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THE OUTCOMES OF PULMONARY PHYSICAL THERAPY AMONG PATIENTS WITH RESPIRATORY FAILURE

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Abstract:
Introduction: *Our aim was to investigate the effects of pulmonary physical therapy in patients with respiratory failure.*
Place and Duration: *In the Pulmonology department of Mohi ud Din Teaching Hospital, Mirpur AJK for one-year duration from March 2019 to March 2020.*
Methods: *A total of 132 patients with respiratory failure were enrolled and divided into a control group (n = 66) and an observation group (n = 66). Patients in both groups received conventional physiotherapy, but those in the observation group additionally received pulmonary physical therapy. The functions of ventilation and air exchange, assessment of acute physiology and chronic health assessment II (APACHE II) as well as the occurrence of complications in patients in both groups were compared.*
Results: *PaO2, PaCO2, PaO2 / FiO2 and estimated FEV2% improved significantly in patients in both groups after treatment, and patients in the observation group were better than in the control group; the differences were statistically significant (P = 0.014). There were no statistically significant differences in the patients' APACHE II scores in both groups before treatment and 2 and 3 days after treatment. The patients' APACHE II scores in the observation group were obviously lower than in the other group at 4 days and 7 days after treatment, and the differences were statistically significant (p = 0.015, 0.029). The total rates of complications in the observation and control groups were 7.57% and 39.39%, respectively, and the difference was statistically significant (p = 0.021).*
Conclusion: *Treating patients of respiratory failure with pulmonary physical therapy can greatly improve ventilation and air exchange functions, avoid complications, and improve health.*
Key words: *respiratory failure, pulmonary physical therapy, therapeutic effect*

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INTRODUCTION:

Respiratory failure is a severe respiratory failure with complex causes. Patients are usually accompanied by increased PaCO2 and decreased PaO2[1-2]. Clinically, in most cases, patients are treated with ventilator therapy, which can significantly reduce the patient's respiratory energy consumption and reduce the risk of treatment[3-4]. However, invasive mechanical ventilation can lead to complications in patients such as atelectasis and pneumonia associated with the respiratory muscles. Deep vein thrombosis (DVT) will occur due to patients' long-term limited activity[5-6]. For pulmonary physical therapy, standardized nursing procedures are used to maintain normal lung ventilation and air exchange function through physical measurements such as lung health assessment, back blows, aerosol inhalation, coughing movements, vibrating phlegm, postural drainage, and sputum suction. It is commonly used to treat patients in the intensive care unit[7-8]. This study investigated the effect of using pulmonary physical therapy in patients with respiratory failure to provide a reference for clinical treatment at a later stage. Now it is analyzed and reported as follows.

MATERIALS AND METHODS:

This study was held the Pulmonology department of Mohi ud Din Teaching Hospital**,** Mirpur AJK for one-year duration from March 2019 to March 2020. A total of 132 respiratory failure patients were selected as study subjects. There were 66 patients in the observation group, including 47 men and 19 women, aged 18 to 71 years, with a mean age (62.18 ± 4.28) years. There were 66 patients in the control group, including 45 men and 21 women, aged 19 to 70 years, with an average age (61.77 ± 5.03) years. There were no statistically significant differences in the overall patient data in both groups. Therefore, they were comparable. The study was approved by the Ethics Committee.

Inclusion criteria: 1) Patients treated with invasive mechanical ventilation for ≥ 48 h; 2) patients aged ≥ 18 years; 3) patients with an endotracheal tube placed through the mouth; 4) patients with good lung function; 5) patients who volunteered to participate in the study and signed the informed consent.

Exclusion criteria: 1) Patients with contraindications to pulmonary physical therapy; 2) patients with a fracture of the sternum or rib; 3) patients with complications of bleeding or clotting dysfunction; 4) patients who surrendered or died; 5) patients with severe mental disorders. All patients in both groups received conventional treatments such as a blow to the back, rollover, and postural drainage. Patients from the observation group were additionally treated with pulmonary physiotherapy: 1) the qualified patients underwent pulmonary physical therapy after assessing their disease state, contraindications and indicating patients; 2) Manipulative Lung Filling: Patients were administered manipulative lung filling 2 times daily. An artificial respiration bag with an oxygen storage device was connected to oxygen at a flow rate of 8 l / min to 10 l / min. Tidal volume was 1.5 times the normal volume; the compression frequency was 10-12 times / min; patients' breathing was held for 2 s after the end of air aspiration. The artificial respiratory bag was released rapidly on exhalation to create a pressure difference inside and outside the airway so as to exclude secretion in the airways; 3) Vibration: The vibrating sputum removal device was used on the patients twice a day for 15-20 mins at a time with a frequency of 20-30 cps;

4) Early rehabilitation of function: Patients were involved in active and passive limb movements, including fist exercises, arm lifting exercises, knee and lower limb flexion and extension exercises, ankle pump exercises, breathing and expectoration exercises once a day and 30 minutes per every time. The study was approved by the Ethics Committee. The functions of ventilation and air exchange, the acute physiology and chronic health status II (APACHE II) scores at different time points and the occurrence of complications in patients in both groups were compared. 1) Arterial partial pressure of oxygen (PaO2), arterial partial pressure of carbon dioxide (PaCo2), oxygenation index (PaO2 / FiO2) and lung function (estimated FEV2%) were monitored in the patients; 2) patients' APACHE II scores were monitored before treatment and 2 days, 3 days, 4 days and 7 days after treatment; 3) complications: including ventilator pneumonia, pulmonary atelectasis, pulmonary edema, and deep vein thrombosis (DVT). Statistical analysis for products and services (SPSS) 20.0 (Chicago, IL, USA) was used for statistical analysis. Measurement data and count data were determined by t-test and x2-test. P <0.05 suggested that the difference was statistically significant.

RESULTS:

Comparison of ventilation and air change function

Differences in PaO2, PaCO2, PaO2 / FiO2 and estimated FEV2% in patients in both groups were not statistically significant before treatment (p = 0.065, 0.087, 0.077, 0.131). Compared with the patients before treatment, PaO2, PaCO2, PaO2 / FiO2 and estimated FEV2% in patients after treatment improved significantly. The observation group was superior to the control group, and the differences

were statistically significant (p = 0.014, 0.045, 0.035, 0.020) (Table 1).

Table 1: Comparisons of ventilation and air exchanging functions

Group	PaO2 (mmHg)		PaCO2 (mmHg)		PaO2/FiO2		Estimated FEV2%	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n=66)	49.94±13.21	78.39±8.95	75.34±11.93	63.17±9.55	238.53±22.44	316.28±9.63	49.34±4.24	76.59±5.22
Control group (n=66)	48.68±12.28	63.54±9.04	77.27±10.71	71.08±9.13	243.26±23.45	281.78±9.71	50.38±4.38	62.69±4.71
t value	1.921	2.559	1.693	2.013	1.813	2.317	1.629	2.511
P value	0.065	0.014	0.087	0.045	0.077	0.035	0.131	0.020

Compare APACHE II results at different time points

The differences in the patients' APACHE II scores in both groups were not statistically significant before treatment and after 2 and 3 days after treatment (p = 0.079, 0.068, 0.054). The APACHE II results of the patients in the observation group were obviously lower than those of the control group at 4 days and 7 days after treatment, and the differences were statistically significant (p = 0.015, 0.029) (Table 2).

Table 2: Comparisons of APACHE II scores at different time points

Group	APACHE II score				
	Before treatment	2 d after treatment	3 d after treatment	4 d after treatment	7 d after treatment
Observation group (n=66)	18.34±5.37	14.08±5.12	12.44±5.02	8.70±4.55	7.71±5.03
Control group (n=66)	18.16±5.16	13.72±4.88	12.31±4.75	12.01±5.32	11.78±4.87
t value	1.783	1.912	1.950	2.557	2.435
P value	0.079	0.068	0.054	0.015	0.029

Comparing complications

The overall rates of complications in patients in the observation group and the control group were 7.57% and 39.39%, respectively, and the difference was statistically significant (p = 0.021) (Table 3).

Table 3: Comparisons of complications [n (%)]

Group	Ventilator-related atelectasis	Pulmonary edema	pneumonia	DVT	Overall incidence rate
Observation group (n=66)	4 (6.06)	0 (0.00)	1 (1.51)	0 (0.00)	5 (7.57)
Control group (n=66)	16 (24.24)	6 (9.09)	2 (3.03)	2 (3.03)	26 (39.39)
t value					6.921
P value					0.021

DISCUSSION:

Lung physiotherapy is a treatment method that combines the physiological characteristics and the physical principles of the body in the treatment and prevention of lung diseases, that drains the respiratory secretions with a better effect based on the principle of physical methods, to keep the airways open and maintain the normal state of the airways[9-10]. There is a physical regimen throughout the entire process, from sputum production to coughing up the airways. During the sputum secretion process, sputum in the airways can be loosened by inhalation of the aerosol, postural conversion, and vibration of the chest wall to reduce the viscosity of the sputum. At the same time, vibration outside the chest wall, lung inflation, and other techniques can also enhance coughing and help eliminate sputum. Clinical treatment of respiratory failure as a complex physiological disorder requires airway patency and electrolyte stabilization[11]. Therefore, this study investigated the effect of pulmonary physical therapy in patients with respiratory failure to provide a reference to clinical treatment later on. The results of this study showed that PaO2, PaCO2, PaO2 / FiO2

and estimated FEV2% in patients in both groups improved significantly after treatment compared to those before treatment[12-13]. The above values in the observation group patients were higher than in the control patients and the differences were statistically significant (p = 0.065, 0.087, 0.077, 0.131), indicating that the patients' ventilation and air exchange functions in the observation group were significantly improved. This is mainly because pulmonary physiotherapy assesses the condition of the lungs, and measures such as postural drainage, breathing exercises, lung dilation, vibration and percussion, kinesiotherapy, and airway suction are used to help bronchial and alveolar secretions[14]. large bronchi, improve oxygenation and ventilation, improve lung compliance, promote lung inflation, and ensure a clean trachea. Meanwhile, the present study found that the incidence of complications in the observation and control groups was 7.57% and 39.39%, respectively, and the difference was statistically significant (p = 0.021). This may be because pulmonary physical therapy can improve the success rate of ventilator disconnection in patients with respiratory failure and shorten the time of withdrawal, thus reducing the rate of complications related to ventilation. Clinically, the APACHE II scoring is now widely used in intensive care units and in the most authoritative critical illness assessment system that can define the condition of patients with severe disease. It can also lead to an objective prediction of mortality in these patients. This can be the basis for helping physicians to review the care plan in a timely manner and use medical resources rationally, thus improving the quality of care[15]. Our study showed that there were no significant differences in APACHE II scores between patients in both groups before treatment and 2 and 3 days after treatment (P = 0.079.0.068.0.054). The APACHE II results in the observation group at 4 days and 7 days after treatment were significantly lower than in the control group (P = 0.015.0.029). This is because patients can not only prevent complications through pulmonary physical therapy, but also prevent muscle failure to improve daily vital abilities and reduce the incidence of DVT through early functional rehabilitation, thereby improving APACHE II outcomes. However, it has been found in clinical practice that if the patients' sputum is sticky, it can be diluted by inhalation of the aerosol. Once patients have moistened their throats with sufficient water, pulmonary physical therapy may be more effective. Patients must sit or recline by vibrating or tapping the chest and a side or back position to drain posture rather than the head down position. Healthcare professionals should patiently explain preoperative work and perform the procedure step by step, carefully monitor patients' breathing, blood pressure, oxygen saturation and heart rate, and stop treatment immediately if the patient experiences discomfort.

CONCLUSION:

Pulmonary physical therapy can significantly improve ventilation and air exchange functions in patients with respiratory failure, prevent complications and improve health, which can be further promoted and used clinically.

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