Case Report

Respiratory Rehabilitation for A Loss to Follow-Up Pulmonary Tuberculosis Patient with Bilateral Hydropneumothorax: A Case Report

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Submitted: April 26th, 2024
Accepted: January 21st, 2025
Published: February 28th, 2025

Respir Sci. 2025; 5(2): 82-91
https://doi.org/10.36497/respirsci.v5i2.147

Abstract

Background: Tuberculosis (TB) is a preventable and treatable disease. However, without treatment, mortality from TB is 50%, whereas with treatment, 85% of people with TB can be cured. Incomplete treatment of pulmonary TB can lead to various complications, one is hydropneumothorax, which is an abnormal picture of air and fluid in the pleural cavity. Complications of this condition can lead to long-term impairment of lung function with varying degrees of severity. Pain and shortness of breath are clinical features that interfere with daily activities and are associated with a decreased quality of life. Pulmonary rehabilitation is a crucial component in managing respiratory diseases, including pneumothorax, which aims to restore respiratory muscle strength, optimize lung expansion, and prevent complications such as atelectasis, pleural adhesions, or chronic respiratory insufficiency.

Case: A 26-year-old woman presented to the emergency department with moderate dyspnea. She was diagnosed with loss to follow-up (LTFU) TB with bilateral hydropneumothorax and malnutrition. She was in the third month of a four-drug anti-TB regimen and had a chest tube with water shield drainage (WSD) placed in both the right and left chest walls. The rehabilitation problems in these patients are dyspnea, pain in the chest tube insertion area, immobilization, and partial dependency.

Discussion: A pulmonary rehabilitation program was initiated during hospitalization and continued in the outpatient rehabilitation clinic, including energy conservation techniques, breathing exercises, relaxation, splinted cough, chest wall mobilization, respiratory muscle stretching, and laser therapy for pain management. Barthel Index (BI) shows improvement from 10 to 45 due to pain reduction. Visual Analog Scale (VAS) 7-8 to 5, allowing the patient to use her right upper extremity for daily activities.

Conclusion: Pulmonary rehabilitation is a cost-effective therapy that can improve symptoms and quality of life in patients with post-TB hydropneumothorax. It also reduces spasms, dyspnea, and pain.

Keywords: activities of daily living, hydropneumothorax, infectious disease, rehabilitation, tuberculosis

INTRODUCTION

Tuberculosis (TB) is a major global health issue, with Indonesia being among the countries most heavily impacted by it. According to the World Health Organization's Global TB Report 2023, Indonesia is classified as a high-burden country for TB. Of particular concern is the fact that TB is the second most fatal infectious disease in Indonesia after COVID-19.[1]

Indonesia has the second-highest TB burden in the world after India. The incidence rate in 2021 is 354 per 100.000 population. However, the patient's compliance with the oral TB drug regimen is still low.[2] In 2015, around 40.2% of TB patients in Indonesia had stopped taking their medication before they were declared cured. The patients who have been prescribed medicine for tuberculosis ceased taking it for two months or more without authorization are described as "Lost to Follow Up" (LTFU).[3]

A considerable 26% of patients discontinue their medication due to an improvement or absence of symptoms. For those who have previously received treatment for TB and are classified as LTFU, "Treatment after LTFU" is required. LTFU is the main cause of TB mortality, household transmission, and the proliferation of drug-resistant strains.[4]

Patients with TB, both treated and untreated, can develop respiratory sequelae due to damage to the airway, lung parenchyma, and pleura. Parenchyma lesions may present as tuberculoma, lung cavitation, scarring, and lung destruction. Airway lesions result in the development of bronchyectasis, tracheobronchial stenosis, and bronchiolithiasis. Both contribute to the development of mixed restrictive and obstructive pulmonary disease commonly found in chronic infection.[5]

Tuberculosis with pleural lesions such as hydropneumothorax is commonly found in Indonesia, but published studies on pulmonary rehabilitation for such cases are still limited. Therefore, we present a case of a 26-year-old female LTFU TB patient with bilateral hydropneumothorax in this report.

CASE

A 26-year-old female patient visited the emergency room with recurring difficulty in breathing. She had been experiencing shortness of breath for four months before being admitted to the hospital, which was accompanied by a persistent cough with white phlegm. At the time of admission, the patient's right chest had been inserted into a chest tube for two weeks. She also reported localized pain with a visual analog scale (VAS) score of 8-9.

The patient had a previous history of pulmonary TB in 2014, but she discontinued the treatment on her own after only one month. Despite not experiencing any further symptoms of cough or dyspnea, the patient reported feeling easily fatigued. However, she could still perform her daily activities and work without issues. In 2022, the patient

experienced a loss of body weight, night sweats, increased fatigue, and diarrhea that lasted for two weeks. The patient was diagnosed with lung tuberculosis bacteriological confirmed from RSUD Cengkareng and was given TB medications. The treatment was also stopped after one month due to nausea.

In September 2023, the patient reported sudden shortness of breath, and upon examination, a left pneumothorax was confirmed and a chest tube was inserted. After discharge, daily activity was limited to bed rest. In October 2023, the patient experienced shortness of breath again. A right pneumothorax was diagnosed and a chest tube was placed in the right chest. Two weeks before the admission, both the left and right chest tubes became detached. The right chest tube was reattached at the previous hospital, while the left one was reattached at Persahabatan Hospital just one day ago.

During a physical examination, the patient's Body Mass Index (BMI) was 13.7 kg/m^2, along with muscle wasting and clubbing fingers. During physical examination, notice the patient's neck posture is forward head the tilting of the cervical vertebrae is 40 degrees forward with a rounded shoulder with spasms of pectoralis major.

On respiratory examination, the patient had a respiratory rate of 36 breaths per minute, and their blood oxygen saturation was 98% with a nasal cannula delivering 4 liters of oxygen per minute. The patient had supraclavicular, suprasternal, and epigastric retractions, left-side asymmetrical chest wall movement, and a chest tube inserted in the right thorax. The chest tube has 4 cm undulation and fluid production on the right hemithorax, and the left thorax has 10 cm undulation, with fluid and bubble production. The vesicular sound on the left chest was reduced, and no rales or wheezing sounds were present.

The patient reported dyspnea, which was rated using the Borg scale (13-2-0), and the single breath count test (SBCT) was 5. The modified Medical Research Council (mMRC) dyspnea scale was rated as 4. Barthel Index (BI) was 10; the patient was fully continent for bowel control, but all other parameters were scored 0.

During the diagnostic workup, the chest X-ray on November 26, 2023, revealed findings consistent with possible pneumonia and a differential diagnosis of pulmonary tuberculosis. The right lung was partially collapsed with a right pneumothorax on the chest tube, while the left lung was almost completely collapsed with a left hydropneumothorax on the chest tube, indicating increased fluid density. The patient was also anemic with a hemoglobin of 9.5 g/dL and hypokalemic with a potassium level of 3.38 mmol/L.

Reinsertion of the left chest tube was performed. The patient's pulmonary rehabilitation has begun since hospitalization and consists of posture correction, breathing retraining exercises using deep breathing techniques 5 times/hour, relaxation breathing exercises, respiratory control with splinting in the chest tube insertion area, thoracic mobility

exercises, stretching of the pectoralis, upper trapezius, and rhomboid muscles, and unsupported sitting mobilization as tolerated. After being discharged, she could continue her exercises at home daily. She was given high-level laser therapy on the chest tube insertion area during control in the outpatient rehabilitation clinic to reduce pain.

In addition, the patient was scheduled for spirometry, mycobacteria detection with Mycobacteria Growth Indicator Tube (MGIT), and left lung decortication.

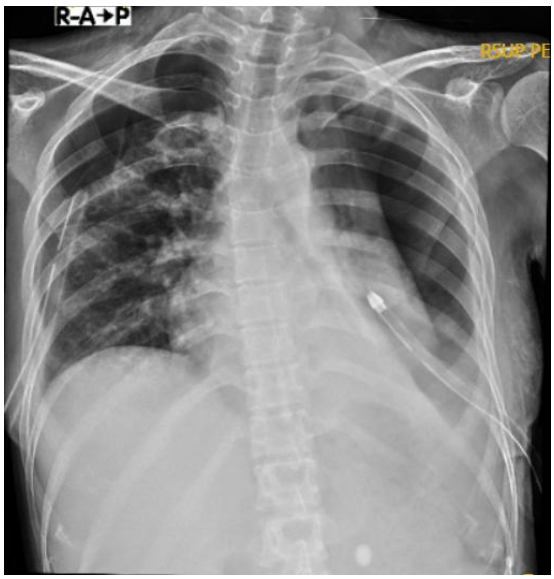

Figure 1. Thoracic x-ray on November 26, 2023

At 1 month of follow-up, the patient was hospitalized again because the left chest tube had detached from the left hemithorax. The tube was subsequently reinserted during a hospital stay. Anemia was found with Hb 8.7 mg/dL, and the patient was given a pack of red cell transfusion.

During observation, the patient appeared short of breath, with a respiratory rate of 20 times per minute, SpO_2 100% with O_2 nasal cannula 6 Lpm, and accessory inspiratory muscle contractions were seen. The patient also experienced pain at chest tube insertion with VAS 7-8.

Figure 2. Robotic High Laser

The rehabilitation program included Transcutaneous Electrical Nerve Stimulation (TENS) and laser therapy in the chest tube area, breathing retraining exercises, chest mobility exercises, respiratory muscle stretching, and energy conservation techniques.

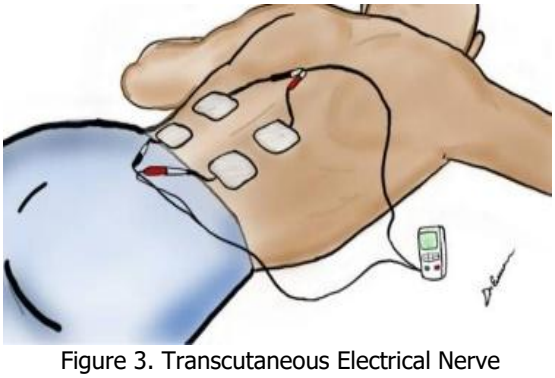

Figure 3. Transcutaneous Electrical Nerve Stimulation (TENS)[6]

Improvement in pain scale to VAS 5 was noted after pain control modalities. Gradual mobilization exercises are carried out to be able to stand upright. During mobilization exercises, the patient is partially assisted to sit on the edge of the bed for 8 minutes; the Borg scale was assessed at 13-3-0. Barthe index showed partial improvement in feeding, grooming, dressing, bladder control, toileting, and transfer, with a final score of 45. Most of the improvement was due to the pain control on the right side of the chest wall, allowing the patient to use her right hand more freely.

At the beginning of the treatment period, the right chest tube was repositioned. After several days of treatment, the left chest tube was removed because no improvement was noted, while the right chest tube was maintained. Spirometry result showed a Vital Capacity of 880 ml (34% of Predicted Vital Capacity), and Forced Expiration Volume at first second (FEV_1)/Forced Vital Capacity (FVC) of 89%, indicating severe respiratory restriction and diffusion problem without obstruction. The patient was scheduled for left lung decortication after the MGIT results showed negative results.

During treatment and exercise, the patient occasionally showed demotivation due to the experience of multiple chest tube detachments. This condition made the patient afraid to move and mobilize. Training with encouragement and supervision made patients more motivated to carry out exercise training during treatment, followed by breathing control and observing vital signs.

The patient was advised to consult the pain division for pain management related to high pain scales. The patient was also advised to consult the psychiatry department to manage demotivating conditions and increase patient adherence to treatment and exercise. Evaluation and management from all related divisions are the key to successfully improving the patient's condition.

DISCUSSION

Pulmonary TB can lead to chronic lung function deterioration.[7] The lung function decreases up to 35% with every infection episode. Post-TB sequelae include non-specific (35%), specific (30%), and obstructive syndrome (33%). About 13% of cases have radiological abnormalities. The patient in this case was diagnosed with pulmonary TB twice but was unable to complete medication due to her intolerance to adverse effects.

Hydropneumothorax is the presence of air and fluid in the pleural cavity, which may occur due to infection or non-infectious causes. Tuberculosis is the most common cause of hydropneumothorax. In TB, the condition usually begins with a focus of infection, which can grow to form a cavity that eventually ruptures, releasing air and fluid into the pleural cavity. An imbalance between the production and absorption of air and fluid in the pleural cavity, and the presence of negative

intrapleural cavity pressure cause damage to continue to occur.[8]

Chest tube insertion is the main management of hydropneumothorax to remove excess air and fluid from the pleural cavity. In a few cases, pleural drainage in more than one hemithorax is required to manage the hydropneumothorax. Survivors of this case are influenced by age, the presence or absence of HIV, and the severity of the lung involved.

The use of a chest tube is usually required for a long duration until the lungs expand, so patients are at risk of experiencing physical inactivity that leads to immobilization, dependence on activities of daily living (ADL), and limited participation. This was seen in the condition of our patient, who had been immobilized for 2 months. This immobilization was worsened as the patient experienced pain with high VAS. Pain intervention plays an important role in the mobilization management of this case. Increased pain tolerance can increase exercise and mobilization adherence.

Most studies of hydropneumothorax patients with chest tubes report shortness of breath as the main clinical symptom. This condition is caused by damage to the pleural wall, causing lung collapse as well as a ventilation-perfusion mismatch. In some cases, the duration of chest tube insertion varied, with an average of 21.3±10.6 days.[9]

Tuberculosis patients showed a longer duration of chest tube requirement (27.1±9.0 days) compared with hydropneumothorax due to other bacteria or malignancies, showing 11.9±3.7 and 10.8±5.3 days, respectively. The average duration of the chest tube insertion was 24.8 days (±13.1) in the study conducted by Kasargod and Awad.[9]

Suta et al in a literature review study, showed that the goal of short-term pulmonary rehabilitation is to reduce dyspnea, anxiety, and depression, while the long-term goal is to maintain the patient's functional status, improve QOL, and facilitate a return to ADL independence.[10]

Pulmonary rehabilitation can be initiated in the acute phase. The goal of the program is to maintain respiratory function and prevent complications such as deconditioning and contractures, using positioning, breathing exercises, active and passive movements and early mobilization. In the acute phase or exacerbation of a chronic condition, it is necessary to assess whether the patient's condition is safe enough to provide exercise.[11]

We provided a pain control management program to facilitate comfortable mobilization for the patient. We started mobilization exercises at a very light level, from sitting upright to sitting on the edge of the bed (Borg scale score between 9-11), with the target up to standing.

Though relatively young and had no history of HIV infection, the severity of the lung damage is extensive, which may delay recovery. Patients with extensive lung disease like this have limited exercise capacity due to impaired gas exchange and

alveolar ventilation. The decrease in oxygen supply to skeletal muscles results in a shift to anaerobic metabolism for energy production.[12] This leads to muscle wasting and fatigue, while extended hospitalization results in muscle deconditioning, depression, and declining quality of life.

Research on pulmonary rehabilitation in TB loss to follow-up patients is limited. However, available studies have demonstrated significant improvements in symptoms, exercise tolerance, and overall quality of life. In addition, according to a previous study by Pontali et al, there are criteria for participation in pulmonary rehabilitation.[12]

This patient meets the Clinical Standards for PTLD (Post TB Lung Disease) recommendations for pulmonary rehabilitation, which include patients with a history of TB, clinical and radiologic symptoms and signs, impaired lung function, reduced exercise tolerance, and comorbidities such as bronchiectasis, pulmonary hypertension, and a history of hospitalization or at least two exacerbations within 12 months.[13]

The recovery of these patients is a complex process. The goal is to improve symptoms and achieve optimal ADL independence. Pulmonary rehabilitation programs are multidisciplinary collaborations and offer several adjustable components depending on the patient's condition.[14,15]

Adequate patient education regarding disease state, treatment, and prognosis is essential to ensure long-term patient compliance. Education regarding comprehensive rehabilitation programs, the importance of physical activity and exercise to improve the quality of life, and compliance with the rehabilitation program also need to be communicated to patients.[14,15]

Since there are very few publications regarding bilateral hydropneumothorax therapy, there are no best protocols for pulmonary rehabilitation in such cases currently available. In this case report, we provide an individualized pulmonary rehabilitation program tailored to the patient's condition and complications. Previous studies by Taketa et al on pneumothorax after esophagectomy surgery suggest very light-intensity walking exercises to avoid exacerbation of pneumothorax.[16]

The pulmonary rehabilitation strategy, in this case, had several limitations. The first was that the patient's perception of pain was very high. Second, most cases of hydropneumothorax are unilateral, but in this case, bilateral hydropneumothorax was found. Third, our patient's physical function did not immediately recover after chest tube reinsertion. This decrease in physical performance reflected the two-month immobilization since the chest tube was first installed.

Inadequate pain control is a barrier in rehabilitation programs, especially for mobilization. Intercostal space nerve blocks can be added as additional pain management, and we recommend consulting a psychiatry department to maintain the patient's motivation and

overcome depression that may arise due to the chronic illness she is suffering from.[17]

Chest tube insertion in this patient resulted in increased pain and immobilization, resulting in chronic pain and difficulty in overcoming the intercostal neuralgia. Pain management that targets the nerves, bones, or tendons that cause pain provides an analgesic effect while reducing the need for opiate consumption.[18]

After chest tube insertion, lung expansion is expected quickly based on studies in most patients. Patients with a diagnosis of hydropneumothorax that lasts more than 10 days, recurrent, or bilateral, is an indication for surgical intervention.[9]

In this case, we administered a combination of breathing exercises, chest mobility exercises, light mobilization, and respiratory muscle stretching, combined with TENS and High-intensity laser therapy set at analgesic type, 3 W, 20 J/cm^2 to control pain and improve dyspnea. This is in line with the study by Namwaing et al, although the results did not influence the length of time the chest tube was installed.[19]

The patient experienced the pain more tolerably with the deep breathing method accompanied by splinting. For chest expansion exercises, we minimized pain by limiting the movement of the shoulders and upper extremities to a level that was tolerable to the patient.

The functional prognosis of this patient was poor. The patient had difficulty carrying out daily activities and is very limited in pain. If the etiology cannot be eradicated, recurrence can also occur. Malnutrition also limits the patient's capacity for exercise.[19] Eliminating the etiology is important, so MGIT was performed to evaluate the possibility of active TB infection before surgery.

Judging from the extent of the existing lung damage and the patient's poor clinical condition, the rehabilitation target for this patient was more akin to palliative care, where the main goal is to improve the patient's quality of life, eliminate or minimize distressing symptoms and complaints, and maintain psychological and spiritual health.

CONCLUSION

Pulmonary rehabilitation should be initiated as soon as possible for patients experiencing reduced lung function due to TB loss to follow-up. The program should be individualized to the patient's condition to reduce respiratory symptoms, improve the ability to perform ADLs and improve quality of life. Interventions can be targeted to reduce muscular spasms, improve dyspnea, and control pain in Hydropneumothorax patients with active TB. Bilateral pulmonary tissue destruction found in this case will limit the benefit of pulmonary rehabilitation intervention. However, palliative goals can still be pursued to optimize ADLs and remaining respiratory function. Long-term monitoring is necessary after intervention to evaluate the patient's progress in performing ADLs and prevent additional infectious exacerbations.

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