16]. "Alternatively, the presence of preeclampsia may result in elective preterm delivery, avoiding the inflammatory responses of spontaneous preterm labor with all their associated problems" [16].

The most frequently observed abnormality of the CP patients was a delayed milestone and found in forty-nine (41.53%) patients, this result agrees with studies presented in [10,11]. It is well suggested that the diagnosis of the CP is first predicted by parents. They observe some of the child motors developments especially after six

months when the child begins with crawling, rolling and sitting. Particularly among infants born prematurely, neurological abnormalities, observed in the early months of life, may not be associated with motor impairment and may resolve during the first one or two years of life [17]. In our study, perinatal asphyxia was the main perinatal etiology; thirty-seven (31.36%) patients had asphyxia during delivery. Studies have shown that birth with hypoxia has a high prevalence of subtype quadriplegia CP [18]. Other study documented that perinatal asphyxia considered to be less than 10–20% [4].

Twenty-five (21.19%) patients born without any condition but they had well cerebral palsy. A study estimated that about 80% of CP cases are of unknown etiology [19]. Among all the patients there were 3 patients who had acquired cerebral palsy, two of them were victims of accidental cars and the other fell down during the delivery. Twenty-one (17.80%) patients had jaundice directly after the delivery. When extreme jaundice goes untreated for a long time, it can cause condition of kernicterus, afterward accurses the athetoid cerebral paralysis and hearing misfortune. Kernicterus also causes issues with vision and teeth. It can cause mental incapacities as well [20]. Nineteen (16.10%) patients were born with low birth weights. Prematurity has been recognized as the main risk factor for CP [4]. Severe intraventricular hemorrhage and cystic periventricular leukomalacia put the infants born preterm and regarded as the highest

relative risk for the CP [7,21]. Twelve (10.17%) patients had microcephaly. Intrinsic microcephaly is the foremost common birth imperfection in CP as was reported in [3].

Four (3.39%) patients were twins, no cases were both twin siblings affected. Twin and triplet pregnancies are more common in In-vitro Fertilization (IVF) programs and there is a few concerns that certain methods to progress IVF results may incline the newborn child to CP and other formative disorders [22]. The mutations of twins have the next recurrence CP than singletons; moreover the in utero passing of one twin, indeed on the off chance that it happens early in incubation, takes off the surviving twin at an extraordinarily expanded chance for CP [3]. Forty-eight (40.68%) parents were consanguine marriages, which may explain a genetic affection. However, there is no evidence that the antecedence will be a risk factor for CP [23], but it is advisable to decrease consanguineous marriage [9,24].

Figure (1) shows the types of CP according to their GMFCS levels. The mild gross motor disability (levels I and II) existed in 23 (19.50%) children; hemiplegia 9 patients, diplegia 8 patients, and quadriplegia were 6 patients. Thirty-two (27.12%) patients were fallen in level III which was consisted of; 19 hemiplegias, 10 diplegia, and 3 chorio-athitoid with hypotonic. 53.4% of children with mixed type of CP, ataxic and chorio-athitoid, hypotonic type and quadriplegia were fallen in the levels IV and V. From level I to level III, the most major motor disability with spastic hemiplegia was

observed, while the severest CP group varied from levels IV to V which were the ataxic,

hypotonic and quadriplegia in a subtype of spastic cerebral palsy.

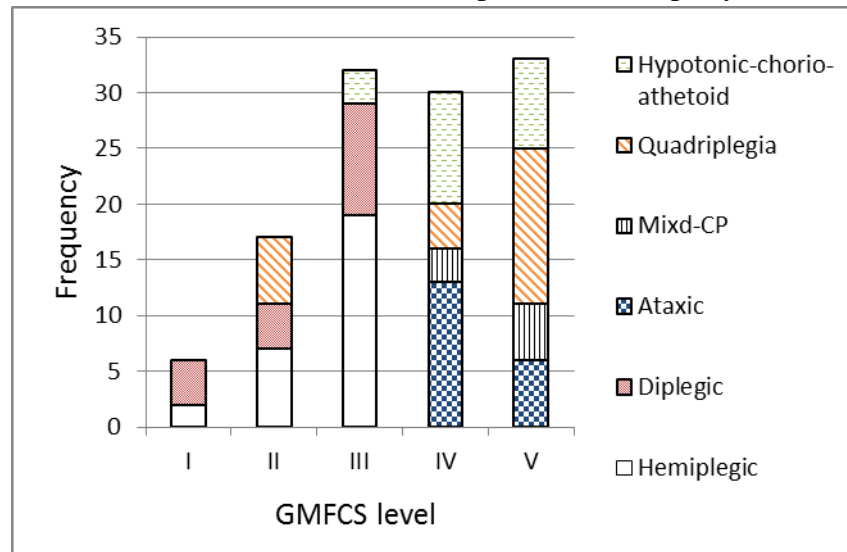


Figure (1): Types of cerebral palsy according to the GMFCS

Conclusions

The main conclusion of our study is that it is difficult to get an estimation and clarification of the exact cause and risk factors that could be associated with the cerebral palsy disorder. However; we found that spastic hemiplegia is the most common clinical pattern of CP due to its high prevalence of birth asphyxia. Using medicine during pregnancy will increase a chance of CP to occur. As a future goal, a further investigation will employ the case-control study within each cohort.

Recommendations

1-To reduce the rate of cerebral palsy, it's better to improve neonatal care units and support them with more powerful diagnostic equipment especially in the developing countries.

2-Improvements a bed for pregnant women to avoid falling down the baby during the delivery time so that the gestation not falling down on the ground.

3-We also recommend using the continuous positive airway pressure (CPAP) for each newborn to reduce the chance of hypoxic ischemic encephalopathy (HIE) and preventing the CP.

4-Establish special centers to care for those children especially those who need traditional physiotherapy, hydrotherapy, and occupational therapist. Besides this, there should be centers for those children to care for them until their parents come back from their jobs.

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