

## Respiratory Complications in Children with Cerebral Palsy

Al Rawhaa A. Abo Amer, Ahmed A. Sobeih, Heba H. Hekal

Department of Pediatrics,  
Faculty of Medicine Benha  
University, Egypt.

**Corresponding to:** Heba H.  
Hekal, Department of  
Pediatrics, Faculty of Medicine  
Benha University, Egypt.

**Email**  
hebahekal9@gmail.com

**Received:** 17 January 2024

**Accepted:** 11 April 2024

### Abstract

**Background:** Cerebral palsy (CP) is non-progressive brain injuries which is often associated with other neurological and musculoskeletal problems. People with CP are at high risk of respiratory difficulties, such as respiratory failure and recurring infections, which may lead to serious health problems or even death. Examining clinical correlations, risk variables, and the effects on mortality and morbidity. **Aim of the work:** This research aimed to evaluate respiratory issues in one hundred children patients with CP. **Methods:** Patients with CP, ranging in age from six months to sixteen years. In order to assess breathing issues, motor function, developmental milestones, and co-morbidities, thorough patient histories, physical exams, and investigations were carried out. **Results:** Respiratory problems were common in the group, such as difficulty swallowing, repeated episodes of sleeplessness, aspiration, and chest infections. Numerous co-occurring disorders were noted, including epilepsy, delayed development, bone abnormalities, and gastroesophageal reflux disease (GERD). Dysphagia, recurrent infections, gastroesophageal reflux disease (GERD), and seizures were more common in patients with respiratory problems, and they were also more likely to die from these conditions. This group was likewise characterized by aberrant test results and lower anthropometric measurements. **Conclusion:** certain comorbidities are associated with an increased risk of respiratory problems, which in turn increases the risk of morbidity and death in CP patients. In order to improve outcomes for CP patients and reduce the burden of respiratory difficulties, the research highlights the importance of tailored therapies that address dysphagia, recurring infections, and related comorbidities.

**Keywords:** Children; Cerebral Palsy; Respiratory Complications

## Introduction

Cerebral palsy (CP) is an umbrella term for a collection of conditions affecting movement and posture development that are permanent in nature. These disorders are thought to have their roots in non-progressive brain lesions that occurred during foetal or infant brain development and limit movement and posture as a result (1).

At 1.4 per 1,000 live births, CP is rather common. According to the Gross Motor Functional Classification System (GMFCS) for CP, the two most prevalent types of motor disability are hemiplegia and diplegia (2).

In addition to movement abnormalities, CP may cause seizures and secondary musculoskeletal issues, as well as problems with sensation, perception, cognition, communication, and conduct (3).

Diseases of the respiratory system account for the vast majority of CP-related hospitalizations and deaths. Term birth, severe motor impairment, epilepsy, spasticity, and severe intellectual disability are all risk factors for early death (4).

Even though people with CP are living longer than in the past, respiratory failure is still the biggest killer in this group (5). A number of studies have looked at the causes of death in children with CP and found that it could be due to things like aspiration from a

dysfunctional oropharyngea and pneumonia, seizures, GERD, and prior respiratory symptoms, especially those that required antibiotics or hospitalization, but not scoliosis (5, 6).

Recurrent pneumonia and respiratory failure in CP patients with oropharyngeal dysfunction are symptoms of chronic lung illness, according to these variables. It manifests as a severe sensitivity to respiratory infections in the latter stages of life, necessitating extensive hospital stays for oxygen support or non-invasive ventilation on several occasions (6). This could happen to some kids while they're little, but our data shows that it usually doesn't happen until they're teens or young adults. It might happen at the same time that they're switching to adult healthcare, when they might not have as easy access to their regular doctors (7). This study aimed to evaluate the respiratory complications, risk factors, and morbidity and mortality rates of cerebral palsy patients.

## Patients and methods

This study was carried out at Children's Hospital, Benha University, and Al Mabarra Insurance Hospital in Tanta Province.

Enrollment in the research was contingent upon obtaining informed permission from parents and obtaining approval of the study protocol from the ethical scientific committees of Benha

University Hospital and Benha Children's Hospital (Approval Code: MS 26-6-2022).

The study included both male and female participants, ranging in age from 6 months to 16 years, as well as those with cerebral palsy and a history of respiratory issues such as apnea, aspiration, recurrent pneumonia, hyperventilation, or cyanosis.

Children with neurological abnormalities other than CP, children whose parents declined to participate, critically sick children, and patients more than 16 years old or less than 6 months were all excluded.

**Type of study:** Cross section

Here is what all patients went through:

Comprehensive medical history, including past medical conditions, present symptoms, and family history of the same illness fetal medical record, A history of chest infections and symptoms associated with cerebral palsy (dysphagia, irregular swallowing or reflux, delayed developmental delay, kyphoscoliosis, and frequency and severity of fits) (history of regular physiotherapy, used medication, presence of comorbid condition as bed sores, need of any surgeries and frequency of hospitalization and survival).

Using percentiles defined for Egyptian children, anthropometric measures (weight, height, body mass index, and

head circumference), developmental milestones, and vital signs were evaluated during the clinical examination (8).

Comprehensive evaluations, including the cardiovascular system, were also conducted: In order to identify any irregular heartbeats or murmurs. For the purpose of identifying anomalous breath sounds, adventitious noises, and respiratory distress, the respiratory system is used. Organomegaly or ascites may be seen in the gastrointestinal tract (GIT) and the abdomen. Musculoskeletal and Central Nervous System (CNS) evaluations include looking for aberrant movement, signs of meningeal irritation, and an evaluation of the motor system (including power, tone, and reflexes). Assessment of kind of CP.

Levels of CP classification: For a systematic approach to CP classification according to mobility levels, the Gross Motor Function Classification System (GMFCS) is useful. To walk independently without aids is to walk at Level I, while to walk with aids is to walk at Level II (without mobility aid by age 4). Walking with the use of a handheld mobility device is referred to as Level III. Level IV involves limited self-mobility, which may need the use of powered mobility equipment. Level V concludes with those who, because of their mobility issues, must be conveyed by manual wheelchair. Individuals with CP might have a better grasp of their

functional skills and mobility restrictions using this method (9).

A full blood count, C-reactive protein, random blood sugar, arterial blood gases, serum electrolytes (sodium, potassium, and calcium), and a chest x-ray or CT scan are all part of the standard diagnostic workup.

#### Data analysis using statistics

All of the data was entered, coded, and analyzed by computer using software developed by SPSS Inc., Chicago, Illinois, USA (version 24). Tabular and diagrammatic representations of the findings were then used for interpretation. The descriptive statistics that were used were mean, standard deviation, range, frequency, and percentage. For categorical data, the association factors were tested using the Chi-Square test  $X^2$ . In research comprising independent samples with normal distribution, the statistical significance of the difference between two population means was assessed using Student's t-test. We used a 0.05 threshold of significance. A non-significant result is defined as a P value  $> 0.05$  (Levesque, 2005).

## Results

This Hundred individuals hospitalized to Children's Hospital, Benha University, and Al Mabarra Insurance Hospital in Tanta with cerebral palsy were included in the research.

The following conditions were present in 52% of the cases: dysphagia, recurrent apnea attacks (16%), aspiration (42%), history of recurrent chest infections (53%), gastroesophageal reflux disease (GERD) (52%), bone deformity (40%), epilepsy (61%), delayed development (all cases), and a history of PICU admission (59%).  $2.3 \pm 1.1$  times was the average number of hospitalizations in the group that was examined in the last year (ranged from once to 4 times). In addition, 53% of patients had fever, 52% coughed, 24% grunted, 32% had tachypnea, 11% aspirated, 32% had increased secretions and sputum, and 52% convulsed. **Table 1**

In the study, the average weight percentile was  $12.2 \pm 8.6$ , the average height percentile was  $14.8 \pm 8.1$ , the average body mass index percentile was  $11.9 \pm 9.1$ , and the average head circumference was  $15.1 \pm 8.5$ . In the group that was studied, the average hemoglobin level was  $9.4 \pm 1.5$  mg/dl, white blood cell count was  $9.7 \pm 7.1 \times 10^3/L$ , platelet count was  $190.3 \pm 88.2 \times 10^3/L$ , random blood sugar level was  $107.2 \pm 21.1$  mg/dl, sodium level was  $137.3 \pm 6.5$  mEq/L, potassium level was  $4.5 \pm 0.6$  mEq/L, and ionized calcium level was  $1.06 \pm 0.17$  mmol/L. Among the cases, 73% tested positive for CRP, 44% had respiratory acidosis, 40% had metabolic acidosis, and 16% had normal ABG.

Whereas 29% of patients did not have respiratory problems, 60% did have

pneumonia, 8% had pleural effusion, and 3% had pneumothorax. In 67% of instances, nasal O<sub>2</sub> was necessary, 4% required CPAP, and 11% required MV. On average, patients spent 12.4±5.8 days in the hospital. Additionally, 7% of patients passed away within the research period. **Table 2**

Rates of dysphagia, recurrent apnea episodes, recurrent aspiration, recurrent chest infections, GERD, epilepsy, history of prior admission to the PICU, and hospitalization during the past year were significantly higher in patients with respiratory complications compared to those without these complications. Patients with and without respiratory problems were not significantly different in terms of bone deformation. **Table 2**

Compared to patients without respiratory difficulties, those with these issues were more likely to have GMFCS and have poor physiotherapy compliance. Patients with and without respiratory difficulties did not vary significantly based on CP

type, aberrant movement, tone and reflexes, medication, or surgery. In comparison to patients who did not have respiratory difficulties, those who did had significantly lower body mass indexes, heights, and weights. **Table 3**

However, when looking at HC percentiles, there was no discernible difference between patients who had respiratory difficulties and those who did not. In comparison to individuals without respiratory problems, those with these issues had significantly lower platelet counts, higher white blood cell counts, and abnormalities in CPR tests. Hemoglobin, random blood sugar, potassium, sodium, and ionized calcium levels did not change significantly between patients with and without respiratory problems. When compared to individuals without respiratory problems, those with these issues tended to remain in the hospital for longer, required oxygen support more often, and died at a greater rate. **Table 4**

**Table 1:** Clinical characteristics of the studied group.

Associated symptoms		Cerebral palsy patients	
		N=100	%
Dysphagia	No	48	48.0%
	Yes	52	52.0%
Recurrent apnea attacks	No	84	84.0%
	Yes	16	16.0%
Recurrent aspiration	No	58	58.0%
	Yes	42	42.0%
Recurrent chest infection	No	47	47.0%
	Yes	53	53.0%
GERD	No	48	48.0%
	Yes	52	52.0%
Bone deformity	No	60	60.0%
	Yes	40	40.0%
Epilepsy	No	39	39.0%
	Yes	61	61.0%
Development	Normal	0	0.0%
	Delayed	100	100.0%
History of previous PICU admission	No	41	41.0%
	Yes	59	59.0%
Frequency of hospitalization during the last year	Mean $\pm$ SD	2.3 $\pm$ 1.1	
	Range	1-4	
Fever	No	47	47.0%
	Yes	53	53.0%
Cough	No	48	48.0%
	Yes	52	52.0%
Grunting	No	76	76.0%
	Yes	24	24.0%
Tachypnea	No	68	68.0%
	Yes	32	32.0%
Aspiration	No	89	89.0%
	Yes	11	11.0%
Increase secretions and sputum	No	68	68.0%
	Yes	32	32.0%
Convulsions	No	48	48.0%
	Yes	52	52.0%

Gastroesophageal reflux disease, or GERD,

**Table 2:** Anthropometric measurements, some laboratory investigations clinical characteristics of the studied group.

		<b>Cerebral palsy patients</b>	
		<b>N=100</b>	<b>%</b>
<b>Weight percentile</b>	<b>Mean ±SD</b>	12.2±8.6	
	<b>Range</b>	3 <sup>rd</sup> -50 <sup>th</sup>	
<b>Height percentile</b>	<b>Mean ±SD</b>	14.8±8.1	
	<b>Range</b>	3 <sup>rd</sup> -50 <sup>th</sup>	
<b>BMI percentile</b>	<b>Mean ±SD</b>	11.9±9.1	
	<b>Range</b>	3 <sup>rd</sup> -50 <sup>th</sup>	
<b>HC percentile</b>	<b>Mean ±SD</b>	15.1±8.5	
	<b>Range</b>	3 <sup>rd</sup> -50 <sup>th</sup>	
<b>Hemoglobin (mg/dl)</b>	<b>Mean ±SD</b>	9.4±1.5	
	<b>Range</b>	7-11	
<b>WBCs (x10<sup>3</sup>/L)</b>	<b>Mean ±SD</b>	9.7±7.1	
	<b>Range</b>	2.3-24.1	
<b>Platelets (x10<sup>3</sup>/L)</b>	<b>Mean ±SD</b>	190.3±88.2	
	<b>Range</b>	45-455	
<b>Random blood sugar (mg/dl)</b>	<b>Mean ±SD</b>	107.2±21.1	
	<b>Range</b>	47-145	
<b>Sodium (mEq/L)</b>	<b>Mean ±SD</b>	137.3±6.5	
	<b>Range</b>	123-153	
<b>Potassium (mEq/L)</b>	<b>Mean ±SD</b>	4.5±0.6	
	<b>Range</b>	3.1-5.9	
<b>Ionized calcium (mmol/L)</b>	<b>Mean ±SD</b>	1.06±0.17	
	<b>Range</b>	0.7-1.3	
<b>CRP</b>	<b>Negative</b>	27	27.0%
	<b>Positive</b>	73	73.0%
<b>ABGs</b>	<b>Normal</b>	16	16.0%
	<b>Respiratory acidosis</b>	44	44.0%
	<b>Metabolic acidosis</b>	40	40.0%
<b>Respiratory complications</b>	<b>None</b>	29	29.0%
	<b>Pneumonia</b>	60	60.0%
	<b>Pleural effusion</b>	8	8.0%
	<b>Pneumothorax</b>	3	3.0%
<b>Oxygen support</b>	<b>No</b>	18	18.0%
	<b>Nasal O2</b>	67	67.0%
	<b>CPAP</b>	4	4.0%
	<b>MV</b>	11	11.0%
<b>Length of hospital stay/days</b>	<b>Mean ±SD</b>	12.4±5.8	
	<b>Range</b>	2-25	
<b>Mortality during study period</b>	<b>Survived</b>	93	93.0%
	<b>Died</b>	7	7.0%

The acronyms BMI, HC, WBC, CRP, and ABG stand for "white blood cells," "arterial blood gases," and "C-reactive protein." CPAP stands for mechanical ventilator and MV for continuous positive airway pressure.

**Table 3:** comparison between patients with and without respiratory problems regarding cerebral palsy symptoms and criteria.

		Respiratory complications				Test	P value
		Yes N=71	%	No N=29	%		
<b>Dysphagia</b>	No	19	26.8%	29	100.0%	X <sup>2</sup> =13.4	<0.001*
	Yes	52	73.2%	0	0.0%		
<b>Recurrent apnea attacks</b>	No	55	77.5%	29	100.0%	X <sup>2</sup> =8.7	<0.001*
	Yes	16	22.5%	0	0.0%		
<b>Recurrent aspiration</b>	No	29	40.8%	29	100.0%	X <sup>2</sup> =9.8	<0.001*
	Yes	42	59.1%	0	0.0%		
<b>Recurrent chest infection</b>	No	18	25.3%	29	100.0%	X <sup>2</sup> =14.1	<0.001*
	Yes	53	74.7%	0	0.0%		
<b>GERD</b>	No	19	26.8%	29	100.0%	X <sup>2</sup> =13.4	<0.001*
	Yes	52	73.2%	0	0.0%		
<b>Bone deformity</b>	No	43	60.6%	17	58.6%	X <sup>2</sup> =0.14	0.91
	Yes	28	39.4%	12	41.4%		
<b>Epilepsy</b>	No	27	28.2%	19	65.5%	X <sup>2</sup> =3.7	0.004*
	Yes	51	71.8%	10	34.5%		
<b>History of previous admission of PICU</b>	No	20	28.2%	21	72.4%	t=16.6	<0.001*
	Yes	51	71.8%	8	27.6%		
<b>Frequency of hospitalization during last year</b>	Mean ±SD	2.5±1.1		1.8±0.9		t=2.9	0.007*
	Range	1-4		1-3			
<b>Type of CP</b>	Spastic quadriplegia	48	67.6%	20	68.9%	X <sup>2</sup> =2.9	0.22
	Ataxia	3	4.2%	4	13.8%		
	Dyskinetic dystonic	4	5.6%	1	3.4%		
	Mixed	16	22.5%	4	13.8%		
<b>GMFCS</b>	I, II, III	9	12.7%	22	75.9%	X <sup>2</sup> =11.6	<0.001*
	IV, V	62	87.3%	7	24.1%		
<b>Abnormal movements</b>	No	40	56.3%	19	65.5%	X <sup>2</sup> =0.98	0.43
	Yes	31	43.7%	10	34.5%		
<b>Tone and reflexes</b>	Normal	0	0.0%	4	13.8%	X <sup>2</sup> =5.3	0.06
	Hypertonia & hyperreflexia	61	85.9%	15	51.7%		
	Hypotonia & hyporeflexia	10	14.1%	10	34.5%		
<b>Medications</b>	Anticonvulsants	51	71.8%	10	34.5%	X <sup>2</sup> =5.9	0.12
	Anti GERD	40	56.3%	12	41.4%		
	Vitamins	71	100.0%	29	100.0%		
	Oxygen therapy at home	9	12.7%	0	0.0%		
	Nebulizers	21	29.6%	0	0.0%		
<b>Compliance to Physiotherapy</b>	Bad	20	28.2%	0	0.0%	X <sup>2</sup> =15.2	<0.001*
	Partial	44	61.9%	11	37.9%		
	Complete	7	9.9%	18	62.1%		
<b>Surgery</b>	None	67	94.4%	25	86.2%	X <sup>2</sup> =1.7	0.18
	Gastrostomy	4	5.6%	4	13.8%		

T: Student t-test, X<sup>2</sup>: chi-square test, \*: significant, "GMFCS" stands for "Gross Motor Function Classification System," while "GERD" stands for "Gastroesophageal reflux disease."



**Table 4:** Comparison between patients with and without respiratory problems regarding anthropometric data, laboratory examinations, and outcome

		Respiratory complications				Test	P value
		Yes		No			
		N=71	%	N=29	%		
Weight percentile	Mean $\pm$ SD	11.3 $\pm$ 9.1		15.8 $\pm$ 7.8		t=3.2	<0.001*
	Range	3 <sup>rd</sup> – 50 <sup>th</sup>		3 <sup>rd</sup> – 50 <sup>th</sup>			
Height percentile	Mean $\pm$ SD	12.9 $\pm$ 8.5		16.2 $\pm$ 7.9		t=3.8	<0.001*
	Range	3 <sup>rd</sup> – 50 <sup>th</sup>		3 <sup>rd</sup> – 50 <sup>th</sup>			
BMI percentile	Mean $\pm$ SD	10.4 $\pm$ 10.3		14.8 $\pm$ 9.5		t=4.1	<0.001*
	Range	3 <sup>rd</sup> – 50 <sup>th</sup>		3 <sup>rd</sup> – 50 <sup>th</sup>			
HC percentile	Mean $\pm$ SD	13.3 $\pm$ 9.7		14.8 $\pm$ 10.2		t=1.31	0.09
	Range	3 <sup>rd</sup> – 50 <sup>th</sup>		3 <sup>rd</sup> – 50 <sup>th</sup>			
Hemoglobin (mg/dl)	Mean $\pm$ SD	8.3 $\pm$ 1.3		8.7 $\pm$ 1.9		t=1.1	0.39
	Range	7.2-11.4		7-11.5			
WBCs (x10 <sup>3</sup> /L)	Mean $\pm$ SD	11.8 $\pm$ 7.3		4.5 $\pm$ 2.4		t=5.2	<0.001*
	Range	2.3-24.1		3-8			
Platelets (x10 <sup>3</sup> /L)	Mean $\pm$ SD	153.4 $\pm$ 78.9		244.3 $\pm$ 83.1		t=2.9	0.002*
	Range	45-340		75-313			
Random blood sugar (mg/dl)	Mean $\pm$ SD	113.5 $\pm$ 22.1		118.7 $\pm$ 13.6		t=1.2	0.11
	Range	45-167		52-145			
Sodium (mEq/L)	Mean $\pm$ SD	136.5 $\pm$ 6.7		139.5 $\pm$ 5.7		t=0.77	0.53
	Range	123-143		127-145			
Potassium (mEq/L)	Mean $\pm$ SD	4.5 $\pm$ 0.6		4.3 $\pm$ 0.5		t=0.33	0.72
	Range	3.1-5.9		3.3-5.6			
Ionized calcium (mmol/L)	Mean $\pm$ SD	1.09 $\pm$ 0.16		1.04 $\pm$ 0.18		t=0.9	0.48
	Range	0.77-1.3		0.7-1.3			
CRP	Negative	6	8.4%	21	72.4%	X <sup>2</sup> =15.2	<0.001*
	Positive	65	91.6%	8	27.6%		
ABGs	Normal	3	4.2%	13	44.8%	X <sup>2</sup> =25.6	<0.001*
	Respiratory acidosis	37	52.1%	7	24.1%		
	Metabolic acidosis	31	43.7%	9	31.0%		
Oxygen support	No	0	0.0%	18	62.1%	X <sup>2</sup> =15.6	<0.001*
	Nasal O2	56	78.8%	11	37.9%		
	CPAP	4	5.6%	0	0.0%		
	MV	11	15.5%	0	0.0%		
Mortality during study period	Survived	64	90.1%	29	100.0%	X <sup>2</sup> =3.9	0.041*
	Died	7	9.9%	0	0.0%		
Length of hospital stay/days	Mean $\pm$ SD	13.4 $\pm$ 7.6		9.8 $\pm$ 5.6		t=3.7	<0.001*
	Range	5-25		2-25			

Body mass index (BMI), head circumference (HC), chi-square test (X<sup>2</sup>), and student t-test (t): t-test for students, (\*) important ABGs stand for arterial blood gases, WBCs for white blood cells, and CRP for C-reactive protein. CPAP stands for continuous positive airway pressure.

## Discussion

This research set out to examine the variables that put cerebral palsy patients at risk for respiratory difficulties, as well as the impact of these issues on the morbidity and death rates of these patients.

Our findings were in line with those of previous research that looked at the causes of cerebral palsy in children. That study included 210 children with CP who had physical therapy or rehabilitation treatments, and out of

those 210, 43.3% were female and 56.7% were male. The children's average age was 67.4 weeks (SD = 50.6) (10).

Similar to other study (11), which investigated cerebral palsy risk factors, kinds, and neuroimaging results in youngsters, The research comprised 89 patients in all; 27 were female and 62 were male, or 69.7 percent and 30.3 percent, respectively. There was a mean age of  $4.4 \pm 2.8$  years.

When it came to the reason for hospitalization, our findings were consistent with research performed by a group of researchers (12), which included 1200 children with CP. Their analysis revealed that 62.0 percent of admissions were due to respiratory illnesses, epilepsy, and pneumonia.

We found similar findings to a study done in 2020 (13), which found that 82% of CP children had swallowing problems and 66% had gastroesophageal reflux illness, both of which are symptoms associated with cerebral palsy. In a similar research, (18) it was observed that dysphagia symptoms were shown in 41 out of 61 children investigated, and that 25 of those cases involving solely the oral phase and mild to severe dysarthria.

In addition, the majority of children (93.8%) had experienced difficulties with the oral phase when eating, drinking, or managing their saliva, as shown in the study *Benfer et al.* (14). (78.5 percent with modified cut-points). Declining gross motor function was linked to directly measured oral phase deficits; all children from GMFCS II-V had these impairments, and the risk of oral phase impairment was two times higher in GMFCS I children compared to TD children (OR = 2.0,  $p = 0.18$ ). The most prevalent impairments when it

came to solids were chewing (65 percent), biting (70 percent), and cleaning behaviors (70 percent). As for fluids, 60 percent of people had trouble drinking from a cup.

These findings are in line with those obtained previously (15), where it was found that the majority of the children surveyed suffered from spastic CP (78.0 percent), with over half of those children being categorized as level IV (21.4 percent) or level V (38.4 percent) in the GMFCS. Sixty percent of patients reported difficulties with speech, 56.6% with learning deficits, and 56.0% with gastrointestinal issues as comorbidities (50.9 percent).

Also, according to the recent study done in 2022 (11), the most prevalent kind of cerebral palsy is spastic variety, which affects 53.9% of cases. Other common forms are spastic diplegia (18%), spastic hemiplegia (10.1%), spastic monoplegia (1.1%), ataxic (4.5%), dyskinetic (2.2%), and hypotonic (10.1%) cases.

Our findings corroborated those of a previous study (16), that examined the anthropometric evaluation of cerebral palsy patients and found that 86% of those patients had a weight that was below the 50th percentile, and that 51% had a weight that was below the 10th percentile.

There were 38 underweight participants in the overall group in the study (47.5 percent), with 9 (26.5 percent) in the mild motor impairment (MMI) group and 29 (63.0 percent) in the severe motor impairment (SMI) group, indicating a substantially higher rate ( $\chi^2 = 11.55$ ;  $df = 2$ ,  $p < 0.01$ ).

Compared to a previous study (17), which comprised 53 children with a cerebral palsy diagnosis, our findings from laboratory studies were consistent. Sixty percent of the patients had anemia,

with the majority experiencing moderate instances (90.3 percent).

A hemoglobin level of 11.48 mg/dl, platelet count of  $301.24 \times 10^9/L$ , and white blood cell count of  $11.13 \times 10^9/L$  were recorded in that research (18). The prevalence of anemia was higher in boys under the age of nine years. Fourteen individuals, or 4.96%, out of 282 patients, had platelet counts below  $150 \times 10^9/L$ .

We found similar findings to others (19), who found that 64.4% had infiltration on the right middle lobe, 40.5% on the left lingula, and 11.9% on the left lower lobe in terms of respiratory problems. The results showed atelectasis in 62.5% of the thorax CT scans, bronchiectasis in 12.5%, pleural effusion in 1%, and pneumothorax in 0.3%.

This, however, contradicts prior researches (20 and 21), which found that mobility decreases with age in moderate to severe CP, which in turn increases the risk of swallowing problems and respiratory illness. Nevertheless, it would be beneficial for more studies to examine the impact of ageing on respiratory illnesses in children, given these studies only involved adults and young people without children.

Our findings corroborated those of other study (22) that found dysphagia and seizures to be the most significant modifiable variables. One of the leading causes of mortality is aspiration pneumonia. Dysphagia, uncontrolled seizures, GERD, and excessive drooling are the primary causes of aspiration.

In a similar study (23), patients reported an increase in hospitalizations when they had feeding difficulties (RR 1.20 95 percent CI 1.13 to 1.27), cortical visual difficulties (RR 1.22 95 percent CI 1.13 to 1.32), cognitive difficulties (RR 1.16

95 percent CI 1.04 to 1.30), or communication impairment (RR 1.26 95 percent CI 1.10 to 1.44).

Our findings corroborated those who found no statistically significant relationship between scoliosis and respiratory disease (24). This contradicts the findings of other valuable researches (25), which found that CP patients often had both scoliosis and respiratory illness when they pass away.

Consistent with the findings reported before (22), we found that CP patients with a Gross Motor Function Classification System Level V were more likely to have respiratory disease. In a similar study by (26), it was shown that being categorized as Gross Motor Function Classification System (GMFCS) IV or V, as opposed to GMFCS I, was a risk factor for respiratory-related hospital admissions [OR = 4.37 (2.90-6.58),  $p < 0.0001$ ; OR = 11.8 (7.69-18.10),  $p < 0.0001$ , respectively].

In a similar study (16), it was noted that 50% of the participants had anthropometric data below the 10th percentile, and that digestive indications were more common in those people.

The study's limitations include its small sample size, which prevented a more accurate analysis, and the fact that it did not survey the whole population but just the CP population that needed hospital admission during the research period.

## Conclusion

Respiratory Comorbidities have a substantial influence on the morbidity and death rates of CP patients. Certain comorbidities have been linked to an increase in respiratory problems. In order to improve outcomes for CP patients and reduce the burden of respiratory difficulties, the research

highlights the importance of tailored therapies that address dysphagia, recurring infections, and related comorbidities.

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**To cite this article:** Al Rawhaa A. Abo Amer, Ahmed A. Sobeih, Heba H. Hekal. Respiratory Complications in Children with Cerebral Palsy. *BMFJ* 2024;41910:233-245.