Journal of Pediatric Academy

Original Article

Year: 2023 Volume: 4 Issue: 1
Doi: 10.4274/jpea.2023.198
J Pediatr Acad 2023; 4: 25-32

The Relationship Between Dyspnea Severity with Radiological and Laboratory Findings in Pneumonia in Children in Pediatric Palliative Care

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Article Information

Article Type: Original Articles
Article Group: Pediatric Rheumatology

Received: 02.11.2022
Accepted: 24.01.2023
Available Online: 31.03.2023

Cite this article as: *Harputluoğlu N, Coşkun M, Çubukçu D, Çelik T. The Relationship Between Dyspnea Severity with Radiological and Laboratory Findings in Pneumonia in Children in Pediatric Palliative Care. J Pediatr Acad 2023; 4: 25-32*

Abstract

In care patients; pneumonia is common due to being bedridden, atrophy of respiratory muscles and use of medical devices. Dyspnea is the second most common symptom after pain in pediatric palliative care. In this study, it was aimed to examine the relationship between the severity of dyspnea and pneumonia. The study is a study that included patients admitted to pediatric palliative care, diagnosed with pneumonia, and applied Modified Borg Scale (MBS) between December 15, 2019 and December 15, 2020. The MBS has a scoring system ranging from 0 to 10 and assesses the severity of dyspnea. A total of 72 (34.4%) patients diagnosed with pneumonia and underwent MBS were included in the study. 51.4% (n=37) of the study group were male, and the median age was 6.00 years (ranges of quarters=9). It was observed that the severity of dyspnea did not affect determining the pneumonia type and possible pathogen (p=0.613, p=0.948, respectively) In line with the results of the study, it can be concluded that there is no relationship between the severity of dyspnea and pneumonia in patients in need of care.

Keywords: Pneumonia, pediatric palliative care, severity of dyspnea

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Introduction

Pneumonia ranks among the top in admission to pediatric emergency departments, clinic wards, and intensive care units and is one of the leading causes of morbidity and mortality in children globally.[1,2] The World Health Organization reports that pneumonia is the most common cause of death in children under the age of five worldwide. Although pneumonia-related deaths have decreased somewhat with safe, effective, and cost-effective treatment, they still account for approximately one-fifth of child deaths globally.[3] Pneumonia, the acute inflammation of the lung parenchyma that usually occurs in response to infectious causes such as bacteria and viruses, is a clinical picture in which fever, respiratory symptoms, and parenchymal involvement are defined by physical examination and/or chest X-rays.[4] Risk factors include poor hygiene, low socioeconomic status, lack or insufficiency of vaccinations, and infrastructure problems in living conditions. In care patients, being bedridden, atrophy of respiratory muscles, and using medical devices are also among the risk factors for pneumonia.

Highlights

- Dyspnea is a multidimensional symptom and requires different management strategies according to its causes. The relationship between pneumonia-related dyspnea and/or severity of dyspnea and the presence of pneumonia has not been adequately studied, particularly in pediatric palliative care patients.
- The Modified Borg Scale is a scale used to evaluate dyspnea in nonverbal children. Modified Borg Scale is not related to the type of pneumonia, possible pathogens, chest X-ray and laboratory findings.
- For dyspnea, which is common in pediatric palliative care patients, causes other than pneumonia should be investigated and treatment should be given for its etiology.

Dyspnea is defined as performing the work of breathing quickly or with difficulty. Dyspnea is a common symptom in pediatric palliative care. It is the second most common symptom after pain, especially in the last month of life.[5-11] The frequency of dyspnea in pediatric palliative care has been reported to be between 17-80%, and the frequency varies according to the diagnosis and evaluation method.[12] Acute or chronic dyspnea can be frightening for the child and the family.[13-15] Dyspnea is a multidimensional symptom and requires different management strategies according to its causes. It may occur due to causes such as infection, acidosis, fluid overload, anemia, lung metastasis, pulmonary embolism, pleural effusion, heart failure, pain, and anxiety.[16] The relationship between pneumonia-related dyspnea and/or severity of dyspnea and the presence of pneumonia has not been adequately studied, especially in pediatric palliative care patients. This study aimed to examine the relationship between radiological findings and laboratory findings of the cases with the presence and severity of dyspnea followed up with the diagnosis of pneumonia in pediatric palliative care.

Material and Method

Organization of Pediatric Palliative Care (PPC) Unit

University of Health Sciences Turkey is a tertiary hospital, and the PPC center started to serve in November 2018. Our pediatric palliative care center has 12 beds and is a model of teamwork consisting of three pediatricians, eight nurses, four staff, one psychologist, one dietician, one social worker, one physiotherapist, one religious worker, and one secretary. Children with comorbidities (such as cancer, history of transplantation, and complex cyanotic congenital heart disease), potentially progressive conditions (for example, cystic fibrosis, severe immunodeficiency, muscular dystrophy), genetic disorders (such as trisomy 13, trisomy 18, osteogenesis imperfecta), and non-progressive but irreversible diseases (cerebral palsy) have been treated in our pediatric palliative care units.

Study Design

The study was cross-sectional in which patients who were followed up in pediatric palliative care between December 15, 2019, and December 15, 2020, had shortness of breath, were diagnosed with pneumonia and applied the Modified Borg Scale (MBS). The cases included in the study were clinically diagnosed with pneumonia by history and physical examination and were supported by chest X-rays and laboratory findings. Patients who did not have a cold, pharyngitis, mild fever, general condition deterioration and cases with bilateral and diffuse auscultation findings were considered as viral pneumonia. Patients with high fever, retraction, toxic appearance, and localized auscultation findings were considered bacterial pneumonia. Laboratory and radiological examinations were performed to distinguish the complexity of symptoms in patients followed in our clinic, the presence of recurrent pneumonia in bedridden patients, and other causes of respiratory distress. Chest radiographs of the patients included in the study were evaluated by a radiologist unaware of their clinical and laboratory findings. First, the presence of pneumonia was evaluated on the chest X-ray, and the involvement pattern was defined in cases with pneumonia. Because the children in our study group were non-verbal and could not evaluate themselves, the MBS was administered by a physical therapist who was unaware of X-ray and laboratory findings. The relationship between MBS scores, pneumonia pattern, and the pathogen was examined.

Data Collection Tools

Case Report Form: Sociodemographic data about the child and his/her family (child's gender, age, primary disease, medical devices and technologies used, presence of additional disease and age of the caregiver parent, gender, education, marital status, number of children, income level, employment status, and household status) was questioned with a personal information form consisting of 13 questions.

MBS: Borg Dyspnea Scale was developed by Gunnar Borg in 1982 to describe the intensity of physical activity. In 1986, the "American College of Sports Medicine" reorganized the scale by scoring between 0-10.[17] The MBS has a scoring system ranging from 0 (none) to 10 (very severe). It is accepted that the severity of dyspnea increases as the score increases on the scale without a cut-off score. (**Figure 1**) It has been used as a reliable and valid scale in various studies in our country.[18]

Radiography: Chest radiograph findings were classified as 0: Normal, 1: Lobar or focal consolidation, 2: Peribronchial reticulonodular infiltration (bronchopneumonia), 3: Ground glass infiltration, 4: Interstitial pneumonia (Linear septal thickening), and 5: Sequellae changes. Lobar and reticulonodular infiltrations were determined as bacterial pneumonia, and ground glass and interstitial infiltration as viral/atypical pneumonia.

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences program version 21.0. The conformity of the variables to the normal distribution was evaluated with Kolmogorov-Smirnov and Shapiro-Wilk tests. Accordingly, it was observed that the variables were not normally distributed. Discontinuous variables were presented as numbers and percentages, and continuous variables as medians and ranges of quarters (IQR). Relationships between parameters in patients with pneumonia were evaluated with Pearson and Spearman correlation analyses. Bonferroni correction and Mann-Whitney U test evaluated MBS scores according to the presence, types, and radiological factors of pneumonia and compared bacterial and viral pneumonia characteristics. A p-value of ≤0.05 was considered statistically significant.

Results

A total of 209 patients were hospitalized during the study period, and 72 (34.4%) diagnosed with pneumonia and underwent MBS were included in the study. 51.4% (n=37) of the study group were male, and the median age was 6.00 years (IQR=9). Demographic characteristics of the cases are shown in **Table 1a**, and the characteristics of caregivers, including sociocultural characteristics, in **Table 1b**. When the primary diagnoses of pneumonia patients were examined, it was observed that 45.8% had neurological, 20.8% had genetic, 15.3% had metabolic, and 18.1% had other diseases. There was lobar pneumonia in 36.1% of the patients, bronchopneumonia in 44.4%, ground-glass appearance in 11.1%, and interstitial pneumonia in 8.3%. According to the radiological evaluation of posteroanterior chest radiography, 80.6% were bacterial, and 19.4% were viral and/or atypical pneumonia. The characteristics of the cases with bacterial and viral pneumonia are presented in **Table 2a** and **Table 2b**. When the MBS score was evaluated in the examination to determine pneumonia types and possible pathogens, it was observed that the severity of dyspnea did not affect determining the pneumonia type and possible pathogen (p=0.613, p=0.948, respectively) (**Table 3**). In patients with pneumonia, no significant relationship was found between the patient's age, laboratory findings, medical device and technological support, the presence of additional neurological diseases, such as epilepsy, length and number of hospitalizations, education and income level of the parents, the number of children cared for by the parents, the working status of the parents and

0- None
1- Very mild
2- Lightweight
3- Medium
4- A little serious
5- Serious
6- More serious
7- Very serious
8- Excess
9- Too much
10-Too much too much

Figure 1. Modified Borg Scale

Table 1a.
Demographic characteristics in patients with pneumonia

Gender **[n (%)]**	
Girl	35 (48.6%)
Boy	37 (51.4%)
Age **[median, (IQR) (1 month-18 years)]**	6.00 (9)
Number of siblings	1.50 (1)
Primary disease **[n (%)]**	
Neurological disease	33 (45.8%)
Genetic disease	15 (20.8%)
Metabolic disease	11 (15.3%)
Other	13 (18.1%)
Pneumonia type **[n (%)]**	
Lober and fokal consolidation	26 (36.1%)
Peribronchial reticulonodular	32 (44.4%)
Ground glass infiltration	8 (11.1%)
Interstitial pneumonia	6 (8.3%)
Clinical diagnose **[n (%)]**	
Bacterial	58 (80.6%)
Viral+atypical	14 (19.4%)
NC (epilepsy) **[n (%)]**	
No	19 (26.4%)
Yes	53 (73.6%)
CVS disease **[n (%)]**	
No	61 (84.7%)
Yes	11 (15.3%)
Respiratory support **[n (%)]**	
Normal	51 (70.8%)
Supported (O_2, CPAP, Home-MV)†	21 (29.2%)
Nutritional support **[n (%)]**	
Normal	17 (23.6%)
Supported (NG, gastrostomy)#	55 (76.4%)
Length of stay **[median, (IQR) day]**	20.50 (25)
Number of hospitalizations **[median, (IQR) year]**	1.00 (2)
Modified Borg Score **[median, (IQR)]**	5.50 (5)

†(O_2; Oxygen support with a mask or nasal cannula, CPAP; Continous positive airway pressure, Home-MV; Home-type mechanical ventilator), IQR; ranges of quarters, #(NG; Nasogastric tube, CVS; Cardiovascular disease, NC; Neurological comorbidity

Table 1b.
Parental characteristics of patients with pneumonia

Parent gender **[n (%)]**	
Female	66 (91.7%)
Male	6 (8.3%)
Parent age **[n (%)]**	
<30	24 (33.3%)
30-40	31 (43.1%)
>40	17 (23.6%)
Parent education **[n (%)]**	
Primary-secondary school	7 (9.7%)
High school-university	65 (90.3%)
Marital status **[n (%)]**	
Single	2 (2.8%)
Married	66 (91.7%)
Divorced-separated	4 (5.6%)
Income status* **[n (%)]**	
≤3000	35 (48.6%)
>3000	37 (51.4%)
Working status **[n (%)]**	
House-wife	58 (80.6%)
Working	14 (19.4%)
Home status **[n (%)]**	
Rent	42 (58.3%)
Own house	26 (36.1%)
With someone else	4 (5.6%)

*It is determined according to the minimum wage in our country

the MBS score (**Table 4**). Correlations determined in patients with pneumonia are presented in **Table 5**.

Discussion

The results of this study, which was performed in patients followed up with a diagnosis of pneumonia in pediatric palliative care unit, revealed that the severity of dyspnea was not related to the type of pneumonia, possible pathogens, chest X-ray and laboratory findings and that MBS was not an indicator for pneumonia.

In our country, according to the Turkey Burden of Disease Study, respiratory tract infections are responsible for 14% of all deaths in the 0-14 age group.[19] In childhood, it has been reported that 29-38% of hospitalized patients for all age groups have pneumonia.[20] Bacterial pathogens are isolated in 2-50% of cases that are followed up with the diagnosis of community-acquired pneumonia.[21,22] While viral agents are determined in 80% of children under the age of two, it is known that viral agents are rare in older children, especially between the ages of 10 and 16.[23] The present study determined pneumonia at a rate of 34.4%, similar to the literature. Pneumonia prevalence was not higher than the general population for the study group in which the patients were hospitalized due to chronic lung disease, neurological diseases, and metabolic diseases such as the pediatric palliative care service.

Dyspnea is the second most common symptom following pain in pediatric palliative care.[8] The relationship of dyspnea to pneumonia in pediatric palliative care patients and children with chronic and complex problems is unknown. Since there was no other scale developed in children in our study, MBS was used similarly to Marquis et al.[24-26] Marquis et al.[24] assigned a nurse to standardize the application of MBS in this patient population, and in our study, MBS was administered by a physical medicine and rehabilitation specialist. In the literature, the predictive value of MBS in terms of hospitalization in pulmonary hypertension was examined, but it was found that it did not predict hospitalization.[27] MBS is a marker in determining mortality associated with pulmonary hypertension in a single study.[28] While the MBS score was 0.51±1.15 at rest in children with cystic fibrosis, it was found to be 2±2.21 after exercise.[29] MBS, which was found to be 4.50±1.93 in asthmatic patients, was reported as 2.57±2.29 in the control group.[30] In our study, the MBS score was determined as 5.50 (IQR=5), indicating severe dyspnea. In patients diagnosed with pneumonia, the severity of dyspnea was not found to be related to the type and cause of pneumonia. In patients diagnosed with pneumonia, the severity of dyspnea was not found to be related to the type and cause of pneumonia. This suggested that pediatric palliative care patients experienced more severe dyspnea than children with other chronic diseases but not associated with pneumonia.

Risk factors for pneumonia include host-related causes, low socioeconomic status, crowded environments, nutritional deficiencies, poor hygiene conditions, and inadequate infrastructure in living areas. Insufficient cough reflex and respiratory muscles make it difficult to clear airway secretions. The absence of a cough reflex is an important risk factor for the development of pneumonia. Our patient group in our study (such as neurological diseases, genetic and cardiac diseases) has an important risk factor that does not have a cough reflex and therefore affects the development, course, and possible complications of pneumonia.[31,32] However, the frequency of pneumonia was not high in our study and patient profile. Malnutrition also increases the severity of pneumonia and mortality. The effect of malnutrition on both protein and vitamin-mineral levels is a risk factor for pneumonia.[33-35] The relationship between vitamin D and zinc (Zn) levels and pneumonia was investigated, and it was revealed that vitamin and mineral deficiencies predispose to pneumonia.[36,37] In our study, we demonstrated a negative relationship between the income level of the family and the intake of nutritional support. Again, we detected a negative relationship between education level and vitamin D levels and a negative relationship between Zn levels in patients with cardiovascular system disease. These different results may have been found in pediatric palliative care patients due to multiple and complex problems. Similarly, we found no difference between sociodemographic characteristics and viral and bacterial types of pneumonia. This may also be due to the small number of our patients. No correlation was found between MBS scores and demographic characteristics. MBS scores were also not different in terms of viral and bacterial types of pneumonia. All these suggested that the severity of dyspnea was independent of pneumonia and sociodemographic features, radiological and laboratory findings.

Table 2a.
Characteristics of patients with bacterial and viral pneumonia[§]

	Bacterial	Viral	p value
Age **[median, (IQR)]**	3.00 (6)	5.00 (7)	0.543
Number of siblings **[median, (IQR)]**	1.00 (1)	1.00 (1)	0.172
WBC **[median, (IQR)]**	12.505 (8.223)	1.0545 (8.838)	0.711
CRP **[median, (IQR)]**	0.20 (4.15)	1.21 (3.68)	0.240
Hemoglobin **[median, (IQR)]**	10.90 (2.0)	11.65 (3.2)	0.472
HTC **[median, (IQR)]**	34.15 (5)	34.50 (10)	0.588
MCV **[median, (IQR)]**	84.00 (9)	84.00 (12)	0.938
PLT **[median, (IQR)]**	294.00 (149)	366.00 (162)	0.153
Zinc **[median, (IQR)]**	66.60 (55.8)	55.85 (-)	0.641
Vitamin D **[median, (IQR)]**	25.30 (23.7)	34.65 (14.8)	0.189
Length of stay **[median, (IQR) (day)]**	14.50 (23)	18.50 (21)	0.881
Number of hospitalizations **[median, (IQR) year]**	1.00 (1)	1.00 (0)	0.166
Gender **[n (%)]** Girl Boy	 28 (80.0%) 30 (81.1%)	 7 (20.0%) 7 (18.9%)	1.000
Respiratory support **[n (%)]** No Yes (CPAP, Home-MV)[†]	 40 (78.4%) 18 (85.7%)	 11 (21.6%) 3 (14.3%)	0.744
Nutricion support **[n (%)]** Normal Supported (NG, gastrostomy)	 13 (76.5%) 45 (81.8%)	 4 (23.5%) 10 (18.2%)	0.728
Cardiovascular disease **[n (%)]** No Yes	 49 (80.3%) 9 (81.8%)	 12 (19.7%) 2 (18.2%)	1.000
Neurologic comorbidity **[n (%)]** No seizure Seizure	 16 (84.2%) 42 (79.2%)	 3 (15.8%) 11 (20.8%)	0.747

[§]Differentiation was made according to radiological evaluation, WBC; White blood cell, CRP; C-reactive protein, MCV; Mean corpuscular volume, HTC; Hematocrit, PLT; Platelet, [†]O_2; Oxygen support with a mask or nasal cannula, CPAP; Continuous positive airway pressure, Home-MV; Home-type mechanical ventilator, NG; Nasogastric tube, IQR; Ranges of quarters

Table 2b.
Characteristics of parents of patients with bacterial and viral pneumonia[§]

	Bacterial	Viral	p value
Parent age **[n (%)]** <30 30-40 >40	 17 (70.8%) 26 (83.9%) 15 (88.2%)	 7 (29.2%) 5 (16.1%) 2 (11.8%)	0.316
Parent gender **[n (%)]** Female Male	 53 (80.3%) 5 (83.3%)	 13 (19.7%) 1 (16.7%)	1.000
Parent education **[n (%)]** Primary-secondary school High school-university	 6 (85.7%) 52 (80.0%)	 1 (14.3%) 13 (20.0%)	1.000
Marital status **[n (%)]** Single Married Divorced-separated	 2 52 (78.8%) 4	 - 14 (21.2%) -	0.454
Income status* **[n (%)]** ≤3000 >3000	 29 (82.9%) 29 (78.4%)	 6 (17.1%) 8 (21.6%)	0.631
Working status **[n (%)]** House-wife Working	 46 (79.3%) 12 (85.7%)	 12 (20.7%) 2 (14.3%)	0.587
Home status **[n (%)]** Rent Own house With someone else	 36 (85.7%) 19 (73.1%) 3 (75.0%)	 6 (14.3%) 7 (26.9%) 1 (25.0%)	0.423

[§]Differentiation was made according to radiological evaluation
*It is determined according to the minimum wage in our country

Table 3.
Relationship between the radiological evaluation of pneumonia cases and MBS[§]

	MBS value		p value
	Median	IQR	
Types of pneumonia **[median, (IQR)]**			
Lobar infiltration	7.00	4	
Bronchopneumonia	6.00	5	0.613
Ground glass infiltration	7.00	3	
Interstitiel pneumonia	5.00	6	
Pathogen **[median, (IQR)]**			
Pneumococcus+bacteria **(=bacterial)**	6.50	5	0.948
Viral+atipical **(=Viral)**	6.50	5	

[§]Differentiation was made according to radiological evaluation
MBS; Modified Borg Scale, IQR; Ranges of quarters

Complete blood count and acute phase reactants do not show a specific finding in diagnosing pneumonia in children. Although infiltrates on chest radiographs support the diagnosis of pneumonia, the diagnostic value of radiological imaging in children is low in the diagnosis and differentiation of bacterial-viral pneumonia.[38,39] Segmental consolidation and lobar consolidation can be evaluated in favor of especially pneumococcal and bacterial infection, while diffuse bronchopneumonia and interstitial appearance can be evaluated in favor of viral and atypical pathogens, but its sensitivity is low.[40-42] In our study, a classification was made similar to the study of Şahin et al.[43] and MBS scores were examined accordingly. Laboratory parameters did not differ in terms of pneumonia and viral-bacterial types of pneumonia. MBS scores and laboratory parameters did not change. This result suggested that the severity of dyspnea was not related to laboratory findings in patients with pneumonia. In our study, when the radiological diagnosis of pneumonia, types, and classification of possible pathogens were examined, it was found that there was no difference in MBS scores of the cases diagnosed with pneumonia clinically. This demonstrated that the severity of dyspnea was not related to the radiological findings in pneumonia. Despite the above-average MBS scores (5.50), the severity of dyspnea in patients diagnosed with pneumonia is not correlated with radiological and laboratory findings.

Study Limitations

This study was a single-center study and may not be generalizable to other centers. In patients diagnosed with pneumonia, the sensitivity and reliability of chest radiography were low in distinguishing between bacterial and viral pneumonia. However, the use of tomography in pediatric patients was avoided due to the radiation effect. Therefore, the study was designed based on direct chest radiography. The MBS has not been validated in our patient population. To our knowledge, there is no approved scale and scoring system for dyspnea for pediatric palliative care patients. The choice of MBS for our study stems from its previous use. It is preferred for patients with a life-threatening disease or at the end of their life because of its ease of use and its representative of reality. Physical therapy and rehabilitation specialist was responsible for scoring. Many patients were not in a position to self-assess their dyspnea. Another limitation is that the study was retrospective, and analgesia and anxiolytics were not given beforehand in order to differentiate pneumonia-related dyspnea.

Table 4.
Correlations of MBS values in patients with pneumonia

		MBS value
Age	r	-0.021
	p	0.864
Number of siblings	r	0.062
	p	0.605
WBC	r	-0.058
	p	0.628
CRP	r	-0.150
	p	0.207
Hemoglobin	r	-0.073
	p	0.542
HTC	r	-0.026
	p	0.827
MCV	r	-0.117
	p	0.327
PLT	r	-0.038
	p	0.753
Zinc	r	-0.185
	p	0.545
Vitamin D	r	-0.101
	p	0.510
Length of stay (day)	r	0.005
	p	0.970
Number of hospitalizations (year)	r	-0.065
	p	0.585
Respiratory support	r_s	0.009
	p	0.941
Nutricion support	r_s	-0.115
	P	0.335
CVS disease	rs	-0.002
	p	0.988
NC (epilepsy)	r_s	0.044
	p	0.716
Parent education	r	0.082
	p	0.493
Parent income	r	0.113
	p	0.345
Parent working status	rs	-0.080
	p	0.503

r; Pearson correlation coefficient, r_s; Spearman correlation coefficient, WBC; White blood cell, CRP; C-reactive protein, MCV; Mean corpuscular volume, HTC; Hematocrit, CVS; Cardiovascular system, NC; Neurological comorbidity, PLT; Platelet, MBS; Modified Borg Scale

Conclusion

The results of this study showed that the severity of dyspnea in patients with pneumonia was not associated with pneumonia and pneumonia type. Although the MBS has use in pediatric palliative care patients, it does not show specificity for pneumonia. Causes of dyspnea

Table 5.
Parameters with significant correlation in patients with pneumonia

		Number of siblings	WBC	CRP	Hemoglobin	HTC	MCV	Zinc	Vitamin D	Respiratory support	Nutrition support	CVS disease	Number of hospitalizations (year)	Parent income
Age	r	**0.305**	-0.018	**0.379**	0.116	0.093	0.187	-0.200	**-0.514**	**-0.321**	**-0.330**	**0.246**	0.043	0.107
	p	**0.009***	0.884	**0.001***	0.331	0.438	0.116	0.512	**0.000***	**0.006***	**0.005***	**0.037***	0.721	0.371
CRP	r	0.021	0.220	1	-0.116	-0.069	0.041	-0.447	-0.268	-0.030	-0.007	0.113	**0.259**	0.122
	p	0.858	0.063		0.332	0.565	0.731	0.125	0.075	0.802	0.957	0.344	**0.028***	0.307
PLT	r	-0.133	**0.243**	0.163	-0.101	-0.034	**-0.347**	-0.127	-0.058	0.047	0.088	-0.200	0.051	-0.008
	p	0.266	**0.040***	0.170	0.398	0.775	**0.003***	0.680	0.704	0.696	0.463	0.092	0.670	0.945
Length of stay (day)	r	-0.020	0.039	0.162	-0.096	-0.052	-0.102	0.016	0.091	0.196	**0.300**	-0.018	**0.758**	**-0.235**
	p	0.868	0.747	0.173	0.421	0.666	0.395	0.959	0.552	0.099	**0.011***	0.880	**0.000***	**0.047***
Respiratory support	r_s	**-0.441**	0.156	-0.160	-0.185	-0.135	-0.013	0.488	**0.438**	1	0.213	0.067	0.184	-0.171
	p	**0.000***	0.191	0.180	0.119	0.257	0.917	0.091	**0.003***		0.073	0.575	0.121	0.152
Nutrition support	r_s	-0.018	0.147	0.040	-0.013	0.003	-0.072	0.356	**0.295**	0.213	1	-0.128	0.235	-0.344
	p	0.879	0.217	0.736	0.916	0.979	0.550	0.232	**0.049***	0.073		0.286	0.047*	0.003
CVS disease	r_s	0.009	**-0.268**	0.076	-0.039	-0.026	0.178	**-0.570**	0.019	0.067	-0.128	1	-0.055	-0.050
	p	0.941	**0.023***	0.527	0.745	0.828	0.136	**0.042***	0.900	0.575	0.286		0.645	0.674
NC (epilepsy)	r_s	0.220	-0.195	-0.004	**0.338**	**0.336**	-0.017	-	-0.015	**-0.240**	0.112	**-0.271**	-0.050	0.174
	p	0.063	0.101	0.975	**0.004***	**0.004***	0.889	-	0.920	**0.043***	0.347	**0.021***	0.679	0.143
Parent education	r	0.094	0.135	0.144	-0.003	-	-0.053	-	**-0.303**	-0.202	-0.182	0.139	0.014	**0.244**
	p	0.433	0.257	0.227	0.977	-	0.658	-	**0.043***	0.089	0.125	0.243	0.904	0.039*
Parent income	r	**0.244**	0.149	0.061	-0.093	-0.060	-0.115	-0.296	-0.134	-0.171	**-0.344**	-0.050	-0.103	1
	p	**0.039***	0.211	0.613	0.437	0.619	0.336	0.326	0.382	0.152	**0.003***	0.674	0.389	
Parent working status	r_s	0.101	0.208	0.158	-0.003	-0.024	-0.137	-0.045	-0.065	-0.006	-0.057	-0.111	0.138	**0.337**
	p	0.397	0.080	0.185	0.978	0.844	0.251	0.885	0.672	0.957	0.632	0.353	0.248	**0.004***

r; Pearson correlation coefficient, r_s; Spearman correlation coefficient, WBC; White blood cell, CRP; C-reactive protein, MCV; Mean corpuscular volume, HTC; Hematocrit, CVS; Cardiovascular system, NC; Neurological comorbidity, PLT; Platelet

other than pneumonia, which is common in pediatric palliative care patients, should be investigated, and treatment should be given for its etiology.

Author Contributions: Harputoğlu N: Concept, design, data collection or processing, analysis or interpretation, literature search, writing; Coşkun M: Concept, data collection or processing, literature search; Çubukçu D: Concept, design, analysis or interpretation; Çelik T: Design, data collection or processing, analysis or interpretation.

Conflict of Interest: There are no conflicts of interest in connection with this paper, and the material described is not under publication or consideration for publication elsewhere.

Ethical Approval: Ethics committee approval for the study was obtained from University of Health Sciences Turkey, İzmir Dr. Behçet Uz Training and Research Hospital Ethics Committee (Approval date:14/01/2021, Approval number: 20). The parents who met inclusion criteria provided verbal and written consent before participating in the study. All study procedures were conducted in accordance with the Declaration of Helsinki and local laws and regulations.

Financial Disclosure: The authors declared that this study received no financial support.

Informed Consent: No conflict of interest was declared by the authors.

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