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Impact of Physiotherapy on Vital Signs and Blood Gases in COVID-19 Patients

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ABSTRACT

Background: The severe acute respiratory syndrome (SARS), the Middle East respiratory syndrome, and the common cold are all diseases that can be brought on by the coronavirus family of viruses (MERS). A disease epidemic that began in China was linked to a novel coronavirus in 2019. A person's quality of life is impacted by Corona Virus Disease 2019 (COVID-19), which also raises the rate of morbidity and mortality. The chance of developing a major disease from COVID-19 rises with age in older adults. A major sickness may be more likely to strike those who already have underlying medical issues.

Objectives: The purpose of the current study is to objectively evaluate the effect of physiotherapy therapy on COVID-19 patients.

Patients and methods: A total of 60 COVID-19 patients were included, with ages ranging from 46–55 years, and were divided into two age-and-sex-matched groups. They were divided into two groups; A and B (intervention and control), of an equal number of patients, each 30. Both groups received their COVID-19 medical treatment. In addition, group A received a physiotherapy protocol, 3 times per week for 2 weeks as a total period of treatment. Vital signs and blood gases were measured before and after the study. **Results**: There was a statistically significantly higher post-intervention O2 saturation and PaO2 in group A vs. group B, and a statistically significantly higher post-intervention PaCO2 in group B vs. group A. There was no statistically significant difference in all other parameters (systolic blood pressure, diastolic blood pressure, HCO3, PH, heart rate, or respiratory rate).

Conclusion: For COVID-19 patients, the physiotherapy therapy PT protocol is an effective, noninvasive, and safe method.

Keywords: COVID-19, Physiotherapy therapy, Blood gases, Vital signs.

INTRODUCTION

Hospitalizations for pneumonia with multi-organ illness brought on by the coronavirus disease 2019 (COVID-19) pandemic have been reported to have increased significantly over night [(1)]. Due to its widespread infectivity and high rate of contagion, the disease was given the designation coronavirus disease 2019 (COVID-19) by the World Health Organization [(2)].

Coronavirus, which is a member of the Nidovirales order of the Coronaviridae family, is divided into four genera: α-, β-, γ-, and δ- CoV. α- and β- CoVs. Only mammals can contract γ- and δ CoVs, yet CoVs mostly infect birds. The Middle East respiratory syndrome-related coronavirus (MERS-CoV), SARS-CoV, α -CoVs (229E and NL63), β -CoVs (OC43 and HKU1), and CoVs (229E and NL63) are among the human coronaviruses (5). The COVID-19-causing CoV is α -CoV in the same subgenus as the SARS virus, but in a distinct clade, according to the genomic and phylogenic analyses (5). The virus was identified on January 7 as a CoV with >95% similarity to the bat CoV and >70% [(3)].

The admission oxygen saturation, respiratory rate, glucose, and diastolic blood pressure (with/without age) multivariate regression model showed promising predictive capacity and may offer a practical, affordable method for early prognostication of patients admitted with COVID-19 in resource-constrained settings [(4)]. Regular arterial blood gas monitoring can aid in the early discovery of respiratory injury, silent hypoxia, and cytokine storm, and with early detection comes early care that can save many lives [(5)].

Due to the persistent and severe inflammation seen in COVID-19, sedentary lifestyles and inactivity are associated with a higher risk of hospitalization and mortality. People are more susceptible to the most severe types of COVID-19 when they have certain diseases [(6)].

Many evidence-based care strategies for chronic illnesses, especially those involving cardiac issues, include physical therapy as a crucial component. Therefore, it would make sense to provide long-COVID-19 patients who have other chronic diseases physiotherapy [(7)].

Pre-post treatment aerobic capacity and endurance, health status, dyspnea-related impairment, and cardio-respiratory function all benefit with physical therapy. Additionally, all post-COVID-19 patients saw an improvement in health status and a general decrease in impairment brought on by dyspnea at the 2-year follow-up [(8)].

The purpose of the current study is to objectively evaluate the effect of physiotherapy therapy on COVID-19 patients.

PATIENTS AND METHODS

A total of 60 patients were chosen from the Mansoura Chest Hospital and Mansoura University

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Hospital, attended the preliminary pre-treatment stage, and participated in the trial until the endpoint. Each of the following inclusion criteria was met by each individual who was judged qualified to take part in this clinical investigation: COVID-19 hospitalized patients, their mean age was 49.7 (SD 3.2) years, mean systolic blood pressure (SBP) was 132.5 (SD 8.5) mmHg, mean diastolic blood pressure (DBP) was 85.4 (SD 10.1) mmHg, mean respiratory rate (RR) was 23.1 (SD 2.7), mean O2 saturation was 85.8% (SD 1.0), mean Heart rate was 81.9 (SD 5.8); patients were able to follow instructions.

Evaluation: Blood gas analysis was used to measure PH, PaO2, PacO2, and HCO3 levels in the blood. In addition to SBP, DBP, RR, O2 saturation, and HR were measured at two different times: pre-intervention and post-intervention, after 2 weeks.

Intervention: After the pre-intervention assessment, the study group's treatment phase began. COVID-19 pharmaceutical protocol was intended to be administered to participants in the trial for an average of 2 weeks for both the study and control groups. Initial patient evaluation and supervision of blood gases and vital signs were followed-up to assess the effect of physiotherapy intervention to reach the normal value. The study group also received a physiotherapy exercise protocol in the form of respiratory physiotherapy, limb exercises, and peripheral muscle training, three sessions per week for two weeks [(6)].

Ethical consent:

The Academic and Ethical Committee of Mansoura University approved the project. Every patient was awake and cooperative. Everyone who signed a permission form and participated in the study was given a thorough description of how it would be conducted. The Declaration of Helsinki for human beings, which is the international medical association's code of ethics, was followed during the conduct of this study.

Statistical analysis

Data were entered and analyzed using IBM-SPSS software (IBM Corp., New York's Armonk). Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher's exact test were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test.

Normal distribution of variables was described as means, standard deviations (SD), and standard errors (SE), and independent sample t-test was used for comparison between groups. Effect sizes were calculated by G*Power software (version 3.1.9.7, Universität Kiel, Germany). A one-way ANCOVA was used to determine whether post-intervention clinical and arterial blood gas parameters differed based on intervention groups whilst controlling for pre-intervention values. P value ≤0.05 was considered to be statistically significant.

RESULTS

Table 1 shows a statistically significantly higher PaCO2, DBP and O2 saturation in the intervention group vs. the control group. The effect sizes were large [d>0.8; d=1.074818, 2.333221 and 1.084652, respectively]. There was no statistically significant difference in all other parameters.

Table (1): Comparisons between the 2 studied groups regarding the baseline characteristics.

Characteristic	Group A	Group B	Total	t-value	P-value
Age (years)	50.8 ± 2.5	48.6 ± 3.7	49.7 ± 3.2	1.573	0.133
SBP (mmHg)	134 ± 8.4	131 ± 8.8	132.5 ± 8.5	0.780	0.445
DBP (mmHg)	93 ± 8.2	77.8 ± 4.2	85.4 ± 10.1	5.212	**<0.001**
Respiratory rate	22.8 ± 2.1	23.4 ± 3.2	23.1 ± 2.7	-0.492	0.629
O_2 saturation	86.3 ± 1.1	85.3 ± 0.7	85.8 ± 1.0	2.518	**0.022**
Heart rate	79.9 ± 4.9	83.8 ± 6.1	81.9 ± 5.8	-1.571	0.134
pH	7.42 ± 0.02	7.42 ± 0.07	7.42 ± 0.05	0.130	0.899
PaO_2	53 ± 5.5	56.6 ± 7.4	54.8 ± 6.6	-1.242	0.230
$PaCO_2$	55.3 ± 6.6	47.3 ± 8.2	51.3 ± 8.3	2.402	**0.027**
HCO3	35.9 ± 3.8	32.6 ± 4.9	34.2 ± 4.6	1.696	0.107

Data is mean (SD). The test of significance is the Independent-samples t-test.

Table 2 shows a statistically significantly higher post-intervention O2 saturation and PaO2 in group A vs. group B, and a statistically significantly higher post-intervention PaCO2 in group B vs. group A. On the other hand, there was no statistically significant difference in all other parameters (SBP, DBP, HCO3, PH, heart rate, or respiratory rate). The effect sizes were large [f>0.4] (f = 1.69145 for O2 saturation, 2.308487 for PaO2, and 0.7273596 for PaCO2).

Table (2): Post-intervention characteristics adjusted for pre-intervention value.

Characteristic	Unadjusted mean (SD)		Adjusted mean (SE)		F	P-value	Partial η^2
	Group A	Group B	Group A	Group B			
SBP (mmHg)	117 (6.4)	118 (6.3)	116.6 (2)	118.4 (2)	0.376	0.548	0.022
DBP (mmHg)	78 (7.9)	74 (5.2)	78.5 (2.9)	73.5 (2.9)	1.077	0.314	0.060
Respiratory rate	20.8 (1)	20.9 (1.1)	20.8 (0.3)	20.9 (0.3)	0.004	0.953	0.000
O_2 saturation	95 (0.9)	91.2 (1.1)	94.9 (0.4)	91.3 (0.4)	42.424	**<0.001**	0.741
Heart rate	74.4 (3.6)	77.2 (3.8)	74.8 (1.2)	76.8 (1.2)	1.344	0.262	0.073
pH	7.40 (0.06)	7.42 (0.09)	7.40 (0.02)	7.42 (0.02)	0.668	0.425	0.038
PaO_2	87.9 (6.5)	63.7 (6.2)	88.7 (1.9)	62.9 (1.9)	90.732	**<0.001**	0.842
$PaCO_2$	39.2 (4.4)	41.8 (3.9)	37.9 (1.2)	43.1 (1.2)	9.011	**0.008**	0.346
HCO3	27.8 (4)	27.3 (5.7)	27.5 (1.6)	27.7 (1.6)	0.007	0.933	0.000

SD: Standard deviation. SE: Standard error. Partial n2 is a measure of effect size. A test of significance is an analysis of covariance (One-Way ANCOVA).

DISCUSSION

In our study, statistically significantly higher PaCO2, DBP, and O2 saturation in the intervention group vs. the control group. The effect sizes were large [d>0.8] (d = 1.074818, 2.333221, and 1.084652, respectively). There was no statistically significant difference in all other parameters.

Our results findings show a statistically significantly higher post-intervention O2 saturation and PaO2 in group A vs. group B, and a statistically significantly higher post-intervention PaCO2 in group B vs. group A. On the other hand, there was no statistically significant difference in all other parameters (SBP, DBP, HCO3, PH, heart rate, or respiratory rate). The effect sizes were large [f>0.4] (f = 1.69145 for O2 saturation, 2.308487 for PaO2, and 0.7273596 for PaCO2).

The findings of the present study are consistent with those of **Jarosz *et al.*** [9]**,** who sought to highlight recent developments in the care of COVID-19 patients using physiotherapy.

They found that physiotherapy (respiratory physiotherapy, limb exercises, and peripheral muscle training) improved the quality of life in those patients. In addition, the results of the current study agree with the results of **Malik and Tassadaq** [10], who investigated the benefits of deep breathing exercises on arterial blood gases in patients with pulmonary complications. They found that deep breathing exercises are significant in improving Pao2 and decreasing Paco2 in patients with respiratory problems.

On the other hand, the findings of the present study are at odds with those of **Jarosz *et al.*** [9], who investigated the use and efficacy of respiratory physiotherapy in the prevention and treatment of COVID-19 patients. They found that although there are several physiotherapeutic strategies and approaches that may be applied to treat COVID-19 illness, there hasn't been enough rigorous research to back them up.

In conclusion, physiotherapy can be recommended as a safe and effective modality for controlling COVID-19 complications and reducing the period of patient hospitalization.

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