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Effect of Non-Rebreathing Mask Oxygenation and 30-Degree Head-Up Positioning on Consciousness and Hemodynamics in Pulmonary Tuberculosis Patients: A Case Study

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ABSTRACT

Introduction: Tuberculosis is transmitted by bacteria called Mycrobacterium tuberculosis and is lassified as an infectious disease. Transmission occurs when an individual inhales airborne particles containing sputum droplets from a tuberculosis sufferer.
Objective: To determine the level of consciousness and hemodynamic changes in pulmonary tuberculosis patients before and after the implementation of non-rebreathing mask oxygenation and a 30 degree head up position.
Method: The strategy applied in compiling this paper is a case study method used to describe the situation descriptively in accordance with the topic of discussion, namely the Implementation of Non-Rebreathing Mask Oxygenation and 30° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients.
Result: Before administering non-rebreathing mask oxygenation and 30-degree head-up position, Mr. S experienced a decreased level of consciousness with a GCS of 8 and shortness of breath. After administering non-rebreathing mask oxygenation and 30-degree head-up position for 3 days, Mr. S's level of consciousness increased with a GCS of 10.
Conclusion: Based on the author's observations in the implementation of the case study related to "Implementation of Non-Rebreathing Mask Oxygenation and 30° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients" for 3 days starting from April 16-18, 2025 at Faisal Islamic Hospital, Makassar, it can be concluded that after the Implementation of Non-Rebreathing Mask Oxygenation and 30° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients, awareness and hemodynamic changes can be increased.

Keywords: Pulmonary tuberculosis, consciousness, hemodynamic, non-rebreathing mask, head up position 30 degree

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Introduction

Tuberculosis is an infection caused by the bacterium Mycrobacterium tuberculosis. It is transmitted through the air, specifically when someone inhales droplets released when someone with TB coughs or sneezes. This infection generally attacks the lungs, but in some cases, the bacteria can also spread to other body structures, including the bones and joints, and the meninges. This infection outside the lungs is known as extrapulmonary tuberculosis (Ariani et al., 2022).

Tuberculosis (TB) is a contagious disease caused by infection with the bacterium Mycobacterium tuberculosis. Approximately 90% of TB cases are adults, with a higher number of cases among men than women. This is thought to be because men are more likely to be exposed to risk factors and have better access to healthcare facilities than women (Adhanty & Syarif, 2023). Individuals with weakened immune systems are at higher risk of contracting this disease due to its highly contagious nature (Mustopa et al., 2024).

Tuberculosis is a disease that can infect all age groups and can develop into a fatal condition, especially when a person's immune system is weakened (Irianti, 2024).

The cause of this health problem is the Mycrobacterium tuberculosis bacteria, which infects lung tissue. Transmission occurs through small liquid particles released when someone coughs or sneezes, which then enter the body of a healthy person through inhalation through the mouth or nose (Rahmawati et al., 2024). If healthy people inhale these bacteria, they are at risk of being infected with the bacteria that cause tuberculosis (Lestari, 2023). Transmission occurs through the air when the sufferer coughs, sneezes, or blows phlegm carelessly (Angelina & Drew., 2024).

Some complications that may occur include pneumothorax, hemoptysis (coughing up blood), respiratory failure, heart failure, pleurisy, pleural effusion, empyema, laryngitis, and pneumonia (Fadhilah et al., 2024).

The main symptoms in patients with pulmonary tuberculosis include (Meo et al., 2024): Prolonged cough which is sometimes accompanied by bloody phlegm, Chest pain, Weakness, Fatigue, Fever or chills for more than a month, Night sweats, Weight loss, Shortness of breath.

According to (Handayani, L. (2024). pulmonary tuberculosis is a type of tuberculosis that attacks the lung parenchyma but does not involve the pleura or lymph nodes around the hilum. This category is called pulmonary TB because lesions or damage are found in the lung tissue itself.

Approximately 90% of TB cases are adults, with a higher number of cases among men than women. This is thought to be because men are more likely to be exposed to risk factors and have better access to healthcare facilities than women (Adhanty & Syarif, 2023).

According to data from the World Health Organization (WHO) in 2022, the number of people diagnosed with tuberculosis, with the number of TB cases globally reaching 10.6 million, represents an increase of approximately 600,000 compared to the previous year's estimate of 10 million cases. In the United States, there were an estimated 325,000 new cases of TB, with 239,987 cases (or 74%) reported in 2022, a 4 percent increase from the previous year (Elizah et al., 2024).

Indonesia ranks second in the world for the number of pulmonary tuberculosis cases, just behind India. An estimated 969,000 cases of tuberculosis (TB) occur in Indonesia, equivalent to one new case every 33 seconds. The recorded incidence rate is 354 cases per 100,000 people, indicating that 354 individuals are diagnosed with TB in each population group (Afif & Fatah, 2024).

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Tuberculosis occurs in every part of the world, with Southeast Asia accounting for approximately 44% of new tuberculosis cases, followed by Africa with 25%, and the Western Pacific region with approximately 18%. The vast majority, 87% of new cases, are concentrated in the 30 countries with the highest tuberculosis rates globally (Irene Febriany Mamo Kitu et al., 2024).

Objective

To determine the level of consciousness and hemodynamic changes in pulmonary tuberculosis patients before and after the implementation of non-rebreathing mask oxygenation and a 30-degree head-up position.

Method

The strategy applied in compiling this paper is a case study method used to describe the situation descriptively in accordance with the topic of discussion, namely the Implementation of Non-Rebreathing Mask Oxygenation and 30 ° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients.

The reason I chose this research is because Indonesia is one of the countries with a high burden of pulmonary TB in the world. Pulmonary TB patients who experience complications such as respiratory failure often require intensive care in the ICU. Appropriate management during the critical phase will directly impact morbidity and mortality rates.

During the process of writing the results of this case study, the author encountered difficulties in finding patients with pulmonary tuberculosis, making it difficult for the researcher to meet the patient achievement target.

This study employed a case study approach to provide a descriptive overview of the implementation of non-rebreathing mask oxygenation and the 30-degree head-up position on the level of consciousness and hemodynamic changes in patients with pulmonary tuberculosis. The study was conducted in the Intensive Care Unit of Faisal Islamic Hospital, Makassar, located on Jalan A.P. Pettarani, Banta-Bantaeng, Rappocini District, Makassar City, South Sulawesi 90222, with one patient over a period of three days, from April 16 to April 18, 2025.

The subject of this case study was a patient with pulmonary tuberculosis who received non-rebreathing mask oxygenation and was positioned at a 30° head-up angle. The inclusion criteria consisted of patients with pulmonary tuberculosis, decreased consciousness (GCS 3–13), red triage classification, and patients scheduled to receive non-rebreathing mask oxygenation and a 30° head-up position. The exclusion criterion was if the patient's family was uncooperative.

Data were collected through interviews and direct observation. Interviews were conducted to obtain information from the patient's family regarding relevant questions, while observation served as the main method for collecting case study facts. Researchers conducted detailed assessments from the base of the hair to the feet using inspection, palpation, percussion, and auscultation techniques, both before and after administering non-rebreathing mask oxygenation and positioning the patient at a 30° head-up angle. The tools used included an observation checklist and respiratory aids such as the non-rebreathing mask.

This approach allowed the researchers to systematically monitor changes in the patient's level of consciousness and hemodynamic status, providing a comprehensive understanding of the intervention's effects on pulmonary tuberculosis patients in a critical care setting.

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Result

Tabel 1. Assessment of outcome characteristics before and after administration of non-rebreathing mask oxygenation and a 30-degree head-up position

Level of awareness

Day/Date	Time	Before implementation	After implementation
Wednesday, April 16, 2025	08:30	Delirium GCS: 8 E: 3 (Opens eyes to sound/call) V: 2 (Indistinct voice) M: 3 (Abnormal flexion)	Delirium GCS: 9 E: 3 (Opens eyes to sound/call) V: 3 (Disorganized speech) M: 3 (Abnormal flexion)
Thursday, April 17, 2025	08:40	Delirium GCS: 9 E: 3 (Opens eyes with sound stimulation / is called) V: 3 (Irregular words) M: 3 (Abnormal flexion)	Delirium GCS: 9 E: 3 (Opens eyes with sound stimulation/called) V: 3 (Irregular words) M: 3 (Abnormal flexion)
Friday, April 18, 2025	08:25	Delirium GCS: 9 E: 3 (Opens eyes to sound/call) V: 3 (Disorganized speech) M: 3 (Abnormal flexion)	Somnolence GCS: 10 E: 3 (Opens eyes to sound/being called) V: 3 (Disorganized speech) M: 4 (Normal flexion)

Hemodynamics

Day/Date	Parameter	Before implementation	After implementation
Wednesday, April 16, 2025	Blood pressure pulse rate respiration oxygen saturation mean arterial pressur capillary refill time	100/60 mmHg 112x/minute 40x/minute 80 % 73 mmHg >2 seconds	130/70 mmHg 116x/minute 30x/minute 82% 90 mmHg <2 seconds
Thursday, April 17, 2025	Blood pressure pulse rate respiration oxygen saturation mean arterial pressure capillary refill time	—	130/80 mmHg 123x/minute 33x/minute 85% 96 mmHg <2 seconds
Friday, April 18, 2025	Blood pressure pulse rate respiration oxygen saturation mean arterial pressure capillary refill time	—	135/80 mmHg 116x/minute 28x/minute 91% 98 mmHg <2 seconds

The use of a non-rebreathing oxygen mask, along with a 30° head elevation in patients experiencing decreased consciousness, is appropriate because neurological function is highly dependent on oxygen, and increasing PaO2 and SaO2 will improve consciousness. Restoring oxygen improves brain mitochondrial function, improves aerobic metabolism, and reduces the production of lactic acid, which is toxic to neurons. A 30° head elevation can increase lung expansion (ventilation), facilitate breathing, stabilize circulation, and reduce organ burden.

Discussion

Based on a case study conducted on Mr. "S" regarding the administration of Non-Rebreathing Mask Oxygenation and 30-degree Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis patients at the Intensive Care Unit of Faisal Islamic Hospital, Makassar Patient response before administration of non-rebreathing mask oxygenation and 30 degree head up position. On the first day, before administering non-rebreathing mask oxygenation and maintaining the head position at 30 degrees, "Mr. S" experienced decreased consciousness with a GCS score of 8 and shortness of breath. On the second and third days, the patient was monitored with non-rebreathing mask oxygenation and maintaining the head position at 30 degrees.

Pulmonary tuberculosis patients who experience decreased consciousness are caused by lung damage due to infection, which deprives the body of sufficient oxygen. Severe oxygen deprivation can cause brain dysfunction, leading to confusion or loss of consciousness (Andresen et al., 2023). This research aligns with research by Wulandari et al., 2023, which states that for pulmonary tuberculosis patients experiencing decreased consciousness, administering oxygen using a non-rebreathing mask (NRM) combined with a 30° head-up position is considered an appropriate treatment. This combination is considered effective because a 30° head-up position can help reduce intracranial pressure and increase oxygen supply to the brain, ultimately contributing to improved consciousness. Oxygen administration is adjusted to the patient's needs, with a target O_2 saturation of more than 92% (Thalib et al., 2023).

Patient response after administration of non-rebreathing mask oxygenation and 30 degree head up position. On the first day after the administration of non-rebreathing mask oxygenation and a 30 degree head up position, "Mr. S" was found to have a level of consciousness with GCS 9 (delirium), blood pressure 130/70 mmHg, pulse rate 116x/minute, respiration 30x/minute, oxygen saturation 82%, mean arterial pressure (MAP) 90 mmHg, capillary refill time (CRT) <2 seconds.

On the second day, the patient was only monitored with non-rebreathing mask oxygenation and a 30 degree head up position. "Mr. S" had a level of consciousness of GCS 9 (delirium), blood pressure of 130/80 mmHg, pulse rate of 123x/minute, respiration 33x/minute, oxygen saturation 85%, mean arterial pressure (MAP) 96 mmHg, capillary refill time (CRT) <2 seconds.

On the third day, the patient was monitored only with non-rebreathing mask oxygenation and a 30-degree head-up position. "Mr. S" The patient's level of consciousness was recorded with a GCS of 10 (delirium), blood pressure of 135/80 mmHg, pulse rate of 115 beats/minute, respiratory rate of 28 breaths/minute, oxygen saturation of 91%, mean arterial pressure (MAP) of 98 mmHg, and capillary refill time (CRT) of <2 seconds.

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The use of a non-rebreathing oxygen mask accompanied by a 30° head elevation in patients experiencing decreased consciousness is an appropriate action because neurological function is highly dependent on oxygen, and increasing PaO2 and SaO2 will improve consciousness. This research is in line with research (Amiar, W., & Setiyono, 2021) which states that if the brain's blood volume decreases (through the head-up position which increases venous return), then intracranial pressure also decreases so that the brain gets.

Head elevation can be done with the help of a pillow or an electric bed that can be adjusted automatically (Ahmad Muzaki et al., 2022). Thus, 30° head elevation can reduce the workload of respiratory muscles, prevent hyperventilation, and increase tidal volume (Saputri et al., 2021).

A study conducted by (Amiar, W., & Setiyono, 2021) entitled "The Effectiveness of the Semi-Fowler Position on Increasing Oxygen Saturation Levels in Pulmonary TB Patients" found that the semi-Fowler position is effective in reducing shortness of breath. This position widens the airways, which can increase oxygen supply. By increasing oxygen in the body, this action can help increase hemoglobin and improve oxygen levels in the patient's body. Therefore, the semi-Fowler position is very beneficial for patients with pulmonary TB because it can support increased oxygen levels in the body.

According to research conducted by (Wulandari et al, 2023), oxygenation with a Non-Rebreathing Mask (NRM) can increase oxygen saturation and improve tissue perfusion, thus positively impacting patient consciousness. The 30° head elevation also plays a role in reducing intracranial pressure, which contributes to hemodynamic stabilization, including blood pressure and pulse rate.

This research is also in line with research (Safitri et al., 2022) which explains that the 30° head-up position utilizes the influence of gravity to support lung expansion and reduce pressure from the abdominal cavity that presses on the diaphragm, and can relieve symptoms of shortness of breath in patients with pulmonary tuberculosis.

During the process of writing the results of this case study, the thing that hindered the author was the difficulty in finding pulmonary tuberculosis patients, thus increasing the researcher's ability to meet the patient achievement target.

Conclusion

Based on the author's observations in the implementation of the case study related to "Implementation of Non-Rebreathing Mask Oxygenation and 30° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients" for 3 days starting from April 16-18, 2025 at Faisal Islamic Hospital, Makassar, it can be concluded that after the Implementation of Non-Rebreathing Mask Oxygenation and 30° Head Up Position on the Level of Consciousness and Hemodynamic Changes in Pulmonary Tuberculosis Patients, awareness and hemodynamic changes can be increased.

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Authors' contribution

Each author makes an equal contribution to all parts of the research. All authors have reviewed and approved the final draft critically and are responsible for the index and similarity of the manuscript.

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