Original Investigation

Demographic and Clinical Characteristics of Patients with Cerebral Palsy

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Abstract

Objective: The purpose of this study was to identify the demographic and clinical characteristics of patients with cerebral palsy (CP) who applied to the Physical Therapy and Rehabilitation Center and to increase the awareness of physicians and therapists on this subject.

Methods: The data of 224 patients who applied for treatment between July 2015 and August 2017 were retrospectively reviewed. This data included clinical and demographic characteristics, such as age, sex, CP type, additional disorders, and treatments.

Results: A total of 204 patients were analyzed. Eighty-six of the patients were women and 118 were men. Average of age and age of diagnosis were 10, 35 years, 14.5 months. Distribution according to CP types was as follows: spastic 167 (81.8%), diplegic 50 (24.5%), tetraplegic 93 (45.6%), hemiplegic 24 (11.8%), and mixed 14 (6.9%) patients. The functional levels of the patients were first rank with 26% grade 4 according to the Gross Motor Function Classification System (GMFCS) and 27.5% grade 1 according to the Manual Ability Classification System (MACS). Of the etiologic risk factors, premature birth was the most common with 41.1% and asphyxia was the second with 25.4%. In the additional problems observed in CP, speech disorder was the most common with 57.8%, followed by mental retardation 44.6% and epilepsy 32.3%. Overall, 78.9% of the patients had previously received physiotherapy, 43.1% had used orthotics, and 30.9% had undergone musculoskeletal surgery. In total, 27.8% of the orthoses used were foot, ankle orthosis.

Conclusion: Precautions should be taken to reduce the perinatal causes, which are the most common in CP etiology, such as improvement and dissemination of neonatal care centers, close follow-up of risky babies, and early diagnosis and treatment. The majority of CP patients constitute spastic diplegic and tetraplegic types, and additional problems, such as speech impairment, mental retardation, and epilepsy are more common. This necessitates the continuation of CP treatment with a multidisciplinary approach.

Keywords: Cerebral palsy, clinic, demographic, gross motor function classification system, manual ability classification system, spastic, rehabilitation

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Introduction

Cerebral palsy (CP) is a group of movement and postural disorders caused by non-progressive permanent damage to developing brain tissue (1). CP occurs due to a permanent damage to the cerebral cortex before, during, and after delivery up to 2 years, depending on the occurrence of the risk factors in its etiology (2). Although the prevalence of CP varies in different cultures, it is reported that its prevalence ranges from 1 to 5 in every 1000 live births (3). Diagnosis is made using patient's history, physical examination, and supportive laboratory tests. Etiological risk factors causing CP are diverse, especially including prematurity, anoxia, difficult birth, and low birth weight (2). Recent changes in neonatal care in developing countries prenatal causes in CP (such as intrauterine bleeding, toxins, infections) became important. In addition, in developing countries, due to insufficient neonatal care, birth complications (difficult birth, anoxia) and neonatal problems (prematurity and low birth weight) have increased (4, 5). In fact, CP is a combination of many disorders and symptoms. In addition to movement and posture disorders, many problems such as epilepsy, mental retardation, speech and hearing impairment, skeletal deformities, swallowing and nutrition disorders, and oral and dental problems are seen in CP (6-8).

In the treatment of cerebral palsy, many branches should work together through a coordinated and multidisciplinary approach (9, 10). In addition, the inclusion of the patient and the family in treatment gives more successful results (7). Frequently, professionals from various fields such as physical therapy and rehabilitation (PTR), orthopedics, pediatric neurology, physiotherapy, and occupational therapy play an active role in the treatment. For all these reasons, physicians and therapists working on CP should very well know the clinical presentation, demographic features, etiologic risk factors, functional levels, and treatment approaches of the patients with CP.

For this purpose, we performed our study to determine the clinical and demographic characteristics of patients with CP treated in a PTR center.

Methods

Data of 224 patients admitted to the PTR center between July 2015 and August 2017 were analyzed retrospectively. From patient files and records, gender, age, complaints, history, examination and etiologic risk factors; medical, orthopedic and other treatment information; orthesis or other devices; information on additional complications and problems (speech disorder, epilepsy, hearing impairment, mental retardation, etc.); and patient's CP type (spastic diplegic, hemiplegic, tetraplegic, dyskinetic, ataxic, hypotonic, mixed) were recorded in the study protocol form. In addition, information about the family and mother's history, type of birth, duration of birth, and number of births were also recorded. Those born before 38 weeks were classified as premature, those born between 38 and 42 weeks were classified as term, and those born after 42 weeks were classified as postmature. The delivery and the week after the delivery was considered as the perinatal period, and the first month after birth was considered to be the postnatal period.

The data on patients' functional competencies, lower extremities, standing, and walking were obtained and recorded according to the gross motor function classification system (GMFCS) (11). For upper extremities and hands, recorded data were added to the study according to the manual ability classification system (MACS) (12).

The staging of rough motor function classification system was performed using the age-graded evaluation scale. In general, the GMFCS were staged as follows:

Stage 1: Independent walking; there is a limitation in advanced gross motor skills

Stage 2: Walking without an auxiliary device, but limited walking in the community
Stage 3: Walking with an auxiliary device and more limited walking in the community
Stage 4: Due to restriction, wheelchairs are used at home or in the community, or the patient is carried
Stage 5: Mobilization is very limited, despite an auxiliary device due to significant limitations; carried in arms or in a chair

The MACS were staged as follows:

Stage 1: Capable of easily and successfully holding and using objects
Stage 2: Capable of holding most objects and using them, but there is a slight decrease in the speed and/or quality of success
Stage 3: Can barely hold and use objects; needs assistance in preparing and/or changing activities
Stage 4: Capable of holding a limited number of easily used objects in adapted situations
Stage 5: Incapable of holding and using objects and having an extremely limited ability to perform even simple activities

Statistical Analysis
The study was completed with the remaining 204 patients after 20 patients with partial data had been excluded from the study. The Statistical Package for Social Sciences version 20.00 (IBM Corp.; Armonk, NY, USA) program was used to analyze the distribution of patients' GMFCS and MACS stages according to their CP type, with a descriptive statistical analysis.

Informed consent was obtained from patients aged over 18 years and from parents of those patients who were younger than 18. An approval was obtained from İstanbul University Cerrahpaşa Faculty of Medicine Ethics Committee (No: 83045809/604.01, dated 04.09.2015).

Results

Eighty-six out of 204 patients who completed the study were female (42.2%), and 118 (57.8%) were male. The average age of the patients was 10.35±8.32 years, and the average age at diagnosis was 14.5±12.6 months (Table 1). Table 2 shows the distribution of patients with CP, most of whom belong to the tetraplegic spastic type (number of patients, %) (93, 45.6%) according to the CP types. According to GMFCS, 29 of the cases were Stage 1 (14.2%), 27 were Stage 2 (13.2%), 54 were Stage 3 (26.5%), 53 were Stage 4 (26%), and 41 were Stage 5 (20.1%). According to MACS, 56 patients were Stage 1 (27.5%), 52 were Stage 2 (25.5%), 43 were Stage 3 (21.1%), 23 were Stage 4 (11.3%), and 30 were Stage 5 (14.7%) (Table 3). The GMFCS and MACS staging distributions according to the types of patients with CP are shown in Figure 1 and 2.

The distribution of the results of the etiological risk factors is shown in Figure 3: The most common factors were premature birth at 41.1% (n=84), asphyxia-difficult birth at 25.4% (n=52), idiopathic at 14.2% (n=29), and consanguineous marriage 13.7% (n=28).

When the additional problems of the patients were examined, the most common problem were speech disorders at 57.8% (n=118), mental and behavioral retardation at 44.6% (n=91), and epilepsy

Table 1. Demographic Characteristics of Patients With CP

	Male	Female	Total
Number of patients (n, %)	118 (57.8)	86 (42.2)	204
Average (age) (mean±SD) (min-max)	9.96±7.93 (1-40)	10.9±8.85 (1-41)	10.35±8.32 (1-41)
Age of diagnosis (month) (mean±SD)	14.1±12.1	14.8±13.1	14.5±12.6

CP: cerebral palsy; min, minimum; max, maximum; SD: standard deviation

Table 2. Types of Patients With CP

Cerebral Palsy Types	Number of Patients (n)	Percentage (%)
Spastic	167	81.8
• Diplegic	50	24.5
• Tetraplegic	93	45.6
• Hemiplegic	24	11.8
Dyskinetic	6	2.9
Ataxic	8	3.9
Hypotonic	9	4.4
Mixed	14	6.9
Total	204	100.0

CP: cerebral palsy

Table 3. GMFCS and MACS Staging Distribution of Patients With CP

Stage	GMFCS		MACS	
	n	%	n	%
1	29	14.2	56	27.5
2	27	13.2	52	25.5
3	54	26.5	43	21.1
4	53	26.0	23	11.3
5	41	20.1	30	14.7

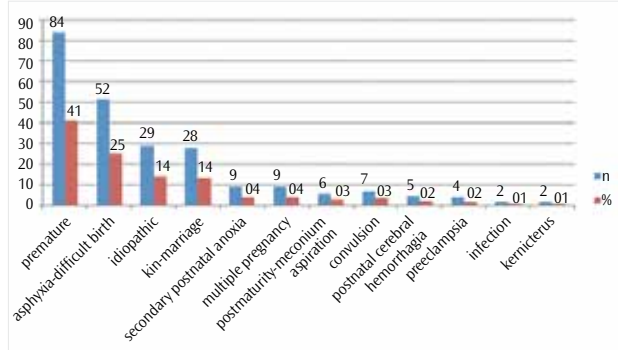CP: cerebral palsy; GMFCS: gross motor function classification system; MACS: manual ability classification system

Figure 1. Distribution of GMFCS stages according to the types of patients with CP

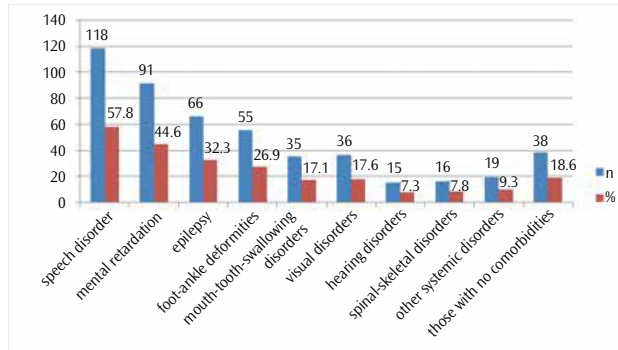CP: cerebral palsy, n: number of patients, GMFCS: gross motor function classification system
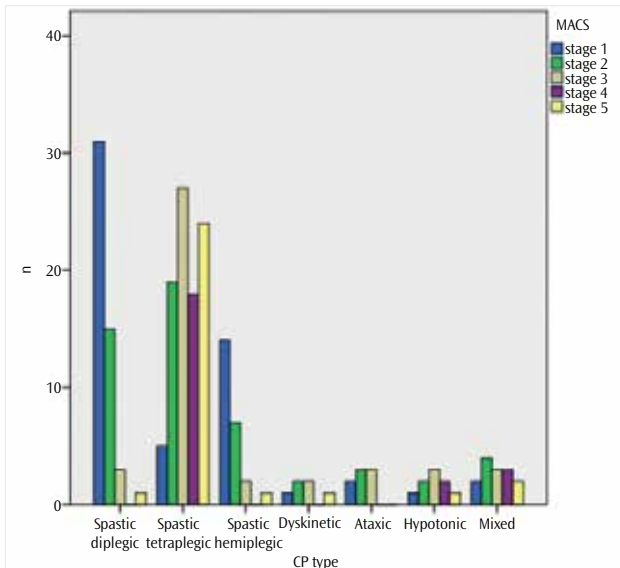

Figure 2. Distribution of MACS stages according to the types of patients with CP

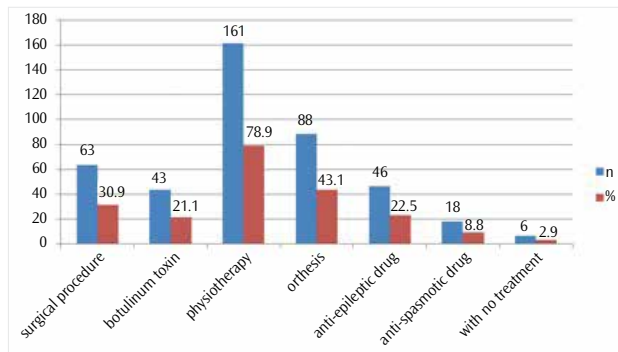CP: cerebral palsy: n: number of patients; MACS: manual ability classification system

Figure 3. Distribution of etiological risk factors in patients with CP

n: number of patients; %: percentage rate

Figure 4. Comorbid disorders of patients with CP

n: number of patients; %: percentage rate

Figure 5. Treatments received by CP patients at admission
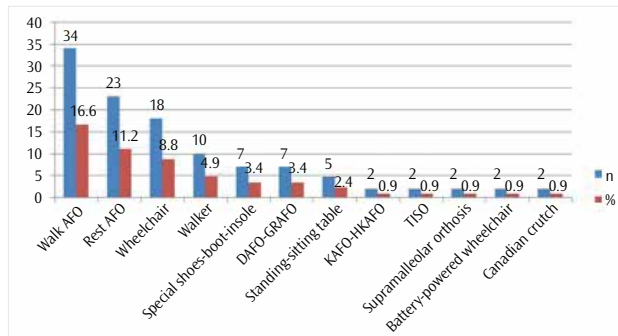
n: number of patients; %: percentage rate

Figure 6. Ortheses and devices used by CP patients

n: number of patients; %: percentage rate

at 32.3% (n=66). The distribution of the patients according to their additional diseases or disorders is shown in Figure 4. Additional problems, particularly epilepsy, were more common in tetraplegic CPs. When we look at the skeletal deformities of patients with CP, the lower extremity deformities were 19.6% (n=40), mostly foot deformities and hip dislocation. Spinal deformities were at 7.8% (n=16), and scoliosis and kyphosis were most common (Figure 4).

When we look at the treatments the patients were receiving at the admission time, physiotherapy applications were in the first place at 78.9% (n=161), the use of orthesis at 43.1% (n=88), surgical procedures (musculoskeletal system operations for CP complications) were 30.9% (n=63), botulinium toxin injection was 21.1% (n=43), anti-epileptic drug use was 22.5% (n=46), and anti-spasmotic drug use was 8.8% (n=18) (n=6) (Figure 5).

One hundred and seven of our patients did not use orthosis or auxiliary devices. In 27.8% (n=57) of the patients using auxiliary devices, the ankle-foot orthosis was the most common one, and the distribution of orthosis and the use of auxiliary devices is shown in Figure 6.

Discussion

Cerebral Palsy is the most common childhood neuromuscular disease worldwide, being an important cause of mortality and morbidity, and it also causes permanent disability (8). Therefore, it is known that early diagnosis and early initiation of rehabilitation are very important for patients with CP (13). In this respect, it is found that approximately half of the CP patients reported in the literature were diagnosed in the first 6 month and 1 year, and the other half were diagnosed later (14-16). In our study, although we have patients who had been diagnosed in the first 12-month period, the average age at diagnosis was 14 months. Late diagnosis causes the loss of benefits of neural plasticity that is provided if the treatment is initiated within the first 4 months and the loss of benefits in the myelinization development process (17).

Since the priority is to reduce the incidence of CP, it is very important to define the etiological risk factors and to take precautions in this respect. The etiologic risk factors of CP vary widely. Prenatal and perinatal causes such as prematurity, low birth weight, anoxia, asphyxia, and difficult birth are important in developing countries such as our country (18-20). In studies conducted in our country, CP risk factors are stated especially as a low birth weight (35%-45%), premature birth (25%-40%), and asphyxia-anoxia (30%-45%) (3, 6, 8, 21, 22). Doğan et al. (22) reported the most common risk factors in CP as prematurity with 40.8% and difficult birth and asphyxia with 34.7%. According to the study conducted by Demir et al. (3), asphyxia was found to be the most common factor with 39.2%, and prematurity was found to be the second most common risk factor with 25.5%. In our patients, premature birth (41%) and asphyxia-difficult birth (25.4%) were the first-ranked risk factors, and low birth weight was evaluated as premature birth. The improvement in the prevalence of CP as a result of the improvement in the intensive care conditions and the survival of preterm infants has been attributed to the insufficiency of the brain tissue perfusion and the increase of cytokine levels (23). Although the etiology of CP might be multifactorial, an important majority might be idiopathic in nature because the cause is not fully known. Aydin et al. (24) reported patients with idiopathic CP at the rate of 21.3%,

whereas Eriman et al. (8) reported it as 14.9%. In our study, this rate was found to be 14.2%.

In the etiology of cerebral palsy, consanguineous marriages are also important. Especially in populations with consanguineous marriages, the CP prevalence is higher (24, 25). In our country, while the consanguineous marriage is very common, the rates of consanguineous marriages in the etiology of CP have been reported to range between 20% and 35% (8, 21, 24, 26). In our study, this rate was determined as 13.7%. In this respect, reducing the prevalence of CP will be effective by avoiding consanguineous marriages and raising public awareness (23). As can be seen in our study, prenatal and perinatal risk factors are the most important causes of the CP etiology in our country. This shows that the frequency of CP can be reduced by measures taken during the perinatal process, such as birth follow-up, the type of delivery, and the place (hospital) and time (term) of delivery.

The most common type of cerebral palsy is the spastic type, the majority of which constitutes the spastic diplegic type (6, 27-29). Kakooza et al. (30) reported bilateral spastic type at 45%, while Abas et al. (31) reported the spastic type at 72.5%. In studies conducted in our country, the spastic type is seen approximately with the rate ranging between 75% and 90% (4, 8, 9, 22). Eriman et al. (8) reported the diplegic subgroup at 46%, and Öneş et al. (6) reported it as 34%. Diplegic CP is more common in premature infants (32), and although four extremities are affected, spasticity is significantly seen in the lower extremities. Tetraplegic spastic CP is the most severe group of patients, and spasticity is observed in all extremities, but dominantly in the upper extremities in the clinic of the patients (6). Öneş et al. (6) reported the rate of tetraplegic spastic type CP patients as 29%. Hemiplegic spastic type is seen in the average range between 10% and 20%, and especially the upper extremity and distal extremities are more affected (6, 32). Other types such as dyskinetic, ataxic, hypotonic, and mixed (dyskinetic+spastic) type CP are found in varying rates of approximately 10% and below (6, 32). In our study, the most common spastic type CP patients were the spastic type (81.8%) and as subgroups, the tetraplegic (45.6%) and diplegic (24.5%) types. In contrast to the literature, that the tetraplegic spastic type was more common compared to the diplegic type was due to the fact that the study was performed in a PTR center preferred by more severe CP patients.

When we look at the GMFCS distribution of patients according to their CP types, we see that Stages 4 and 5 are more frequent in spastic tetraplegic cases, and Stage 1 is more common in spastic hemiplegics cases. This shows that gross motor functions are severely affected in spastic tetraplegic cases and less in hemiplegic cases. In addition, as seen in the MACS classification, it was found that Stages 1 and 2 were more frequent in spastic diplegic and hemiplegic cases. This shows that fine motor skills are better in this type of CP patients with unilateral or less upper-extremity effects. In the literature, the severe effect on gross and fine motor functions has been reported as more frequent in bilateral spastic and dyskinetic type CP cases (30).

Patients with cerebral palsy might have many additional problems and pathologies besides motor function disorders. The most common are speech disorders, mental retardation, visual impairment, and epilepsy (6, 8, 20, 33). Although the frequency of these disorders in the literature varies sometimes, the rates

are approximately reported between 30% and 80% (10, 20). Kakooza et al. (30) reported mental and cognitive retardation with 75% and epilepsy with 45% as the most common morbidities. Abas et al. (31) reported the most common comorbidities as cognitive impairment and epilepsy with the rates of 77% and 38%, respectively. In our study, the most common disorders compatible with the literature were speech disorders (57.8%), mental retardation (44.6%), and epilepsy (32.3%). In addition, epilepsy and speech disorders were more prevalent in the tetraplegic and diplegic spastic type CP patients, compatible with those reported in the literature (30). Skeletal system deformities are also common in patients with CP. Spine disorders have been reported to be common, especially accompanied by foot and ankle deformities (6, 8, 22). Öneş et al. (6) reported the foot deformities at 42.4% and spine deformities at 8.8%, whereas Eriman et al. (8) found the foot deformities to be 45.5% and the spine deformities 13.8%. In our study, foot-ankle deformities were the first with 26.9% and spinal deformities (scoliosis, kyphosis) were the second most common skeletal disorders with 7.8%.

Because of these deformities, gait disturbances, and functional impairment due to motor loss in cerebral palsy patients, many patients also use auxiliary orthoses (4). Ankle and foot orthoses are most commonly used, and they have been reported in the literature to range between 35% and 47% (6, 8). In our study, with the rate of 27.8%, ankle and foot orthoses were the most commonly used orthoses. In addition, wheelchairs and walkers used by our patients were among the most commonly used auxiliary devices.

Cerebral palsy treatment is a multidimensional rehabilitation process. It includes medical agents such as botulinum toxin injections, baclofen, tizanidine, and benzodiazepine used in the treatment of physical therapy, exercises, drug therapies, surgical interventions, and spasticity (8, 9, 27). Therefore, CP treatment requires coordination of many professions. When patients with CP are referred to the PTR physicians by pediatric neurologists, the rehabilitation process starts, and orthopedic surgery can be included if necessary. In our study, 78.9% of patients had already undergone physiotherapy, 43.1% had orthosis, and 30.9% had undergone musculoskeletal surgery at the time of admission. As can be seen from these results, CP treatment is a multidimensional and a long rehabilitation process requiring a multidisciplinary approach.

Conclusion

Measures should be taken to reduce the most common perinatal causes in the etiology of CP. In this respect, newborn care centers should be improved and expanded. High-risk neonates should be followed closely, and early diagnosis should be made, and rehabilitation efforts should be initiated as soon as possible. The majority of patients with CP are spastic diplegic and tetraplegic, and among these patients, additional problems such as speech disorders, epilepsy, and skeletal deformities are more common. This necessitates a long-term and multidisciplinary approach, especially PTR applications, in the treatment of CP.

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