

## Göğüs Hastalıkları Hastanesinde Yatan Serebral Palsili Hastalar: 30 Günlük Mortalite ve Karakteristik Özellikleri

Patients with Cerebral Palsy Hospitalized in Chest Diseases Hospital: 30-Day Mortality and Characteristic Features

Merve Ayık Türk<sup>1</sup>, Yasemin Özdoğan<sup>2</sup>, Özgür Batum<sup>2,3</sup>, Gülrü Polat<sup>2,3</sup>, Ufuk Yılmaz<sup>2</sup>

<sup>1</sup>Sağlık Bilimleri Üniversitesi, İzmir Bozyaka Eğitim ve Araştırma Hastanesi, Göğüs Hastalıkları Kliniği, İzmir, Türkiye

<sup>2</sup>Sağlık Bilimleri Üniversitesi, İzmir Dr. Suat Seren Eğitim ve Araştırma Hastanesi, Göğüs Hastalıkları ve Cerrihisi Kliniği, İzmir, Türkiye

<sup>3</sup>Sağlık Bilimleri Üniversitesi, İzmir Tıp Fakültesi, Göğüs Hastalıkları Anabilim Dalı, İzmir, Türkiye

### ÖZ

**Giriş:** Epilepsi, pnömoni, gastrit, özofajit, malnütrisyon, dehidratasyon, kırıklar ve pnömoni dışı akciğer hastalıkları (astım, plevral sıvı, solunum yetmezliği) serebral palsi (SP) hastalarında hastaneye yatışın önde gelen nedenleridir. Bu çalışmada göğüs hastalıkları hastanesine başvuran SP'li hastalarda solunum yolu hastalıkları ve mortalite oranlarının belirlenmesi amaçlanmıştır.

**Gereç ve Yöntemler:** Ocak 2010 ile Aralık 2017 tarihleri arasında Göğüs Hastalıkları Hastanesinde yatan SP'li hastalar çalışmaya dahil edildi ve retrospektif olarak analiz edildi. Birincil sonlanım noktası olarak, hastanede yatan hastaların solunum yolu enfeksiyonuna bağlı 30 günlük mortalitesi incelendi.

**Bulgular:** Toplam 23 hastaya ait 43 yatış değerlendirildi. Ortalama hastanede kalış süresi 15.5 (1-62) gündü. SP'li hastaların hastaneye yatış nedenleri ağırlıklı olarak solunum yolu enfeksiyonlarından (pnömoni %88,4, akciğer apsesi %7) oluşmaktaydı. En sık izole edilen patojen mikroorganizmalar gram-negatif bakterilerdi. Hırıltılı solunum, bakteriyel kültür üremesi, vazopressör ve invaziv mekanik ventilasyon ihtiyacı 30 günlük mortaliteyi artıran faktörlerdi (sırasıyla p=0,016; p=0,024; p=0,003; p=0,003). 30 günlük mortalite oranı %26,08 (6/23) idi. İki hasta ilk yatışta kaybedilirken, dört hasta tekrarlayan yatışlarda kaybedildi.

**Sonuç:** Serebral palsili hastalar sıklıkla solunum yolu enfeksiyonları nedeniyle hastaneye yatırılmaktadır. Tekrarlayan hastane yatışları mortaliteyi artırabilir. Bu çalışmada, solunum yolu enfeksiyonları nedeniyle hastaneye yatırılan SP hastaları arasındaki yüksek mortalite oranı göz önüne alındığında, SP'li hastaların yakın takibinin önemi vurgulanmaktadır.

**Anahtar Kelimeler:** Serebral palsi; otuz günlük mortalite; göğüs hastalıkları

**Bu çalışma ASYOD toplantısında sunulmuştur**

Sorumlu Yazar: Uzm. Dr. Merve Ayık Türk  
Sağlık Bilimleri Üniversitesi, İzmir Dr Suat Seren Eğitim ve Araştırma Hastanesi,  
Göğüs Hastalıkları Kliniği, İzmir, Türkiye  
Email: merve.ayik@hotmail.com

### ABSTRACT

**Aim:** Epilepsy, pneumonia, gastritis, esophagitis, malnutrition, dehydration, fractures, and non-pneumonic lung disorders (asthma, pleural fluid, respiratory failure) are the leading causes of hospitalization among cerebral palsy (CP) patients. This study aimed to determine respiratory tract diseases and mortality rates in patients with CP admitted to the chest diseases hospital.

**Materials and Methods:** Patients diagnosed with CP and hospitalized in Chest Diseases Hospital between January 2010 and December 2017 were included in the study and analyzed retrospectively. As the endpoint, hospitalized patients' respiratory tract infection-related 30-days mortality were examined.

**Results:** A total of 43 hospitalizations of 23 patients were evaluated. The mean length of hospital stay was 15.5 (1-62) days. The reasons for hospitalization in patients with CP were mainly composed of respiratory tract infections (pneumonia %88,4, lung abscess %7). The most frequently isolated pathogenic microorganisms were gram-negative bacteria. Wheezing, bacterial culture growth, vasopressor and invasive mechanical ventilation were all factors that increased 30-day mortality (respectively p=0.016; p=0.024; p=0.003; p=0.003). The 30-day mortality rate was %26,08 (6/23). While two patients died at first hospitalization, four patients died on recurrent hospitalizations.

**Conclusion:** Patients with CP are often hospitalized due to respiratory tract infections. Recurrent hospitalizations may increase mortality. This study emphasizes the importance of close follow-up with these patients considering the high mortality rate among CP patients hospitalized for respiratory tract infections.

**Key Words:** Cerebral palsy; thirty days mortality, chest diseases

Cerebral palsy (CP) is a group of diseases that occur due to nonprogressive damage in developing fetal and infant brain, cause permanent changes in movement and posture, and are characterized with movement limitations (1). Cerebral palsy is more likely to be seen in premature birth, low birth weight, difficult birth, and multiple pregnancy. It affects 1.5-3 infants per 1000 live births (2). The main problem in CP is impairment of fulfillment and control of voluntary movements. Deficient cognitive functions, epilepsy, emotional problems, hearing and vision pathologies can be present with musculoskeletal problems (tonus changes, loss of balance, apraxia, and motor retardation) (3).

Patients with CP whose all body systems (especially musculoskeletal, respiratory, gastrointestinal, and urinary systems) are affected are frequently admitted to the hospital. Epilepsy, pneumonia, gastritis, esophagitis, malnutrition, dehydration, fractures, and non-pneumonic pulmonary diseases (asthma, pleural fluid, respiratory failure) are among the reasons for hospitalization (4). The most common causes of mortality, morbidity, and poor quality of life in children who are most severely affected is respiratory illness (5). Adults with CP have a 14-fold risk of death from respiratory diseases when compared to the general population (6). Despite the fact that that patients are frequently hospitalized for pulmonary disorders, there is little information in the literature about the mortality rates of pulmonary diseases among CP patients.

This study aimed to determine respiratory tract diseases and mortality rates in patients with CP admitted to the chest diseases hospital.

## Materials and Methods

### 2.1 Patient Selection

This study was done after the approval of the Izmir Dr. Suat Seren Chest Diseases and Surgery Training Hospital local ethics committee (date: 21.02.2018, approval number: 1773). Patients diagnosed with CP (ICD-10 code: G80) who were admitted to and discharged from the chest diseases and surgery training and research hospital between 2010 and 2017 were analyzed retrospectively. Patients who were diagnosed with CP by a neurologist and who were reported to have musculoskeletal problems (tonus changes, loss of balance, apraxia, and motor retardation) by their relatives were defined as CP. When there was not enough information about CP, information were obtained from the patients' relatives by phone. Fifty hospitalizations were determined according to the ICD-10 code for CP. Seven hospitalizations with incorrect coding were excluded from the study. When the hospitalizations were evaluated, if the time between repeated hospitalizations was shorter than 30 days, it was excluded from the study. We collected data on age, gender, respiratory symptom, radiology, bacteriology, vaccination, treatment, and treatment outcomes.

### 2.2 Statistical Analysis

PASW Statistics for Windows (Version 18.0. Chicago: SPSS Inc) was used for analysis. Wilk and Kolmogorov-Smirnov normality tests were used to determine whether continuous data were normally distributed. The conformity of the continuous variables to the normal distribution was tested. In the comparisons of independent groups, the variables with normal distribution were evaluated with the Student's t test, and those not with the "Mann-Whitney U-Test". The qualitative variables were presented in cross-tables as frequencies and percentages, and their distributions were compared with the Chi-Square Test Methods. Results were given as mean  $\pm$  SD, median (min-max), number, and percentage (%).

The margin of error for the first type was determined as  $\alpha:0.05$  in all statistical comparison tests and it was tested with two tails. If the "p" value was less than 0.05, the difference between the groups was considered statistically significant.

### Results

A total of 43 hospitalizations of 23 patients were evaluated, 12 (52.1%) of the patients were male and the mean age was 22 ( $\pm 9.51$ ) years. Fourteen (%60.8) patients had one hospitalization, six (26.08%) had two hospitalizations, one (4.34%) had five hospitalizations, and two (8.69%) had six hospitalizations. The mean length of hospital stay was 15.5 (1-62) days. The characteristics of the patients and hospitalizations are summarized in Table 1 and 2.

Chest X-rays revealed consolidation in the right lung in 21 (%48.8) hospitalizations and in the left lung in 14 (%32.5) hospitalizations. Bilateral pulmonary involvement was detected in eight (%18.6) hospitalizations. Pleural effusion was detected in five (11.6%) of the hospitalizations.

Table 3 shows microbiological pathogens grown in cultures. Microbiological growth was observed in 13 (30.2%) of 43 hospitalizations. Sputum cultures were positive in seven patients, while tracheal aspirate cultures were positive in six patients. In three patients, the same causative pathogen was grown two times on different hospitalizations.

By univariate analysis, factor affecting 30-days mortality were examined (Table 4). Variables with  $p < 0.05$  in univariate analysis were analyzed with multivariate analysis. No statistically significant variable was detected by multivariate analysis.

In the intensive care unit, eight (18.6%) admissions underwent invasive mechanical ventilation. In the first 72 hours, four patients needed vasopressor treatment because of hypotension. The 30-day mortality rate was 26.08% (6/23). While two patients died at first hospitalization, four patients died on recurrent hospitalizations.

## Discussion

This study has demonstrated common reasons for hospitalization in patients with CP admitted to the chest diseases hospital. Pneumonia is a major reason for hospitalizations among patients with CP. The majority of these patients have a history of pulmonary aspiration. The most frequently isolated pathogenic microorganisms were gram-negative bacteria. The outcome may be mortal in patients with a history of frequent hospitalization

**Table 1:** Characteristic features of 23 Cerebral palsy patients

Characteristic		n	%	Median (Range)
Age		23		22±9,51
Gender	Male	12	52,1	
Epilepsy	Yes	11	47,8	
	No	12	52,1	
Congenital Heart Disease	Yes	1	4,34	
	No	22	95,6	
Chronic Lung Disease	Yes	1	4,34	
	No	22	95,6	
Immunosuppressive Treatment	Yes	0	0	
	No	23	100	
Flu Vaccine	Yes	3	13,04	
	No	20	86,9	
Pneumonia Vaccine	Yes	2	8,69	
	No	21	91,3	
Preterm Birth	Yes	1	4,34	
	No	22	95,6	
30-Days Mortality	Yes	6	26,08	
	No	17	73,92	

**Table 3:** Microbiological factors detected in respiratory secretions during hospitalization

Microbiological agent	Number of patients	Percent of patients (%)
Pseudomonas Aeruginosa	4	30,7
Klebsiella Pneumoniae	1	7,69
Stafilococcus Aureus	2	15,3
Corinebacterium Species	2	15,3
M.Tuberculosis	1	7,69
Acinetobacter spp	2	15,3
Escherichia coli	1	7,69

Mahon and Kibirige reported that upper and/or lower respiratory infections accounted for 42% of hospitalizations (7). Due to the characteristics of our patient group, all hospitalizations occurred due to respiratory tract infections. However, respiratory infections account for 13-42% of hospitalizations in patients with CP who are admitted to the general hospital (7).

Pulmonary problems have an important role in the mortality and morbidity of patients with CP. Swallowing function and cough reflex that prevent oropharyngeal aspiration have deteriorated by 10-58% in patients with CP. Due to recurrent aspirations, chronic cough leads to impairment of mucociliary clearance, pathogenic

**Table 2:** Reasons for hospitalization of patients with cerebral palsy

Characteristic		30-Days Mortality		p- value
		No (n)	Yes (n)	
Cough	No	9	0	0,566
	Yes	29	5	
Sputum	No	16	0	0,139
	Yes	22	5	
Dyspnea	No	15	0	0,145
	Yes	23	5	
Wheezing	No	23	0	0,016
	Yes	15	5	
Aspiration	No	16	0	0,139
	Yes	22	5	
Fever	No	16	0	0,139
	Yes	22	5	
Nausea	No	32	5	1,00
	Yes	6	0	
Hypoxemia	No	19	0	0,056
	Yes	19	5	
Tachypnea	No	24	1	0,144
	Yes	14	4	
Hypotension	No	28	3	0,608
	Yes	10	2	
Mental Change	No	32	3	0,228
	Yes	6	2	
Diagnosis	P	3	3	0,863
	E	1	0	
	LA	3	0	
	Tbc	1	0	
Pleural Fluid	No	34	4	0,479
	Yes	4	1	
Bacterial culture growth	No	29	1	0,024
	Yes	9	4	
Invasive mechanical ventilation	No	34	4	0,003
	Yes	1	4	
Vasopressor	No	37	2	0,003
	Yes	1	3	

P: Pneumonia, E: Empyema, LA: Lung Abscess, Tbc: Tuberculosis

bacterial colonization in the respiratory tract, and progressive parenchymal lung disease (8). Recurrent aspiration pneumonias seen during follow-up can sometimes lead to serious pneumonia attacks that are life-threatening and often require hospitalization.

Due to the inability to clear secretions, pneumonia is more difficult to improve in patients with CP when compared with other healthy individuals. Even advanced primary disease can often lead to severe pneumonia requiring ventilatory support (9,10). In our study, the use of vasopressors and invasive mechanical ventilation were factors that increased 30-day mortality. The length of hospital stay was longer compared to other pneumonia-related hospitalizations and 15.5 (1-62) days.

Life expectancy is shorter in individuals with CP compared to the general population. Adults with CP have a higher incidence of morbidity and mortality from ischemic heart disease, cerebrovascular illness, cancer, and trauma than people in the general population (11). Pneumonia is the most common cause of hospitalization and has high mortality rates in patients with CP (12). Adults with CP have a 14 times higher risk of mortality from respiratory diseases than adults without the disorder (13). In our study, six (%26.08) patients died within the 30 days in accordance with the literature. Aspiration pneumonia is most commonly seen in the right lung. In our study, aspiration pneumonia was more common in the right lung in accordance with the literature.

Colonization with *Pseudomonas aeruginosa* and other Gram-negative organisms in children with CP leads to increased morbidity, prolonged hospitalization, and severe pneumonia requiring pediatric intensive care admission (14). Studies have shown that gram-negative bacteria, particularly *Pseudomonas aeruginosa*, cause pneumonia. Gram-negative bacteria constituted the majority in our research, which was consistent with the literature.

Children and adults with CP have consistently higher health care use, including more visits to clinicians, more hospitalizations, longer length of stay (15). In this study, 43 different hospitalizations of 23 patients were examined due to respiratory tract infections. Epilepsy, pneumonia, gastritis, esophagitis, malnutrition, dehydration, fractures, and non-pneumonic pulmonary diseases (asthma, pleural fluid, respiratory failure) were among the reasons for hospitalization.

Our study has some limitations. In addition to a small number of patients, other accompanying morbidities (mental status, non-respiratory infections, muscular dystrophy, orthopedic problems) could not be detected because it was a retrospective study.

In conclusion, patients with CP are often hospitalized due to respiratory tract infections. Recurrent hospitalizations may increase mortality. This study emphasizes the importance of close follow-up with these patients considering the high mortality rate among CP patients hospitalized for respiratory tract infections.

#### **Declarations:**

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**Conflict of Interest:** The authors declare there are no potential conflicts of interest. This article is protected by copyright. All rights reserved.

Creating ideas or hypotheses for research: UY, YÖ, MAT. Planning methods to achieve results: YÖ, MAT. Supervision and responsibility of the project and the organization of the article and the audience: UY, GP. Providing "vital" personnel, space, financial resources, tools and equipment for the Project: ÖB, YÖ, MAT. Taking responsibility for making experiments, following patients, organizing and reporting data: ÖB, YÖ, MAT. Take responsibility for logical presentation: MAT, UY. Take responsibility for literature screening: MAT. Taking responsibility for the creation of the whole or the actual part of the work: MAT, UY. Before delivering the article, it is necessary to reopen the premise not only in terms of imitation and language, but also in terms of intellectual content: UY, GP

**Ethical Approval:** This is a retrospective study, local ethical approval was received and ethical approval date and number 21.02.2018-1773. The study protocol was approved by the İzmir Dr. Suat Seren of the Chest Diseases and Surgery Training Hospital. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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**Informed Consent:** Informed consent was waived because of the retrospective nature of the study.

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