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Implementation of Evidence-Based Nursing for Expelling Sputum in Tuberculosis Patients with Chest Physiotherapy and Effective Coughing Exercises: A Case Study

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Abstract

Background: Background: Tuberculosis is a bacterial infection caused by the bacillus Mycobacterium tuberculosis is an aerobic bacterium in the form of a rod bacillus, but this bacterium survives against acid. **Objective:** This case study was conducted to present the implementation of evidence-based nursing providing effective chest physiotherapy and coughing exercises as an effort to expel phlegm in tuberculosis patients. **Case Presentation:** The persistent method carried out a physical examination in tuberculosis patients. The patient with tuberculosis is Mr. D, 45 years old male, who was taken to the hospital on October 10th, 2021, at 13:20 with complaints of coughing for two weeks accompanied by bleeding. The assessment results of vital signs: blood pressure 120/80 mmHg, pulse 98 times/minute, temperature 36.5ºC, breathing 30 times/minute. After being given nursing intervention for three days, the ineffective airway clearance was resolved with a patent airway characterized by normal breathing frequency. **Conclusion:** Effective chest and cough physiotherapy is considered effective in overcoming the problem of airway clearance. This research is one of the empirical data to be developed in a research design with a higher level of evidence in the future so that nurses can provide accurate interventions to solve nursing problems related to airway clearance in TB patients. The clinical implication of this research is the importance of complete guidelines and more straightforward standard operating procedures in providing nursing interventions in the form of chest physiotherapy and effective coughing exercise.

Keywords: Stigma, COVID-19, nurses, transcendental phenomenology, Philippines.

INTRODUCTION

Tuberculosis (TB) is a bacterial infection caused by the bacillus Mycobacterium tuberculosis. Mycobacterium Tuberculosis is an aerobic bacterium in the form of a rod bacillus, but this bacterium still survives against acid, called Acid Resistant Bacteria (BTA). This bacterium most often attacks the lungs, but other organs can be attacked by tuberculosis, namely the meninges, kidneys, and bones (1).

Most pulmonary tuberculosis infections occur because germs enter the respiratory tract of individuals with active lung disease emitting organisms. Individuals susceptible to inhaling droplets will become infected, which then causes pulmonary tuberculosis. In general, pulmonary tuberculosis plays a role in the inflammatory reaction that produces exudate in the alveoli, bronchopneumonia, granulomas, and fibrous tissue (2).

The World Health Organization (WHO) shows an increase in the prevalence of TB cases from 9.6 million to 10.4 million in 2021, while Indonesia ranks second in the world with the most TB disease. According to TB data in Indonesia, in 2021, the number will reach 845,000, while the number of deaths will be more than 98,000 (3,4).

Tuberculosis patients will experience an inflammatory process that causes individuals to experience an ineffective immune response disorder, causing symptoms such as cough with sputum or coughing up blood, shortness of breath, chest pain, night sweats, and decreased appetite. Physical examination showed increased respiratory rate, irregular breathing rhythm, and additional breath sounds such as rhonchi (5,6).

Referring to these manifestations, a common nursing problem in TB patients is the ineffectiveness of airway clearance (7). Ineffective airway clearance is the inability to clear secretions or blockages in the airways to maintain respiratory status. Airway obstruction is caused by the accumulation of sputum in the airways, resulting in inadequate ventilation (8,9). Therefore, it is necessary to take action to mobilize sputum production so that the respiratory process can run adequately to meet the body's oxygen needs (10).

One of the nursing interventions that can be applied to clear the sputum in the airway is chest physiotherapy and practical coughing exercises, the role of nurses, is needed to help reduce patient complaints. Nurses can help patients maintain a clear airway and expel sputum through chest physiotherapy and effective coughing exercise (11,12).

Chest physiotherapy is a series of nursing actions consisting of percussion, vibration, drainage, deep breathing, and effective cough exercise. Another intervention that can help expel sputum is effective coughing exercises. Effective coughing exercises can clear the larynx, trachea, and bronchioles of secretions or foreign bodies in the airways. Chest physiotherapy and effective coughing exercise can be applied mainly to tuberculosis patients with nursing problems and ineffective airway clearance (13,14).

There are still many found in the clinical practice. Nurses rarely implement chest physiotherapy and practical coughing exercises. Nurses collaborate more often with doctors to give antibiotics when coughing up sputum. The effectiveness of chest physiotherapy and coughing is effective in removing sputum in TB patients. It is known from research that has been carried out that has proven that chest physiotherapy and effective coughing exercises can effectively help patients to expel sputum (15). Based on the results of research on chest physiotherapy and effective coughing exercise interventions, it is stated that this action can help expel sputum. This action is also considered adequate because it can be done by the family quickly and anytime (16,17).

OBJECTIVE

The study aimed to present the implementation of evidence-based nursing, providing chest physiotherapy and effective coughing exercises to expel the sputum in tuberculosis patients.

METHOD

Design

This research uses a case study type. Nursing practice based on EBN implementation. In this case study, the researcher uses the theory according to Polit and Beck (2019), which consists of five stages, namely: (1) asking questions (PICO), (2) looking for related evidence, (3) evaluating evidence, (4) applying evidence, (5) evaluation of the application of EBN (7,18).

Database searching

The first stage is the researcher asks the PICO question (Problem/population, intervention, comparison, outcome). According to EBN, the question will arise: "Which intervention is most appropriate for patients with ineffective airway clearance?". Furthermore, using electronic media such as Google, Google Scholar, and PubMed to search for information to evaluate the results of articles and find references regarding effective chest physiotherapy and coughing in patients with pulmonary tuberculosis so that the sticky secretions can come out.

Data collection process

The study was conducted on pulmonary tuberculosis patients in the Aster room at RSUD dr. Soekardjo Tasikmalaya for 3 days from 11-13 October 2021. Informed consent was done verbally to explain the procedure and ask for consent from the patient and family. Performing effective chest and form physiotherapy, namely nursing actions consisting of percussion, vibration, drainage, deep breathing, and effective coughing. Another action that can help expel sputum is an effective cough. Data were collected from the results of physical examinations, medical records, observations, interviews, and related internet literature sources. The final stage in the nursing process is evaluation. An evaluation was carried out every day (twice a day) after the implementation of the intervention to determine the progress.

Case Presentation

Nursing Assessment

The main component of the nursing process is assessment, where nurses can criticize and detect changes quickly, intervene as early as possible, and carry out nursing care. The assessment results on the patient with tuberculosis are Mr. D, 45 years old, male, was taken to the hospital on October 10th, 2021, at 13:20 with complaints of coughing for two weeks accompanied by bleeding. The study was conducted on October 11th, 2021, at 09:00 in the Aster room. The assessment results of vital signs: blood pressure 120/80 mmHg, pulse 98 times/minute, temperature 36.5^{o}C, breathing 30 times/minute.

The next step, a systematic physical examination, started with assessing the sensory system. The head was symmetrical, and there were no lumps, no lesions, black hair, and no tenderness. Eye examination: both eyes are balanced, the movement of both eyeballs is the same, the conjunctiva is anemic, the pupil is isocratic, there is no visual disturbance, and there is no tenderness. Ear examination: both ears symmetrical, no lesions, no tenderness, no hearing loss. Nasal examination: the nostrils are balanced, there is discharge, no polyps, swelling, no tenderness, and good smell. Oral test: clean mouth, complete teeth, no dental caries, moist lip mucosa, good taste. Neck examination: no jugular vein swelling, no tenderness, good swallowing reflex. Skin examination: brown skin color, warm acral, good skin turgor, no cyanosis. Chest and lung examination: symmetrical chest shape, no lesions, no lumps. Palpation: there is no tenderness, percussion: resonance in all lung fields, Auscultation: crackles. Abdominal examination, Inspection: even skin color, symmetrical shape, Auscultation: bowel sounds ten times/minute, percussion: tympanic, Palpation: no tenderness. Upper Extremity Examination: muscle strength 5

(normal condition). Lower extremities: muscle strength 5 (normal condition).

Table 1. Respiratory status of the patient

Day	Respiratory rate		Rhythm		Are there abnormal sounds?		Ability to expel the sputum	
	m	a	m	a	m	a	m	a
1st Day	29	29	Irregular	Irregular	Ronchi	Ronchi	Unable	Able
2nd Day	27	26	Irregular	Regular	Ronchi	Ronchi	Able	Able
3rd Day	25	23	Regular	Regular	No	No	Able	Able

Table 2. Patent airway post-intervention

	Day	Pre-test (m)	Post-test (a)	Pre-test (m)	Post-test (a)
Respiratory rate (times/minutes)	1st Day	30	29	29	29
	2nd Day	29	27	28	26
	3rd Day	25	25	24	23
Are t abnormal sounds?	1st day	Ronchi	Ronchi	Ronchi	Ronchi
	2nd day	Ronchi	Ronchi	Ronchi	Ronchi
	3rd day	no	no	No	no
Rhythm	1st day	Irregular	Irregular	Irregular	Irregular
	2nd day	Irregular	Irregular	Regular	Regular
	3rd day	Regular	Regular	Regular	Regular
Ability to expel the sputum	1st day	Unable	Unable	Able	Able
	2nd day	Able	Able	Able	Able
	3rd day	Able	Able	Able	Able

Nursing Diagnosis

On October 11th, 2021, the assessment obtained subjective data from patients complaining of coughing for two weeks and sometimes accompanied by blood. Meanwhile, the patient's objective data showed shortness of breath, 30 breaths/minute, and rhonchi sounds. Based on the data above, it was obtained that the nursing problem of ineffective airway clearance was related to airway hypersecretion characterized by Ronchi breath sounds (SDKI no. D0001) (19).

Nursing Intervention/Implementation

The purpose of nursing intervention is for the patient's respiratory status to return to normal after being given intervention for three days. Implementation is the implementation of the nursing care plan to help the patient achieve the goals that have been set. In efforts to achieve these goals, nurses must have the ability to build trusting relationships, therapeutic communication skills, advocacy skills, psychomotor abilities, and evaluation skills. We hope that the patient's respiratory status will return to normal after three days of nursing care.

Nursing Evaluation

The application of chest and cough physiotherapy is effective for three days, with a frequency of exercise 2x a day in the morning (m) and afternoon (a) days.

Table 1 explained that after chest physiotherapy and effective coughing exercises, there was a change in airway patency on the third day of the afternoon session. It was characterized by normal RR (23 times/minute), regular breathing rhythm, no crackles, and the patient was able to expel sputum. A patent airway can be maintained until the third day. Effective cough technique. Meanwhile, the success of this intervention was assessed based on airway patency, which consisted of four outcome criteria: respiratory rate, breath rhythm, additional breath sounds, and the ability to expel sputum

DISCUSSION

The case study, in this case, is a TB

patient with a nursing problem of ineffective airway clearance. Based on the Indonesian Nursing Intervention Standards (SIKI), one of the independent interventions that nurses can do to overcome these problems is chest physiotherapy and teaching effective coughing techniques. Meanwhile, the success of this intervention was assessed based on airway patency, which consisted of four outcome criteria: respiratory rate, breath rhythm, additional breath sounds, and the ability to expel sputum.

On the first day of effective chest physiotherapy and coughing, the results obtained were a decrease in respiratory rate on the second day, namely 27 times/minute. On the third day, it became normal (23 times/minute). These results are in line with the study of Rifki and Sri (2022) in pulmonary TB patients who showed normal/vesicular breath sounds, respiratory rate 22 times/minute, blood pressure 110/80 mmHg, pulse rate 85 times/minute, and temperature 36 ^{0}C (20). Also supported by research by Hanafi (2020) with the results of the patient evaluation for three days after chest physiotherapy, namely a decrease in respiratory rate from 28 times/minute to 22 times/minute (21). Previous research has proven that there is conformity to the results achieved; namely, the respiratory rate becomes normal. Mobilization of sputum from the airways after chest physiotherapy will widen the alveoli cavity, so the pressure decreases, resulting in maximum alveolar expansion. Maximal development of the alveoli will support adequate ventilation to increase the intake of more oxygen to the lungs, thereby reducing the patient's complaints of shortness of breath (22).

The evaluation showed that after chest physiotherapy exercises and effective coughing were carried out, additional breath sounds (Ronchi) were no longer heard on the third day of the morning to the afternoon session. The sound of crackles is caused by airflow through the airways containing sputum or exudate. Sputum in the airway can be mobilized through chest physiotherapy and coughing. The discharge of sputum makes the airways free of sputum so that crackles are no longer heard, so that this can be supported by the theory that effective coughing will help the process of removing secretions that have accumulated in the airway so that there are no longer any adhesions in the airway which in turn makes the airway patents and reduced shortness of breath (23,24).

The evaluation results showed that after effective chest physiotherapy and coughing, there was a change in breathing rhythm from irregular to regular on the second day of the afternoon session. Then on the third day, the normal breathing rhythm in both the morning and evening sessions. Changes in the rhythm of breathing occur along with the normal respiratory rate. Normal breathing frequency and regularity of respiratory rhythm occur because of the adequacy of oxygen supply in the lungs, which will be distributed throughout the body. An airway free from accumulated secretions will facilitate oxygen transport from the respiratory tract to the lungs. AGD indicates adequate oxygen supply in the body within normal limits (25,26).

The ability to expel the patient's sputum is shown on the first day until the last day of giving effective chest physiotherapy and coughing. The ability to remove secretions is related to the patient's ability to cough effectively. Effective coughing can encourage secretions accumulated in the airways to come out. After doing chest physiotherapy exercises and effective coughing for three days, the results showed that the patient could expel secretions because he could cough effectively (27). This is supported by the theory, which states that an effective cough will help remove secretions accumulated in the airway so that there are no more adhesions in the airway so that the airway is patent and shortness of breath is reduced (28).

The evaluation results showed that after effective chest physiotherapy and coughing, there was a change in airway patency on the third day of the afternoon session. It was characterized by normal RR

(23 times/minute), regular breathing rhythm, no rales, and the patient was able to expel sputum. A patent airway can be maintained until the third day. Indicators of airway patency are normal RR, regular breathing rhythm, no additional breath sounds, and the patient can expel sputum from the airway. Airway patency can be achieved through chest physiotherapy and effective coughing because these actions can mobilize secretions in the airways that improve respiratory function (29). A patent airway is the outcome target or criterion for the diagnosis of ineffective airway clearance.

CONCLUSION

The implementation of EBN for chest physiotherapy and effective coughing exercise in TB patients for three days showed the expected results following the SDKI, SLKI, and SIKI. It was through the presence of a patent airway characterized by normal breathing frequency, regular breathing rhythm, and no additional breath sounds that the patient was able to exhale the sputum. Researchers hope that more nurses will apply independent interventions such as chest physiotherapy and effective coughing because it has been proven empirically (evidence-based) to overcome the problem of ineffective airway clearance, especially in pulmonary TB patients.

This research is one of the empirical data to be developed in a research design with a higher level of evidence in the future so that nurses can provide accurate interventions to solve nursing problems related to airway clearance in TB patients. The clinical implication of this research is the importance of complete guidelines and clearer standard operating procedures in providing nursing interventions in chest physiotherapy and effective coughing exercise. This will make it easier for nurses to carry out these interventions, thus supporting effective and efficient nursing care management.

This case study has limitations in comparing nursing problems caused by TB with other causes. This is due to differences in the pathophysiological process between TB and other diseases, so the same nursing diagnosis in different cases, such as emergency cases and maternity nursing, cannot be presented in the discussion session. Obstruction by liquids or solids causes the ineffectiveness of the airway in emergency cases. Both interventions that the researcher did in this case (chest physiotherapy and effective coughing exercise) could not be performed.

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