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Correlation between Pulmonary Function and Functional Activity Level on Cerebral Palsy Children

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Abstract:
Purpose: is to investigate and emphasize the relationship between lung performance and the functional activity level in CP cases.
Patients and Methods: The pulmonary rater of one hundred CP children, twenty-nine boys, and seventy-one girls, was assessed using PC-based ultrasonic spirometry (Spiro-Sonic FLO). The pediatric outcome data collection instrument was also employed to evaluate the functional activity of the participants. Importantly, the Pearson correlation coefficient was used to evaluate the ratio mismatch between the forced expiratory volume one (FEV1), forced vital capacity (FVC), and PODCI subscales.
Results: The results showed a direct relationship between pulmonary function and functional activity level in the cases of CP children.
Conclusion: In the cases of CP children, pulmonary function is directly correlated to functional activity level.
Keywords: Pulmonary Function, Functional Activity Level, Cerebral Palsy Children

1.Introduction:

Cerebral palsy is a commonly recognized physical disorder among children. CP cases are more likely than healthy ones to have respiratory dysfunction. Among the most prevalent symptoms are; recurrent chest infections, bronchiectasis, atelectasis, sleep apnea, and chronic pulmonary complications. Aspiration and drooling are linked to the highest potential hazard of expected medical complications and death rate (1).

Kwon & Lee (26) made a comparison of CP children and normal ones based on respiratory pressure and lung performance criteria. As a result, CP cases suffer from dysfunction in breathing and lung pressure issues (6).

Mutlu et al. (7) examined the correlation between disability, activity restriction, and

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restrictions in CP children, and discovered that activity and participation restriction are linked to disability.

Pulmonary function testing (PFT) is a non-invasive test that shows how well your lungs are functioning. The critically analyzed and interpreted information provides objective evidence of the patient's current respiratory function and can also be used for follow-up care of the patient being treated (Ray&Biswas) (8).

Children with cerebral palsy are expected to suffer from sleep apnea, atelectasis, pneumonia, bronchiectasis, and chronic disruptive pulmonary complications. Furthermore, Patients with CP are at a higher risk of facing restrictive lung problems. Subsequently, a lack of pulmonary reserve, drooling, aspiration, gastric reflux, impaired airway clearance, and the lack of nutritional status all boost the possibility of having possible respiratory disorders (11).

Kwon & Lee (6) discovered that CP children who had impaired motor function had lower vital capacity and weaker breathing muscles (9). In CP children aged 2 to 18, the PODCI, PedsQL, and CHQ PF-50 scales are trustworthy, accurate, and sensitive. Moreover, Dilbay et al. (10) investigated the reliability and accuracy of measures used to evaluate health-related issues and functional health status in CP cases (10).

The major objective of the current study is to trace the correlation between pulmonary performance and the functional activity level in CP children.

2.Patients and Methods

2.1. Study participants and recruitment criteria:

A total of one hundred hemiplegic children were enrolled in the study (29 male and 71 female). Their average age was 12.240.97 years, their average body weight was 45.66.7 pounds, and their average height was 134.299.98 inches. They were selected from the Kafrelsheikh University Faculty of Physical Therapy’s outpatient clinic, and Kafrelsheikh University Pediatric Hospital's Department of Physical Therapy. The participants must all possess the following characteristics:

(1) Pediatricians specializing in Pediatric Neurology have provided the diagnosis of spastic hemiplegic CP.

(2) Based on Ashworth’s modified scale, spasticity’s grades varied from 1 to 2 (MAS).

(3) Children were able to take in and follow the verbal orders and instructions that were included as part and parcel of the test.

Before their children were included in the trial, all patients’ parents were asked to sign a written consent form. All of the participants were weighed and measured using a height and weight scale that can measure up to 1.9m in height and 160kg in weight. All participants had their pulmonary function assessed using a digital ultrasonic spirometer with USB and were asked to complete a pediatric outcome data collection instrument (PODCI) adolescent self-report questionnaire.

2.2. Materials:

(1) Height and weight scale.

(2) Modified Ashworth scale (MAS).

(3) PC-based ultrasonic spirometry (Spiro- Sonic FLO): is such a highly reliable spirometer used to evaluate and test pulmonary performance. Spiro-Sonic FLO, when combined with the Spiro Reporter software, is a valuable tool for screening COPD and monitoring asthma and other chronic respiratory disorders.

Also, Spiro-Sonic FLO automatically calibrates itself before each measurement using half-duplex single path digital ultrasonic flow measurement. The device has no moving parts and a continuous flow tube, making disinfection quick and straightforward. Because of its incredibly low flow resistance, the Spiro-Sonic FLO is ideal for diagnosing children, the elderly, and sick patients.

Arvedson & Clin (4), Adolescent self-report using the Pediatric Outcome Data Collection Instrument (PODCI): In children’s orthopedics, a questionnaire is used to measure functional results.

A committee was formed by the Pediatric Orthopedic Society of North America to design the layout. The AAOS/POSNA Outcomes Instrument is another name for the questionnaire. This tool, as well as the grading methodology, are free of charge and are provided through the website of the American Academy of Orthopedic Surgeons.

Upper extremity functionality, transfers, and basic mobility, sports and physical function, comfort/pain, global function, and the satisfaction rate with one's physical state are all investigated to work as functional qualities. The score for each dimension runs from 0 to 100, with 100 signifying the highest level of function or enjoyment. The PODCI questionnaire was a reliable instrument for assessing function in pediatric orthopedic groups in the past. In the adolescent self- report, patients were asked to answer 83 questions to get the full picture of the survey.

3.Statistical Analysis:

Subjects' gender, age, body weight, body height, FEV_1, FVC, FEV1/FVC ratio, and findings for all PODCI subscales were defined using descriptive analysis. Pearson correlation was used to determine the relationship between the FEV_1/FVC ratio and PODCI subscales.

4.Results

The current study was conducted on one hundred hemiplegic children (29 male and 71 female). Their mean age was 12.24 ± 0.97- year, with an average bodyweight of 45.6 ± 6.8 and height of 134.29 ± 9.98. The mean value and standard deviation of FEV_1 were 1.27 ± 0.102, FVC was 1.82 ± 0.108, FEV_1/FVC ratio was 0.695 ± 0.024, upper extremity functioning was 62.13 ± 11.113, transfers and basic mobility was 84.65 ± 14.583, sports and physical function was 29.76 ± 10.782, comfort/pain was 69.42 ± 6.6451, global function (an average of the four preceding calculations) was 35.71 ± 3.959, and happiness with the physical condition was 61 ± 18. 573 **Table (1)**.

Table (2) shows the results of Pearson correlation between the ratio of FEV_1/FVC and the six components of PODCI adolescent self-report that shows a noticeably negative relation at the 0.01 level (2-tailed) between FEV_1/FVC ratio and the six components of PODCI adolescent self-report

Table(1):Descriptive Statistics for pulmonary function test and PODCI subscales

	N	Mean	Std. Deviation
FEV1	100	1.27	0.102
FVC	100	1.8221	0.108
Ratio	100	0..695	0.024
GB	100	35.71	3.959
USE	100	62.13	11.113
TB	100	84.65	14.583
SP	100	29.76	10.782
PC	100	69.42	6.6451
HP	100	61	18.573
Valid N (listwise)	100		

5.Discussion

This study has traced the correlation between pulmonary function and activity level in 100 (29male and 71female) spastic hemiplegic cerebral palsy children selected from the Kafrelsheikh University, Faculty of Physical Therapy's Outpatient Clinic, Kafrelsheikh University. Also, the participants were nominated from the Department of Physical Therapy, Kafrelsheikh University Pediatric Hospital.

The children's average age was 12.240.97 years, their bodyweight was 45.66.8, and their height was 134.299.98. They were tested for pulmonary function using PC-based ultrasonic spirometry (Spiro-Sonic FLO), from which data about FEV_1, FVC, and the ratio between FEV_1 and FVC were gathered, and PODCI adolescent self-report was used to evaluate functional activity.

Pearson correlation was used to determine the relationship between the FEV_1/FVC ratio and PODCI subscales. The findings revealed a link between lung function and exercise level.

In pathologic settings, a decrease in physical activity may result in the outgrowth of peripheral muscle abnormalities and malfunction due to muscular weakening and increased muscle fatigue.

Aboudrar et al. (13), Riley et al. (14), Tyml & Mathieu- Costello (15), Previous studies in children with neurological illnesses discovered a relationship between respiratory function, muscle strength, and the number of daily living activities or functional exercise capacities.

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Table (2): Correlations between FEV1/FVC and six components of PODCI

		F	USE	TB	SP	PC	HP
FEV1/FVC	Pearson Correlation	-0.758 -**	-0.758 -**	-0.734 -**	-0.798 -**	-0.717 -**	-0.757 -**
	Sig. (2-tailed)	> 0.0001	>0.0001	>0.0001	>0.0001	>0.0001	>0.0001
	N	100	100	100	100	100	100

****. Correlation is crystal clear at the 0.01 level (2-tailed).**

Subsequently, the findings were consistent with the findings of much other research, indicating that a drop-in functional activity as a result of aberrant movement and ambulatory function could be the cause of decreased respiratory ability. Physical fitness, such as cardiovascular fitness, has been linked to respiratory function (19-20). Respiratory muscles, lung parenchymal tissue, and airway structures necessitate both active physical activity and optimum motor development in children.

According to the study's findings, a decrease in GMFCS-defined functional motor ability is related to respiratory function and respiratory muscle fatigue. As a result, in CP cases who are less active, a thorough examination of respiratory ability and concomitant muscular functionality is urgent and highly recommended (12,13,14,15).

Importantly, because the FEV_1, FVC, and FEV_1/FVC ratios are calculated using maximal expiratory effort as a surrogate for expiratory muscle power, they tend to be vital measurements for diagnosing lung medical complications. The mentioned metrics are pretty significant in integrated respiratory function measurements (15).

Moreover; previous research has indicated that pulmonary performance in CP children exhibited both limiting and disruptive lung illnesses characteristics. Subsequently, the FEV_1, FVC, and PEF were employed as outcome metrics in the study.

CP patients, particularly those with improper functions, have breathing disorders, paradoxical breathing, and decreased breathing volume. These findings can result in severe micro-atelectasis and a decrease in lung dispensability. Respiratory problems are the major source of medical problems and diseases in CP cases.

Subsequently, many significant trials targeted improving respiratory function as it a process for CP children. Prior research has found that various exercise programs have positive benefits on vital capacity (VC). The impact of respiratory practice on CP patients was infrequently documented. FRT resulted in considerable increases in FEV_1 and FVC.

Prior controlled research by Lee et al. (16,17,18,19,20,21,22,23,24,25), CP Patients who have poor functional activity are the most vulnerable to medical consequences. As a result, in the therapy process, strategies and trials to improve respiratory functioning should be considered (12).

Previous research found that pulmonary function in CP children comprised intrusive and restricting lung disease characteristics. As a result, FVC, FEV_1, FEV_1/FVC, and MMEF were all taken into account in the current should be an integral part of the treatment investigation.

Conclusion:

To conclude, pulmonary function is directly connected to ehtfunctional activity level in spastic hemiplegic cerebral palsy children. Futuristic work and research are urgently needed to figure out the outcomes of respiratory medical training in the cases of spastic cerebral palsy.

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