Neuroimaging, Etiology, Clinical Findings, and Evaluation of Associated Problems in Children with Cerebral Palsy

Neuroimagistică, Etiologie, Constatări Clinice și Evaluarea Problemelor Asociate la Copiii cu Paralizie Cerebrală

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Abstract

Introduction: Cerebral palsy (CP) is the most common cause of motor impairment in childhood. Its incidence in our country is 4.4/1000 live births. Although motor dysfunction forms the basis of the clinic in cerebral palsy, epilepsy, speech, hearing, vision, nutrition and learning disorders, and many orthopedic problems may accompany this condition. *Aim:* This study examined CP types, neuroimaging findings, etiologies, clinical findings, and nutritional status of pediatric patients with CP who applied to our hospital. *Material and methods:* The files of patients aged 1-18 years with CP who applied to Hatay Mustafa Kemal University Medical Faculty Hospital between 01/09/2019-01/09/2020 were retrospectively scanned. The etiology, clinical findings, additional problems accompanying the clinic, and brain magnetic resonance images (MRI) of the patients included in the study were evaluated. *Results:* Forty eight patients were included in the study. Of the patients with a mean age of 4.9±3.5 years, 33 (68.8%) were male. Spastic CP was present in 93.7% of the patients. Considering the subgroups of patients with spastic type CP, the most common was quadriplegic CP (42.2%). The most common etiological factor was prematurity (56.4%). When we look at the accompanying problems, malnutrition was the most common problem with (72.9%) and epilepsy with a rate of (54.2%). Then came hearing, vision, and speech problems, respectively. When the cranial MRI images of the patients were examined, periventricular leukomalacia (PVL) was the most common MRI finding, with 70.8%. *Discussion:* We found that prematurity was the most common cause in the patients with cerebral palsy we followed in our region. With the improved newborn conditions, even babies born at short weeks have the opportunity to live. *Conclusion:* Considering the imaging findings, the first rank of PVL is proportional to prematurity. PVL is a common imaging finding in premature infants.

Keywords: *cerebral palsy, etiology, nutrition problems.*

Rezumat

Introducere: Paralizia cerebrală (PC) este cea mai frecventă cauză a deficienței motorii în copilărie. Incidența sa în țara noastră este de 4,4/1000 de născuți vii. Deși disfuncția motrică formează baza clinicii în paralizia cerebrală, epilepsia, tulburările de vorbire, auz, vedere, nutriție și învățare și multe probleme ortopedice pot însoți această afecțiune. *Scop:* Acest studiu a examinat tipurile de PC, constatările neuroimagistice, etiologiile, constatările clinice și starea nutrițională a pacienților pediatrici cu PC care au fost tratați la spitalul nostru. *Material și metode:* Dosarele pacienților cu vârsta cuprinsă între 1 și 18 ani cu PC care s-au tratat la Spitalul Facultății de Medicină din cadrul Universității Mustafa Kemal din Hatay în perioada 01/09/2019-01/09/2020 au fost scanate retrospectiv. Au fost evaluate etiologia, constatările clinice, problemele suplimentare care însoțesc clinica și imaginile prin rezonanță magnetică cerebrală (RMN) ale pacienților incluși în studiu. *Rezultate:* Patruzeci și opt de pacienți au fost incluși în studiu. Dintre pacienții cu vârsta medie de 4,9±3,5 ani, 33 (68,8%) au fost bărbați. CP spastică a fost prezentă la 93,7% dintre pacienți. Luând în considerare subgrupele de pacienți cu PC de tip spastic, PC tetraplegică a fost cea mai frecventă (42,2%). Cel mai frecvent factor etiologic a fost prematuritatea (56,4%). Dacă avem în vedere problemele asociate, malnutriția a fost cea mai frecventă problemă (72,9%) și epilepsia cu o rată de 54,2%. Apoi au apărut problemele de auz, de vedere și, respectiv, de vorbire. Când au fost examinate imaginile RMN craniene ale pacienților, leucomalacia periventriculară (LPV) a fost cea mai frecventă constatare RMN, cu 70,8%. *Discuție:* Am constatat că prematuritatea a fost cea mai frecventă cauză la pacienții cu paralizie cerebrală pe care i-am urmărit în regiunea noastră. Cu condițiile îmbunătățite ale nou-născuților, chiar și bebelușii născuți în săptămâni scurte au posibilitatea de a trăi. *Concluzie:* Având în vedere rezultatele imagistice, primul rang al LPV este proporțional cu prematuritatea. LPV este o descoperire imagistică comună la copiii prematuri.

Cuvinte cheie: *paralizie cerebrală, etiologie, probleme de nutriție.*

Introduction

Cerebral palsy (CP) is a non-progressive movement and posture disorder resulting from irreversible damage to the developing brain. It is the most common cause of motor disorders in childhood [1]. While its incidence is 2.5/1000 live births globally, this rate is 4.4/1000 live births in our country [2, 3]. The etiology of CP is complex. The risk roles in etiology are 70–80 percent prenatal, 10 percent – 20 percent natal, and 10 percent postnatal, and in some situations, the etiology cannot be proven [4]. It is known that the most common causes of CP are premature birth and hypoxia. The lower the gestational age, the higher the risk. Asphyxia is the most common cause in term babies [4, 5]. The etiology of the remaining 8% of the cases is often trauma or infection [6]. It has been stated that more than one risk factor accompanies premature and low birth weight infants, and the most critical risk factor for CP is periventricular leukomalacia (PVL) and intraparenchymal hemorrhage.

Although motor dysfunction is the basis of the clinic in cerebral palsy, epilepsy, speech, hearing, vision, nutrition, learning disabilities, and many orthopedic problems may accompany this condition [7, 8]. For this reason, CP treatment should be planned with a multidisciplinary approach in which many specialists such as pediatricians, pediatric neurologists, physiotherapists, orthopedists, pediatric gastroenterologists, and language and speech therapists come together. Although the damage to the brain itself is not progressive, secondary and tertiary problems arising from the damage are essential for careful planning of the rehabilitation process. Focusing on a single point in the treatment and rehabilitation process and ignoring many other factors causes treatment failure. For this reason, it is crucial to detect and consider the presence of accompanying problems in the treatment of CP and planning the rehabilitation.

In this study, CP types, neuroimaging findings, etiologies, clinical findings, and nutritional status of pediatric patients with CP who applied to our hospital were examined, and it was aimed to determine the frequency of other accompanying conditions besides movement disorder.

Material and Method

The files of patients aged 1-18 years with CP who applied to Hatay Mustafa Kemal University Faculty of Medicine Hospital between 01/09/2019 and 01/09/2020 were retrospectively scanned. Ethics committee approval required for the study was granted by the Clinical Research Ethics Committee of Hatay Mustafa Kemal University. Patients without follow-up, applications to the health board, and those with missing information in their files were excluded from the study. The etiology, clinical findings, additional problems accompanying the clinic, and brain magnetic resonance images (MRI) of the patients included in the study were evaluated.

Cerebral Palsy Classification

CP classification was divided into three according to the localization of the lesion in the brain and the affected body parts. Spastic, dyskinetic, and ataxic subtypes were determined. Individuals with spastic type CP were also classified as unilateral and bilateral involvement [9].

Nutrition Evaluation

Bodyweight and height for age, and body weight for height ratios were calculated by measuring the height, body weight, and head circumference of the patients. Neyzi et al. malnutrition status was determined by comparing the rates calculated with the help of percentile charts [10].

Statistical Analysis

IBM SPSS 21 for Windows program was used for statistical analysis. As descriptive statistics, mean ± standard deviation was given for numerical variables, and frequency and percentage values were given for categorical variables.

Results

It was determined that 186 patients entered our hospital 338 times in 1 year. Twenty eight patients who did not come to follow-up regularly and 110 patients who entered a committee for their health report were excluded from the study. Thus, 48 patients were included in the study. While 35 (72.9%) of the patients were Turkish nationals, 13 (27.1%) patients were Syrian nationals. With a mean age of 4.9±3.5 years, 33 (68.8%) of the patients were male, and 15 (31.2%) were female. Spastic CP was present in 93.7% of the patients. When the subgroups of patients with spastic type CP were examined, it was seen that bilateral involvement was higher, and according to the topographic distribution, the majority of this was composed of quadriplegic (42.2%) individuals. When the etiological factors were examined, it was determined that the most common etiological factor was 27 (56.4%) prematurity, followed by hypoxia with a rate of 12 (25%). (Table 1)

Table 1: Demographic and clinical findings of the patients

Age (year, mean±SD)		4,9±3,5
	n	%
Sex		
Male	33	68,8
Female	15	31,2
Nationality		
Turkish	35	72,9
Syrian	13	27,1
CP type		
Spastic	45	93,7
Unilateral	13	27,1
Bilateral	32	66,6
Atetoid	3	6,3
Etiology		
Prematurity	27	56,4
Hypoxia	12	25
Hyperbilirubinemia	3	6,2
Cerebrovascular	3	6,2
Other	3	6,2

When we look at the accompanying problems, malnutrition was the first with 35 (72.9%), while epilepsy was the second most common problem with 26 (54.2%) comorbidities. Then, it was determined that hearing, visual and speech disorders were accompanied, respectively.

When the cranial MRI images of the patients were examined, it was determined that periventricular leukomalacia was the most common MRI finding, with a rate of 34 (70.8%). This was followed by hyperintensity in the basal ganglia, corpus callosum atrophy and cystic encephalomalacia (Table 2).

Table 2: Problems accompanying CP and imaging findings of the patients

Associated problems	N	%
Malnutrition	35	72,9
Epilepsy	26	54,2
Hearing disorders	5	10,5
Visual disorders	3	6,3
Speech disorders	1	2,1
MRI Finding	**n**	**%**
Periventricular leukomalacia	34	70,8
Basal ganglia hyperintensity	6	12,5
Corpus callosum atrophy	5	10,5
Cistic encephalomalacia	5	10,5

Discussion

Cerebral palsy is a condition that should be handled multidisciplinary because of various problems that occur in other systems besides movement disorder. For this reason, it is very important to determine the problems of patients with CP and to solve these problems in the treatment to ensure the success of the treatment process and to increase the quality of life of the individuals. Prematurity was in the first place in the aetiology of patients with CP that we followed in our clinic. It is known that the most common cause of CP, with an incidence of 2/1000 live births all over the world, is prematurity [11, 12]. Due to the developing prenatal, natal and postnatal care conditions, survival rates increase in babies born prematurely or with low birth weight.

It is known that the risk of CP increases, especially in those born before the 28th gestational week and/or in babies born under 1500 g [13]. A variety of risk factors contribute to the development of CP in a premature newborn after delivery. Intraventricular haemorrhage, periventricular leukomalacia, bronchopulmonary dysplasia, hyperbilirubinemia, hypocarbia, newborn sepsis, hypoxia, and apnea are some of the symptoms [14]. On the other hand, it was determined that the second most common etiological factor was hypoxia. It's linked to a higher chance of brain injury as well as long-term and neurodevelopmental problems such cerebral palsy (CP), cognitive impairment, behavioral issues, vision or hearing loss, and epilepsy [15]. While spastic type CP was found in 93.7% of our patients, the remaining rate was athetoid type CP. Spastic type CP is the most common type of CP and appears to be associated with premature birth or intrauterine growth retardation. Athetoid type CP can be seen either with the spastic type or alone. While severe hypoxia is more common in babies with spastic and athetoid type CP together, pure athetoid type CP is frequently seen in babies with hyperbilirubinemia [16].

In our study, most of our patients consisted of babies born prematurely or exposed to hypoxia. In addition, there was a history of hyperbilirubinemia in three of our babies. It is thought that this may be related to the fact that healthcare professionals are informed about hyperbilirubinemia and that its treatment is carried out effectively. Considering the imaging findings, periventricular leukomalacia (PVL) was in the first place. PVL is encountered more frequently in brain imaging of babies born prematurely than those born at term. In severe hypoxia, PVL and multicystic encephalomalacia can be seen together [17]. At the same time, clinical studies show that it is associated with maternal/fetal infection and inflammation [18]. In our study, premature patients and patients with a history of hypoxic birth constitute most of the patient group. Therefore, it is expected to see PVL in imaging findings. As a result of our study, it was determined that malnutrition and epilepsy were the first among the problems accompanying CP. As a result of the multicenter study conducted by Aydın et al. in our country, the malnutrition rate in patients with CP was reported as 94.3% and the epilepsy rate as 55.3% [19]. In our study, these rates were 72.9% and 54.2%, respectively. Although the incidence of epilepsy was the same, there was a significant difference between malnutrition rates. This disparity in our center's favor can be attributed to the fact that diet has long been an essential aspect of treating children with CP.

Conclusion

Our study is valuable in emphasizing the detection and treatment of accompanying problems in patients with CP. As a result of our study, it was determined that prematurity was the most influential etiological factor, PVL occurred in most of the babies, and accordingly, spastic bilateral type CP was the most common. Although malnutrition was the most common condition accompanying CP, it was determined that it was at a lower rate than in national studies. The fact that malnutrition is less common than in our country suggests that this view is gaining traction. Although our study was conducted in a single-center, the results of Turkish and Syrian children could be revealed. This result can be considered one of the strengths of our study. The detection of etiology and imaging findings at the same rate as the literature is another valuable point of our study.

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