CRITICAL MEDICAL AND SURGICAL NURSING JOURNAL
Vol. 14, no. 1, March 2025
Journal Homepage: https://e-journal.unair.ac.id/CMSNJ

Impact of Semi-Fowler Position and Clapping in Oxygen Saturation in COPD Patients

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ARTICLE HISTORY
Received: August 27, 2024
Accepted: Februari 28, 2025
Published: Februari 28, 2025

KEYWORDS
Semi-fowler position, clapping, oxygen saturation, chronic obstructive pulmonary disease (COPD)

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is a non-communicable disease that often causes low oxygen levels and shortness of breath. The semi-Fowler position and clapping are non-pharmacological techniques that help improve lung function and clear mucus. This study aims to determine their effect on increasing oxygen saturation in COPD patients.

Methods: This experimental study included 18 COPD patients in the Hospital Care Unit (HCU), selected through consecutive sampling. Inclusion criteria were diagnosed COPD, conscious patients willing to participate, and oxygen saturation below 90%. Exclusion criteria included hemodynamic instability. The intervention involved placing patients in a semi-Fowler position (45° incline) to enhance lung expansion and performing clapping (gently tapping the chest with cupped hands) to aid mucus clearance. Oxygen saturation was measured before and after using a pulse oximeter. The Wilcoxon Signed-Rank Test was used to analyze non-normally distributed data.

Results: The mean oxygen saturation before intervention was 85.94%, increasing to 98.56% post-intervention, with a significant improvement of 12.62% ($p=0.00$, $p < 0.05$). Demographic data, including age, gender, and COPD severity, were collected.

Conclusion: The semi-Fowler position and clapping significantly improve oxygen saturation in COPD patients, highlighting their clinical usefulness. Future research should explore long-term effects, different COPD severities, and combinations with other respiratory therapies for better disease management.

Cite this as:

Dinaryanti, R.S., Yulefsi, B., Wasijati, W., Malkis, Y., Fitriani, R. (2025). Impact of Semi-Fowler Position and Clapping in Oxygen Saturation in COPD Patients. Crit. Méd. Surgical. Nurs. J, 14(1),39-44.

1. INTRODUCTION

Chronic obstructive pulmonary disease is a chronic inflammatory process of the lungs (Lee et al., 2021; Szalontai et al., 2021). This disease includes chronic bronchitis with fibrosis accompanied by obstruction of the small airways, and emphysema with dilation of the air cavity accompanied by destruction of the pulmonary parenchyma, decreased lung elasticity, and obstruction of the small airways which will result in shortness of breath to respiratory failure (Andrew Johan, 2017; Brandsma et al., 2020). COPD is also characterized by chronic cough, productive sputum, shortness of breath, sometimes accompanied by wheezing (wheezing), and non-specific symptoms in the form of lethargy, weakness, weight loss, and anorexia. Chronic Obstructive Pulmonary Disease (COPD) is the leading cause of chronic morbidity and mortality worldwide (GOLD, 2022). According to WHO, in 2023 COPD is the third cause of death in the world with the number of deaths reaching 3.23 million people (WHO, 2023). Global initiative for Chronic Obstructive Lung Disease It is estimated that epidemiologically, the increase in the

death rate will always increase until 2060 (GOLD, 2022).

Chronic Obstructive Pulmonary Disease (COPD) is ranked as the fourth leading cause of death worldwide. It is a significant contributor to respiratory disorders, commonly found in both developed and developing countries. The incidence of COPD has been increasing in Indonesia, with the Basic Health Research (RISKESDAS) 2018 reporting a COPD prevalence of 3.7%, with a higher frequency observed in males (Kementerian Kesehatan Republik Indonesia, 2018)

COPD is characterized by persistent airflow limitation, which causes difficulty in breathing and decreased oxygen saturation. The management of COPD often involves pharmacological treatments as well as non-pharmacological approaches such as the Semi-Fowler position and clapping to improve oxygen saturation and reduce symptoms. Clapping is a manipulative technique that involves tapping the chest with cupped hands to help loosen mucus in the airways, which can improve sputum clearance (MacLeod et al., 2021).

However, the application of clapping must be done carefully, particularly in COPD patients. It is important to ensure that the patient is stable and not experiencing acute exacerbations or other complications that could be worsened by manipulative techniques. Clapping should be done gently to avoid causing discomfort or injury, and it is recommended to avoid areas of the chest where there might be fractures, wounds, or significant inflammation (Evangelopoulos et al., 2021). Additionally, the patient should be monitored for any signs of increased distress or worsening symptoms during or after the procedure.

Clapping in conjunction with positioning techniques like the semi-Fowler position, where the patient is seated at a 45° angle that can help improve lung expansion and oxygenation, particularly in those with compromised respiratory function (Baddour et al., 2024). These non-pharmacological techniques are generally safe for stable COPD patients, but they should be employed as part of a comprehensive care plan that also includes pharmacological treatments and regular monitoring (Azizah et al., 2022).

Chronic obstructive pulmonary disease (COPD) is one of the diseases that occur due to the worsening of symptoms characterized by an infection in the respiratory, with an increase in dyspnea symptoms and sputum production (Rohman, A. N., Fitri, N., & Purwono, 2021). Increased sputum production in COPD patients will provide a cough reaction. Cough is a very important reflex mechanism to keep the airway open by getting rid of the mucus secretion that accumulates in the airways (Imamah & Utami, 2022).

COPD can cause disturbances in the oxygenation process due to damage to the alveoli and changes in respiratory physiology and can cause symptoms including shortness of breath, limited activity, excessive sputum production so that it can experience coughing, chronic and chronic shortness of breath caused by thick and settled mucus build-up causing airway obstruction so that oxygen intake is not adequate (Rumampuk, E., & Talib, 2020). The impact caused by the decrease in oxygen saturation is that the patient shows symptoms in the form of shortness of breath with a respiration rate of more than 30 times/minute, there is the use of muscles to help breathe, changes in mental status in the form of restlessness, tachycardia and cold sweats resulting in the patient failing to breathe (GOLD, 2022).

Chronic Obstructive Pulmonary Disease (COPD) commonly affects individuals over the age of 40, with the highest rates seen in people aged 60 and older. COPD becomes more common with age, particularly in individuals who have a history of smoking or exposure to environmental pollutants (WHO, 2024). Studies have shown that both clapping and the Semi-Fowler position can improve oxygen saturation in COPD patients. For example, clapping has been found to increase oxygen saturation by 5-7% by helping clear mucus from the airways (Windradini et al., 2021). The Semi-Fowler position (placing the patient at a 30-45° angle) can improve oxygen saturation by 10-12% by allowing better lung expansion. Both techniques have been statistically shown to significantly increase oxygen saturation ($p < 0.05$), helping reduce shortness of breath (Kahtan et al., 2024).

Both techniques are safe for most stable COPD patients. However Clapping should only be used for patients without acute symptoms or complications. The Semi-Fowler position is suitable for most COPD patients with shortness of breath, but caution is needed for those with other medical conditions that may affect their tolerance to positioning (Firdaus et al., 2023). The Semi-Fowler position helps reduce shortness of breath by widening the airways and allowing for better lung expansion. This helps patients take in more oxygen, improving oxygen saturation in the blood and reducing feelings of breathlessness. When combined with medications like bronchodilators and steroids, both the Semi-Fowler position and clapping can enhance the effects of the medication, improving oxygen saturation, clearing mucus, and reducing symptoms of breathlessness. This combined approach helps manage COPD more effectively. Based on the description above, this study aims to determine the effect of giving semi-fowler and clapping positions to increase oxygen saturation in COPD patients in the HCU room (Sharma et al., 2023).

2. METHODS

Study Design

This research is a type of research quasi-experimental. With one group pretest and posttest design without control group.

Population, Samples, and Sampling

The study population consisted of 18 COPD patients treated in the HCU room in October 2023. Based on the Federer formula, the required sample

size was determined to be 18 respondents. The study employed a conclusive sampling technique to select participants. The inclusion criteria for this study were as follows: COPD patients diagnosed by a healthcare professional, willingness to participate, a conscious state to ensure understanding and cooperation, and oxygen saturation below 90% before the intervention, indicating a need for non-pharmacological respiratory support. These criteria align with previous studies demonstrating the safety and efficacy of clapping and the Semi-Fowler position in stable COPD patients with low oxygen saturation.

The exclusion criteria included hemodynamic instability, defined by unstable blood pressure, heart rate, or respiratory distress, which could contraindicate manual therapy or positioning techniques. Additionally, patients experiencing acute exacerbations of COPD were excluded, as severe symptoms or hospitalization for exacerbations might make these interventions unsuitable. These criteria were established to ensure the safety and appropriateness of using clapping and the Semi-Fowler position as non-pharmacological interventions in COPD management.

Instruments

The primary parameter for this study is oxygen saturation, which will be measured using a pulse oximeter. Oxygen saturation levels are commonly monitored in COPD patients to assess respiratory function and determine the need for interventions. The pulse oximeter used in this study will be calibrated according to the manufacturer's instructions before use to ensure accuracy in measurements. Regular calibration checks will be performed at the beginning of each study session and whenever the instrument is used on different patients. Additionally, the pulse oximeter will be validated periodically against known standards or reference devices, as recommended by professional guidelines for medical equipment calibration. This ensures the reliability and precision of the oxygen saturation readings.

Procedure

In clapping therapy for COPD patients, the technique typically involves using both hands, with the hands cupped to form a bowl shape. This positioning allows for a soft, hollow sound when the hands gently tap the patient's chest or back. The clapping is done rhythmically, at a rate of 1-2 taps per second, to help loosen mucus in the airways. The hands should not be flat or stiff; the cupped hands create an air pocket that helps mobilize the mucus. The clapping is applied either to the upper back or front of the chest, depending on where the mucus is concentrated. When clapping on the back, the hands are placed over the upper and middle back or shoulder blades, areas where the lower lobes of the lungs are located. This position helps break up the mucus, making it easier for the patient to cough it up. When clapping on the chest, it's typically done over the lower chest areas, focusing on regions affected by mucus buildup. The tapping should be done gently, without excessive force, to avoid discomfort or injury to the patient. The entire session usually lasts for about 3 minutes, depending on the patient's tolerance. The rhythmic, gentle clapping aids in clearing mucus, improving airway function, and reducing symptoms of shortness of breath. For semi-fowler, the intervention was carried out in 30 minutes. The intervention was carried out twice a day in 3 day.

This study adhered to ethical guidelines and was approved by the relevant institutional review board (IRB). Permission to conduct the research was granted by the research site through an official letter with reference number 049/K/DIR/RSUBP/I/2024, ensuring compliance with local ethical standards for research involving human participants. These ethical considerations ensure that the study was conducted with respect for the participants' autonomy, privacy, and safety, aligning with ethical guidelines for research involving human subjects.

Data Analysis

In this study, statistical software will be used for data analysis. The univariate analysis will provide an overview of the frequency distribution of categorical variables such as education levels, ages, and types of occupations. For these variables, frequency and percentage distributions will be presented to summarize the data. For the oxygen saturation variable, the mean oxygen saturation levels will be calculated both before and after the intervention of clapping and the Semi-Fowler position. This will allow for the comparison of average values to assess any changes in oxygen saturation as a result of the interventions.

In the bivariate analysis, the goal is to test whether there is a significant difference in oxygen saturation levels before and after the interventions. Since the data for oxygen saturation is not normally distributed, a non-parametric test will be used for this analysis. Specifically, the Wilcoxon Signed-Rank Test will be applied. This test is appropriate for comparing two related samples or measurements, such as oxygen saturation levels before and after an intervention, and it does not assume a normal distribution of the data.

3. RESULTS

Univariate Analysis

Based on table 1 above, it shows that from 18 respondents, 100% of the respondents' age is > 45 years old. Based on the level of education, 5 respondents (27.8%) had a basic education level, 11 respondents (61.1%) had a secondary education level, and 2 respondents (11.1%) had a higher education level. Based on the type of job, 16 respondents (88.9%) worked and 2 respondents (11.1%) did not work. Based on gender, it was shown that 11 respondents (61.1%) were male and 7 respondents (38.9%) were female.

Based on table 2 above, it shows that the saturation level before being given the semi-fowler

and clapping position in COPD patients was obtained with the average value of oxygen saturation with

Table 1. Demographic Data Characteristics of the respondents, Januari 2024 (n=18)

Characteristic	n	%
Age		
> 45 Years	18	10
Education level		
Primary education	5	27,8
Secondary education	11	61,1
Higher education	2	11,1
Type of work		
Work	16	88,9
Not working	2	11,1
Gender		
Man	11	61,1
Woman	7	38,9

Table 2. Oxygen saturation level before and after interventions, Januari 2024 (n=18)

Oxygen saturation level	Before	After
Mean	85,94	98,56
Median	86,00	99
SD	2,600	1,653
Min	80	93
Max	89	100
N	18	18

Table 3. The effect of semi fowler position and clapping intervention to increase oxygen saturation level in COPD patients, Januari 2024 (n=18)

Research variables	Pre Test	Post Test
Mean	85,94	98,56
Deviasi Hours	2,600	1,653
Difference	12,62	
p Value	0,0000	

mean (85.94%), median (86.00%), standard deviation (12.600%), minimum value (80%) and maximum value (89%). The oxygen saturation level after being given the semi-fowler and clapping position in COPD patients was obtained with the average value of oxygen saturation with mean (98.56%), median (99.00%), standard deviation (1.653%), minimum value (93%) and maximum value (100%).

Bivariate Analysis

Table 3 shows that there is an increase in oxygen saturation after being given the semi-fowler and clapping positions with a difference in the mean value before and after which is 12.62. Based on the statistical test of the wilcoxon test , a p value of 0.000 (P<0.05) was obtained, then H0 was rejected, meaning that there was an effect of giving semi-fowler positions and clapping on increasing oxygen saturation in patients with COPD in the HCU room.

4. DISCUSSION

The primary finding of this study is that both the Semi-Fowler position and clapping therapy significantly increased oxygen saturation levels in COPD patients. Before the intervention, the mean oxygen saturation was 85.94%, and after the intervention, it increased to 98.56%. This increase of 12.62% was statistically significant ($p < 0.05$), indicating that these non-pharmacological techniques were effective in improving oxygen saturation in COPD patients. These findings align with the study's objectives to explore non-pharmacological interventions, such as clapping and the Semi-Fowler position, and their impact on improving respiratory function and reducing shortness of breath in COPD patients.

The mechanism by which these interventions improve oxygen saturation is likely due to their effects on airway clearance and lung expansion. Clapping therapy, the rhythmic clapping on the chest wall helps to loosen mucus that accumulates in the airways, improving airway clearance. By clearing the airways, lung ventilation improves, reducing the work of breathing and helping to reduce CO2 retention. Studies have shown that clapping increases tidal volume and helps expel sputum, making breathing easier (Astriani et al., 2021)

Semi-fowler position, this position helps to optimize lung expansion and facilitate better ventilation by keeping the upper body elevated at a 30-45° angle (Yudistirawati, 2021). The Semi-Fowler position enhances oxygenation by improving the efficiency of respiratory mechanics and increasing the air available for inhalation. Previous studies have confirmed that this position can help increase oxygen saturation in patients with respiratory distress or hypoxemia (Ismail et al., 2021).

These findings are consistent with previous research that has reported improvements in oxygen saturation and airway clearance following clapping and Semi-Fowler positioning (Aggarwal et al., 2024). The combination of clapping and Semi-Fowler position with drug therapy (e.g., bronchodilators, corticosteroids) can have a synergistic effect. Medications help relax the airways and reduce inflammation, making it easier for the patient to breathe, while clapping and Semi-Fowler positioning support the body's ability to clear mucus and improve

oxygen intake. Several studies have shown that combining pharmacological treatments with non-pharmacological therapies leads to better management of COPD symptoms. For instance, bronchodilators can open the airways, allowing the clapping technique to work more effectively by promoting better sputum clearance. Similarly, medications that improve lung function can enhance the benefits of the Semi-Fowler position, allowing the patient to take in more oxygen (Rehman et al., 2019).

However, it is not purely a result of combination therapy of each intervention contributes individually. The medications target the underlying disease processes, while the non-pharmacological interventions help improve respiratory mechanics, reduce work of breathing, and facilitate sputum clearance. The combination of both provides a comprehensive approach to managing COPD and improving oxygen saturation, airway function, and overall patient comfort (Aggarwal et al., 2024).

This study has several important limitations. First, the sample size was small, with only 18 participants, which may limit the generalizability of the findings. A larger sample size would provide more robust data and enhance the external validity of the results. Additionally, the study did not include a control group, making it difficult to draw firm conclusions about whether the observed improvements in oxygen saturation were directly due to the interventions or other factors. Future studies could address this limitation by incorporating a randomized controlled trial (RCT) design, which would allow for more reliable comparisons between the intervention group and the control group. Another limitation is the short duration of the intervention, as the effects of clapping and the Semi-Fowler position were only measured immediately after the intervention, without any long-term follow-up. This short duration may not reflect the sustained impact of these techniques. To overcome this, future research could extend the follow-up period to assess whether the improvements in oxygen saturation last over time. Additionally, the study primarily focused on oxygen saturation, without assessing other clinical outcomes such as pulmonary function, exercise capacity, or quality of life. Incorporating a broader range of outcome measures in future studies would provide a more comprehensive understanding of the interventions' effects. Finally, the study used consecutive sampling, which may introduce selection bias. To minimize this bias, future studies could use random sampling to ensure a more representative sample of COPD patients.

Despite these limitations, the researchers employed several strategies to strengthen the study's design. Clear inclusion and exclusion criteria were established, ensuring that participants had appropriate characteristics for the interventions, such as COPD and low oxygen saturation, while excluding those with hemodynamic instability. This helps improve the study's internal validity by ensuring that the findings are specific to the target population. The focus on non-pharmacological interventions, such as clapping and the Semi-Fowler position, is another strength, as these techniques are low-cost, easy to implement, and can be applied in various healthcare settings, particularly in resource-limited environments. The researchers also adhered to ethical standards by obtaining informed consent from all participants and maintaining confidentiality, ensuring the protection of participants' rights. Moreover, appropriate statistical methods, such as the Wilcoxon Signed-Rank Test, were used to analyze the data, which ensures that the results are valid and reliable. In future studies, addressing these limitations through larger sample sizes, longer follow-up periods, and a more comprehensive set of outcome measures would provide more conclusive evidence about the effectiveness of these non-pharmacological interventions for COPD management.

5. CONCLUSION

The study found that both the Semi-Fowler position and clapping significantly increased oxygen saturation in patients with COPD. These results align with the study's objective of evaluating non-pharmacological interventions to improve oxygenation in this patient group. The findings suggest that these interventions can be effective in increasing lung expansion and aiding in airway clearance, which in turn may help manage symptoms such as shortness of breath and low oxygen levels.

One important implication for nursing practice is that semi-Fowler positioning and clapping can be easily integrated into routine care for COPD patients, particularly in settings where pharmacological options may be limited or in combination with other treatments. Nurses should be trained in these techniques to help optimize patient outcomes. By utilizing these interventions, nurses can support patients in improving oxygenation and managing respiratory distress, which is particularly beneficial for patients who experience frequent exacerbations or chronic respiratory issues.

Moreover, the findings highlight the importance of incorporating non-pharmacological strategies into COPD management plans. As these interventions are simple, cost-effective, and do not require specialized equipment, they can be widely implemented in both hospital and home care settings. However, future research should explore the long-term effects of these interventions and investigate whether they can be more effective when combined with pharmacological therapies, such as bronchodilators or corticosteroids, to address COPD symptoms more comprehensively.

Further studies should also consider assessing additional patient outcomes, such as pulmonary function and quality of life, to gain a more holistic view of the benefits of these interventions. Additionally, it would be valuable to explore how these techniques can be adapted for use in different populations, such as those with more severe COPD or

other coexisting health conditions. Finally, ensuring that nurses and healthcare providers are trained in these non-pharmacological interventions will help promote a more holistic, patient-centered approach to managing COPD.

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