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A Comparison of the General Approach of Surgeons toward Cerebral Palsy Patients and the Current Literature

Hilal AYDIN [1], Ali Engin ULUSAL [2]

[1] Balikesir University, Faculty of Medicine, Department of Pediatric Neurology
[2] Balikesir University, Faculty of Medicine, Department of Orthopedics and Traumatology

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ABSTRACT
Objective: The purpose of the present study was to conduct a survey concerning the attitudes toward patients with CP among physicians in the fields of orthopedics and traumatology in Turkey. **Materials and Methods:** A questionnaire containing 20 items was produced to determine the attitudes toward patients with CP of specialist physicians in these fields. **Results:** One hundred fifteen such physicians performing clinical procedures on CP patients participated in the study - 47 (40.9%) assistant doctors, 43 (37.4%) specialist physicians, 11 (9.6%) assistant professor doctors, 11 (9.6%) associate professor doctors, and three (2.6%) professor doctors. The participants in the study most frequently reported identifying CP in the 1-2 age group (n=47, 40.9%). The CP cases identified in the 1-2 age group were most frequently referred to the physical therapy and rehabilitation department, and those in the 3-12 age group to the pediatric neurology department. The most frequently encountered subtype was spastic CP (n=108, 93.9%). **Conclusions:** The purpose of this study investigating the clinical knowledge, skills and attitudes concerning CP among orthopedic physicians under clinical conditions was to contribute to the development of a specific treat-ment plan.
Keywords: Cerebral Palsy, Treatment, Surgery, Orthopedics and Traumatology.

Serebral Palsi Hastasına Cerrahların Genel Yaklaşımı ile Güncel Literatürün Karşılaştırılması

ÖZ
Amaç: Bu çalışmanın amacı ülkemizde Ortopedi ve Travmatoloji alanındaki hekimlerin serebral palsili (SP) hastalara yaklaşımları konusunda bir anket araştırması yapmak ve çıkan verileri güncel literatur eşliğinde tartışmaktır. **Gereç ve Yöntem:** Ortopedi ve travmatoloji alanında uzman hekimlerin serebral palsili hastalar ile ilgili yaklaşımlarının belirlenmesi amacıyla 20 soruluk bir anket oluşturuldu. **Bulgular:** Çalışmamıza SP hastaları üzerinde klinik uygulamalar yapan 115 tane ortopedi ve travmatoloji alanında asistan, uzman, doktor öğretim üyesi, doçent doktor, profesör doktor katılmış olup; 47 (%40.9) katılımcı asistan doktor, 43 (%37.4) katılımcı uzman hekim, 11 (%9.6) katılımcı doktor öğretim üyesi, 11 (%9.6) katılımcı doçent doktor ve 3 (%2.6) katılımcı profesör doktor idi. Çalışmada katılımcılar, poliklinik koşullarında SP tanısı konulan hastaların en fazla 1-2 yaş grubunda (n=47, %40.9) idi. 1-2 yaş grubunda saptanan SP'li olgular; en sık fizik tedavi ve rehabilitasyon bölümüne yönlendirilirken, 3-12 yaş grubunda saptanan SP'li hastaların en sık çocuk nöroloji bölümüne yönlendirildikleri belirtilmiştir. **Sonuç:** Bu çalışmada poliklinik koşullarında ortopedi hekimlerinin SP hastalığı ile ilgili klinik bilgi, becerileri ve tutumları irde-lenmekle birlikte bu konuda belirli bir tedavi şeması oluşturulmasına katkı yapılmak istenmiştir.
Anahtar Kelimeler: Serebral Palsi, Tedavi, Cerrahi, Ortopedi ve Travmatoloji**.**

Sorumlu Yazar / Corresponding Author: Hilal AYDIN, Department of Pediatric Neurology, Balikesir University, Faculty of Medicine, 10145, Balikesir, Turkey
E-mail: drhilalaydin@gmail.com

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INTRODUCTION

Cerebral palsy (CP) has been defined as a group of permanent deficits emerging in association with non-progressive damage in the infant brain and causing restriction or movement/posture and activity, a definition that remains valid today (The Definition and Classification of Cerebral Palsy, 2007). The general prevalence of CP is 2/1000 (Van Naarden Braun, Doernberg, Schieve, Christensen, Goodman, & Yeargin-Allsopp, 2016). A study from Turkey reported a prevalence of 4.4 per 1000 live births (Serdaroğlu, Cansu, & Ozkan, 2006). The pathology in CP derives primarily from the brain. Prenatal pathologies play a 70-80% role in the etiology, the most commonly determined cause being prematurity (Andersen, Romundstad, & De La Cruz, 2011). Common findings in all clinical definitions of CP include;

- Damage resulting from the deficit in the brain being permanent and non-progressive,
- Occurrence in the very early period of life,
- Movement and posture disorders leading to motor deficit, and
- Clinical findings being capable of alteration as the child develops.

In addition to motor anomalies, accompanying comorbid conditions such as sensory and perception disorders, cognitive and behavioral problems, epilepsy, and secondary musculoskeletal problems may also be present in CP. The condition is classified into three types, depending on the characteristics of the motor anomalies – spastic, dyskinetic, and ataxic (Gulati & Sondhi, 2018) Specific CP symptoms are best detected at the age of 3-5 years, although specific signs and findings may also be observed in infancy (Surveillance of Cerebral Palsy in Europe, 2000). Numerous metabolic and genetic diseases must be considered at differential diagnosis, since these may progress with symptoms and findings resembling the CP phenotype (Leach, Shevell, & Bowden, 2014)

The purpose of the present study was therefore to conduct a survey concerning the attitudes toward patients with CP among physicians in the fields of orthopedics and traumatology in Turkey and to discuss the findings in the light of the current literature.

MATERIALS AND METHODS

Study group

A questionnaire containing 20 items was produced to determine the attitudes toward patients with CP of specialist physicians in the fields of orthopedics and traumatology. Following receipt of the requisite ethical committee approval (no: 2020/176), the questionnaire was sent to the participants online, and they were asked to complete it. It recorded demographic characteristics such as sex and age, the institution where participants worked, their academic title if applicable, and length of time worked in their specialty. It also contained questions assessing general knowledge of CP, the clinical characteristics of cases with CP (age group, subtypes, physical examination findings, and accompanying comorbid conditions), and therapeutic approaches to CP (medication/surgery). Seventeen questions were multiple choice, and three were open-ended. Questionnaires that were not fully completed were excluded from the study.

Statistical analysis

Statistical analysis was performed on SPSS (Statistical Package for Social Sciences) Windows 23.0 software. The independent sample t test was used in the evaluation of normally distributed parameters and the chi-square test for categorical variables. p values <0.05 were considered statistically significant.

Ethic approval

Ethical approval was obtained from Clinical Trials Ethical Board at Balikesir University (decision number: 2020/176).

RESULTS

One hundred fifteen physicians in the field of orthopedics and traumatology performing clinical procedures on CP patients participated in the study - 47 (40.9%) assistant doctors, 43 (37.4%) specialist physicians, 11 (9.6%) assistant professor doctors, 11 (9.6%) associate professor doctors, and three (2.6%) professor doctors. The participants were divided into three groups – assistant doctors (n=47, 40.9%), specialist physicians (n=43, 37.4%), and members of academic staff (assistant professors, associate professors, and professors). Men constituted 114 (99.1%) of the participants, while one (0.9%) was female. The participants' mean age was 35.8±7.01 (25-54) years. The mean length of experience working in the field of orthopedics and traumatology was 8.3±6.88 (0.5-30) years. Fifty-five (47.8%) participants worked in a university hospital, 22 (19.1%) in a public hospital, 11 (9.6%) in a private hospital, and 27 (23.5%) in an education and research hospital (Table 1).

Ninety-five (82.6%) participants stated that CP emerges as a result of damage to the brain, while 105 (91.3%) described CP as a movement and posture disorder resulting from a deficit in the brain in the early period of life and stated that the clinical findings can alter together with the child's development. One hundred ten (95.7%) participants described the etiology of CP as multifactorial.

The participants in the study most frequently reported identifying CP in the 1-2 age group (n=47, 40.9%), followed by the 3-5 age group (n=45, 39.1%). Assistant doctors (n=16) and members of teaching staff (n=14) most frequently determined CP in the 1-2 age group, and specialist physicians (n=20) in the 2-3 age group. The CP cases identified in the 1-2 age group were most frequently referred to the physical therapy and rehabilitation department, and those in the 3-12 age group to the pediatric neurology department.

The great majority of participants stated that CP can only be detected through neurological examination in the early period (n=96, 83.5%). Participants most frequently described 'history and physical examination' as the gold standard diagnostic method for CP (n=65, 56.5%), followed by 'history, physical examination, and genetic, radiological, and laboratory methods' (n=49, 42.6%), while genetic diagnosis was the least frequently selected

method (n=1, 0.9%). Participants reported 'spasticity, hyperreflexia, clonus, and Babinski positivity' as the most frequently encountered findings in CP patients at physical examination (n=53, 46.1%). Thirty-nine (33.9%) participants observed spasticity alone, and one (0.9%) observed Babinski positivity alone.

The most frequently encountered subtype was spastic CP (n=108, 93.9%), while the least frequently encountered type was ataxic CP (n=3). It appeared that specialist physicians had never encountered ataxic CP under polyclinic conditions, while members of teaching staff had never encountered dyskinetic CP patients.

One hundred (87%) participants reported observing comorbid conditions accompanying CP in the clinical setting, while 85 (73.9%) had observed metabolic and genetic diseases resembling the CP phenotype. We also found that metabolic and genetic diseases resembling the CP phenotype were more frequently considered by members of teaching staff at differential diagnosis compared to the other participants (p=0.049).

One hundred fourteen (99.1%) participants adopted a multidisciplinary approach in the management of CP, with only one (0.9%) not doing so. Patients with CP developing hypertonicity were most frequently referred to the pediatric neurology (n=44, 38.3%) and physical therapy and rehabilitation (n=43, 37.4%) departments. Orthopedic surgical intervention in CP was most frequently employed in the 4-8 age group (n=95, 82.6%). Specialist physicians and members of teaching staff most commonly considered orthopedic surgery intervention at the age of 4-6. The majority of all the participants most frequently referred their CP cases to the physical therapy and rehabilitation department following orthopedic surgery (n=98, 85.2%) (Table 2).

Table 1. Participants' demographic characteristics.

Variables	**n (%)**
Gender	
Female	1 (0.9)
Male	114 (99.1)
Mean age (years) Mean±SD	35.86±8.32)
Length of orthopedic and traumatology specialization (years) Mean±SD	8.32±6.88
Academic degree	
Assistant doctor	47 (40.9)
Specialist doctor	43 (37.4)
Assistant professor doctor	11 (9.6)
Associate professor doctor	11 (9.6)
Professor doctor	3 (2.6)
Institution of employment	
University hospital	55 (47.8)
Training and research hospital	27 (23.5)
Public hospital	22 (19.1)
Private hospital	11 (9.6)

SD=Standard deviation.

Table 2. Distributions of characteristics including CP clinical features and treatment approaches.

Variables	**n (%)**
Cerebral palsy	
It develops due to a disorder in the brain.	1 (0.9)
It is accompanied by movement and postural disorders that cause motor impairment.	6 (5.2)
The findings may change as the child develops, but the damage to the brain does not disappear or worsen.	2 (1.7)
Occurs very early in life.	0 (0)
All	105 (91.3)
None	1 (0.9)
Cerebral palsy	
Occurs as a result of brain damage.	95 (82.6)
Occurs as a result of spinal cord damage.	4 (3.5)
Occurs as a result of muscle damage.	0 (0)
All the above	14 (12.2)
None of the above	2 (1.7)
Cerebral palsy etiology	
Depends on a single cause	110 (95.7)
Is multifactorial	5 (4.3)
CP age range in outpatient	
1-2 years	47 (40.9)
3-5 years	45 (39.1)
6-8 years	14 (12.1)
10-12 years	9 (7.9)
Can cerebral palsy be diagnosed in the early period through neurological examination findings alone?	
Yes	96 (83.5)
No	19 (16.5)
What is the most common physical examination finding in patients with CP in your outpatient clinic?	
Spasticity	39 (33.9)
Hyperreflexia	11 (9.5)
Clonus	11 (9.5)
Extensor plantar response (positive Babinski response)	1 (0.9)
All	53 (46.1)
None	0 (0)
Which is the most common type of cerebral palsy you see?	
Spastic	108 (93.9)
Dyskinetic	4 (3.5)
Ataxic	3 (2.6)
Have you seen co-morbid conditions accompanying cerebral palsy (epilepsy, visual disorders, hearing and speech disorders)	
Yes	100 (87.0)
No	15 (13.0)
Should the management of a child with cerebral palsy be	
Medical only	1 (0.9)
Social only	0 (0)
Education only	0 (0)
In psychological fields only	0 (0)
With a multidisciplinary team	114 (99.1)

Table 2. (Continue) Distributions of characteristics including CP clinical features and treatment approaches.

	n (%)
Have you seen metabolic and genetic diseases progressing with symptoms and signs similar to the cerebral palsy phenotype?	
Yes	85 (73.9)
No	30 (26.1)
Which of the following is the gold standard method for the diagnosis of cerebral palsy?	
Genetics	1 (0.9)
Radiological	0 (0)
History and physical examination	65 (56.5)
Laboratory	0 (0)
All the above	49 (42.6)
How do you proceed when muscle tone increases (hypertonicity) in a patient with cerebral palsy?	
I refer the patient to a pediatric neurologist	44 (38.3)
I refer the patient to a physical therapy and rehabilitation specialist	43 (37.4)
I refer the patient for pediatric orthopedic surgery.	22 (19.1)
I start with anti-spasticity drugs.	0 (0)
I perform botulinum toxin injection.	6 (5.2)
When do you recommend orthopedic surgery in cerebral palsy?	
1-2 years	0 (0)
2-3 years	20 (17.4)
4-6 years	49 (42.6)
6-8 years	46 (40.0)
What additional treatments have you required after orthopedic surgery?	
I. None	4 (3.5)
II. Otherwise, which of the following would you specify?	111 (96.5)
Physiotherapy and rehabilitation	98 (85.2)
Botulinum toxin	6 (5.2)
Additional surgical treatment	5 (4.3)
Medication	2 (1.7)

DISCUSSION

CP is the most frequently seen cause of motor deficit in childhood. The condition has been defined as a group disorder causing activity restriction as a result of non-progressive motor dysfunction in association with damage in the fetal or infant brain (Bax, Goldstein, Rosenbaum, Leviton, Paneth, Dan, Jacobsson, & Damiano, 2005). CP findings are mostly determined at the age of 3-5 years, although they can generally be identified at 1-22 months at the earliest through a combination of clinical and neurological signs (Surveillance of Cerebral Palsy in Europe, 2000; Hubermann, Boychuck, Shevell, & Majnemer, 2016). Age at diagnosis varies in the literature, although the majority of cases have been diagnosed before the age of two years (Boyle, Yeargin-Allsopp, Doernberg, Holmgreen, Murphy, & Schendel, 1996; Minocha, Sitaraman, & Sachdeva, 2017; Sultanoglu, Ünlü Akyüz, Çevikol, & Sultanoglu, 2019). The physicians in the present study reported most frequently detecting CP in the 1-2 age group (40%), followed by the 3-5 age group (38.3%). The primary pathology in CP derives from the brain. Several risk factors have been associated with CP, such as prematurity, low birth weight, birth defects, neonatal and maternal infections, multiple pregnancies, placental abnormalities, and birth asphyxia (Patel, Neelakantan, Pandher, & Merrick, 2020). The majority of participants in the present study agreed that CP emerges as a result of brain damage and that the etiology is multifactorial (82.6% and 95.7%, respectively). In the classification of CP, motor abnormalities are defined on the basis of a number of criteria, such as functional motor capacity, anatomical distribution (monoplegia, hemiplegia, diplegia, and quadriplegia), neuroimaging-related damage, and the timing of events (prenatal, natal, and postnatal). CP is thus classified under three basic categories – spastic, dyskinetic, and ataxic (Christine, et al., 2007). Spastic CP is characterized by hypertonicity and hyperreflexia and represents 80-90% of all cases (Pakula, Braun, & Yeargin-Allsopp, 2009).

Dyskinetic CP involves changes in muscle tonus and involuntary movements, while ataxic CP is characterized by uncoordinated movements (Hemming, Colver, & Hutto, 2020). The spastic type has most frequently been determined in previous studies (84.4%-94%) (Minocha, Sitaraman, & Sachdeva, 2017; Hüner, Özgüzel, Telli, &

Sarı, 2011; Cagliyan & Ozel, 2018; Yalcınkaya, et al., 2014; Sigurdardóttir, Thórkelsson, Halldórsdóttir, Thorarensen, & Vik, 2009). The most frequently determined neurological examination findings in the present study were primary motor neuron findings, while in agreement with the previous literature, spastic CP was the most commonly detected type (93.9%). Patients with CP may exhibit accompanying multisystem involvements such as chronic pain, epilepsy, intellectual disability, musculoskeletal deformities, behavioral problems, functional blindness, hearing disorder, and sleep problems (Novak, et al., 2012). The majority of participants (87%) in this study reported comorbid conditions accompanying CP. Although the comorbid conditions accompanying CP were not detailed, since this was a survey study, it appeared that our participants were aware of this and took it into consideration. The evaluation of children with CP must be entirely multisystemic (vision, speech, hearing, orthopedic, physical therapy/rehabilitation, cognitive function, and epilepsy). The management of CP therefore requires a multidisciplinary approach (Taylor, 2001). The majority of participants in the present study also employed such an approach in the management of patients with CP.

The clinical manifestations of inherited, metabolic, and genetic disease may be nonspecific and progressive, particularly at early ages (Hakami, Hundallah, & Tabarki, 2019). Numerous diseases progress with marked spasticity, ataxia, and dyskinesia and require differential diagnosis (Pearson, Pons, Ghaoui, & Sue, 2019). Most participants reported encountering a large number of metabolic and genetic diseases emerging with the CP phenotype under clinical conditions in the present study (73%). The majority also considered conditions requiring evaluation at differential diagnosis in the diagnosis of CP.

The treatment of hypertonicity in children with CP is a significant problem for all clinicians. The brain acquires its most powerful plasticity, compensatory, and recombination ability after the age of two years, for which reason early intervention and treatment are required in the initial treatment of CP. CP is the most common cause of spasticity in childhood, and spasticity is seen at approximately one year of age (Sanger, et al., 2003). Spasticity is determined in 80-90% of children with CP (Albright & Andrews, 2010). Physiotherapy represents the basis of the management of motor deficits in CP and focuses on motor skills and functional mobility (Papavasiliou, 2009). Physiotherapy is more effective when initiated at the age of 4-5 than at later ages (Horstmann & Beck, 2007). Cases of CP developing hypertonicity in the present study were most frequently referred to the pediatric neurology (38.3%) and physical therapy and rehabilitation (37.4%) departments.

In terms of drug use in the treatment of hypertonicity, it is important first to determine the child's tonus pattern (spasticity, chorea, athetosis, and dystonia). Various therapeutic interventions including drugs, botulinum toxin, and orthopedic surgery are also available addition to physical therapy and rehabilitation for treatment spasticity in children with CP. Alternative therapies such as botulinum toxin type A and orthopedic surgery are generally employed in focal or segmental involvement. Botulinum toxin must be considered in spasticity in the lower extremity at age 1-6, in spastic hemiplegia at age 5-15, in Gross Motor Function Classification System (GMFCS) level V CP at age 1-4, and at five years of age in GMFCS level I CP (Bovid & Patel, 2010; Horstmann & Beck, 2007; Heinen, et al., 2010). The timing of surgery depends on the maturation of the central nervous system, ambulation potential, and the speed of deformity development (Galli, Cimolin, Rigoldi, & Albertini, 2016). Rates of 21-30.9% for orthopedic surgery intervention in cases of CP and 5%-44% for botulinum toxin application have been reported (Cagliyan & Ozel, 2018; El, Peker, Bozan, Berk, & Kosay, 2007; Eriman, Icagasioglu, Demirhan, Kolukisa, Aras, & Haliloğlu, 2009; Sucuoglu, 2018) In the present study, rates of 19.1% for referral for pediatric orthopedic surgery and 5.1% for botulinum toxin application were determined.

El et al. (2007) reported a mean age of 6.51±3.36 at referral of CP cases for surgery. The timing of orthopedic surgery in the present study was most commonly at the age of 4-8 (n=93, 80.8%). The age groups in which orthopedic surgical intervention was recommended by specialist physicians and members of teaching staff were very similar. The rate of repeated and unsuccessful surgery in the study was very low. Postoperative rehabilitation and education are an important component of therapeutic success. Cases were most frequently referred to the physical therapy and rehabilitation department (n=98, 85.2%) in terms of postoperative additional treatment. The principal limitations of this research were that due to its nature as a survey study CP could not be classified according to functional motor capacity, that etiological factors could not be identified, that comorbid conditions could not be detailed, and that diseases observed at differential diagnosis could not be evaluated.

CONCLUSION

Although there have been several demographic and clinic studies concerning CP, studies at the survey studies are much rarer. There is no clearly defined standard algorithm in the approach to the treatment of CP. In addition, there are variations in the applications of botulinum toxin, surgery, and physiotherapy. The purpose of this study investigating the clinical knowledge, skills and attitudes concerning CP of orthopedic physicians under clinical conditions was to contribute to the development of a specific treatment plan.

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Conflict of Interest

The authors declare to have no conflicts of interest.

Author Contributions

Plan, design: HA, AEU; **Material and methods:** HA, AEU; **Data analysis and comments;** HA, AEU; **Writing and corrections:** HA, AEU.

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