# Acute Respiratory Distress Syndrome on Disseminated TB in an ICU Patient: Case Study

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Abstract: A 23-year-old man presented to the hospital with shortness of breath, dizziness, and decreased level of consciousness. He was diagnosed with tuberculosis four years ago, but decided to stop taking his TB medication on the seventh day. Chest X-Ray A CT scan of his head revealed hydrocephalus. A hospital examination revealed MTB in his sputum and Cerebrospinal Fluid. Disseminated TB, which causes many complications because it can spread to all organs. Disseminated tuberculosis involves the blood, bone marrow, or liver, or the simultaneous involvement of at least two non-adjacent organs. Complications include TB meningitis, tuberculoma (which can develop into an SOL and hydrocephalus), and thrombocytopenia.

## 1 BACKGROUND

The region with the highest number of tuberculosis cases is Southeast Asia (44%), while Indonesia ranks second in the world for the number of tuberculosis cases after India. Multidrug-resistant tuberculosis (MDR TB) is the resistance of Mycobacterium tuberculosis to first-line anti-tuberculosis drugs (OAT), namely rifampicin and isoniazid. At the global level, in 2017, there were around 558,000 new cases (range: 483,000-639,000) of rifampicin-resistant TB (RR TB), of which almost half were in three countries: India (24%), China (13%), and Russia (10%). WHO estimates that there are 23,000 cases of MDR/RR in Indonesia. Less than one-third of MDR TB in Indonesia is identified and treated appropriately (Lestari et al., 2024). Tuberculosis (TB) causes many complications because it can affect all organs (Su & Yu, 2013). Hematogenous spread of tubercle bacilli throughout the lungs and other organs causes the widespread and possibly lethal form of tuberculosis (Su & Yu, 2013). TB bacteria primarily spread to the lungs, but a substantial proportion also leads to extrapulmonary disease (Tatar et al., 2011; Zhao et al., 2020). 28.6% of respiratory failure cases in the tertiary ICU were due to TB (Muthu et al., 2018). 1-3% of TB patients require ICU care and carry a high risk of death because of complications that can affect multiple organs (Han et al., 2021).

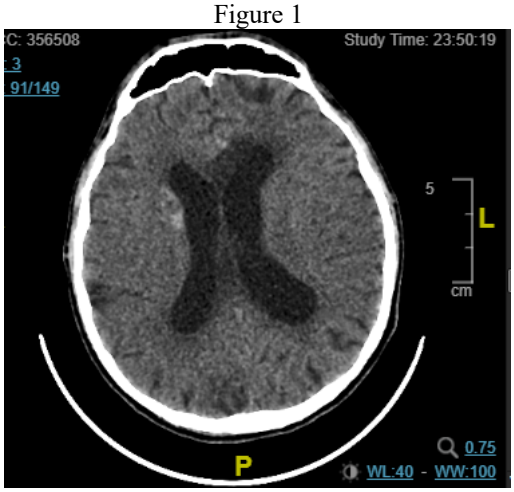
Multiple organ failure in TB patients also affects the lungs, which can develop into Acute Respiratory Distress Syndrome (ARDS (Wang et al., 2021).

## 2 CASE REPORT

A 23-year-old man presented to the hospital with shortness of breath, headache, difficulty concentrating, and somnolence. He had a TB diagnosis nine months ago, but dropped out after seven days of treatment. The patient has been diagnosed with pulmonary TB since August 2020. The patient immediately received treatment in the ICU due to Acute respiratory distress syndrome because he required a ventilator.

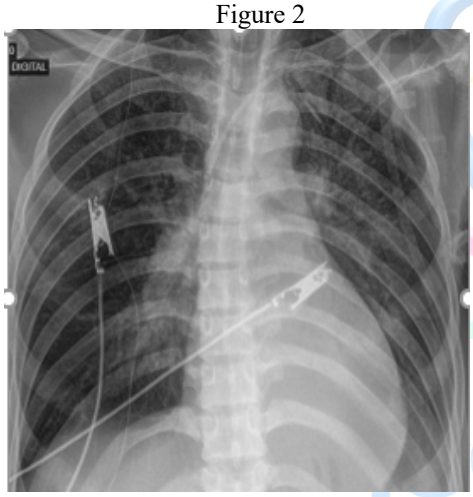
The patient discontinued medication and experienced a deterioration in his condition in early 2024. Subsequently, a sputum MTB (Mycobacterium Tuberculosis) examination was performed, and the results showed MTB detection with intermediate rifampicin susceptibility. On the first day of hospitalisation, the sputum culture showed a fungus, but the sterile no bacteria or fungi.

Figure 1




The results of the CT scan performed showed communicating hydrocephalus.

Figure 2




Lung radiology results showed pulmonary TB with moderate lesions accompanied by pneumonia.

Before admission to the ICU, he was examined for TB. The Cerebrospinal fluid and sputum examinations detected Mycobacterium tuberculosis (MTB) and confirmed rifampicin sensitivity. The patient was admitted to the Medical Intensive Care Unit (MICU) with ARDS. Laboratory results showed anemia (7.4 g/dl), respiratory acidosis (PCO2 = 56.1 mmHg), and PO2 = 76.3 mmHg. In addition, there was an electrolyte imbalance: hypokalaemia (2.2 meq/l), hypocalcaemia (2.65 mg/dl), and a procalcitonin level of 7.05 ng/ml.

While being treated in the ICU, the patient continues TB treatment, with collaboration between rehabilitation, nutritionists, and intensivists.

## 3 DISCUSSION

In the case above, the patient was still young and decided to discontinue treatment after the 7th day. In contrast, research indicates that older age is the strongest factor for dropping out of TB treatment in Indonesia. A study found that at a young age, compliance with TB medication is higher. Discontinuing TB treatment results in recurrent symptoms and complications in various organs, leading to disseminated TB. Critical multi-organ conditions led to admission to the ICU. The data show that 80% of TB patients in the ICU have multiple organs. The data show that 80% of TB patients in the ICU have multiple organs (Murthy et al., 2023).

WHO consistently emphasises monitoring TB drug use (WHO, 2022b). Monitoring extends beyond adherence to TB medication to include side effects. No one is free from side effects of TB, as adverse drug reactions (ADRs) are benign and result from TB toxins (Akkerman et al., 2019). In addition, TB meningitis can lead to the development of tuberculomas, which are intracranial space-occupying lesions (SOLs) (Saifon et al., 2023), and thrombocytopenia can worsen cerebral circulation (Hokeness et al., 2024). Ibrahim et al. (2023) found that 10% of patients with TB meningitis had a tuberculoma. This case study found that cerebrospinal fluid examination detected MTB, which was rifampicin-sensitive. MTB results indicate that spinal tuberculosis causes TB meningitis (Hokeness et al., 2024; Hou et al., 2017). Supporting data include the results of the CT scan, which showed communicating hydrocephalus with a VP shunt. This patient underwent surgery to install a VP shunt on the 10th day of hospitalisation. A line study by Ibrahim et al. (2023) found that 3 of 46 TB meningitis patients developed a tuberculoma that progressed to hydrocephalus. Thus, the patient also had a tuberculoma complicated by hydrocephalus.

In addition to hydrocephalus-related complications, some data indicate that Disseminated TB also causes hematological abnormalities, including thrombocytopenia. Hematological effects are mostly caused by Adverse Drug Reactions (ADR). ADR to TB drugs can also. ADR of TB drugs can also cause systemic effects, including leukocytosis, leukopenia, thrombocytopenia, and thrombocytosis (Srividya et al., 2020) . Since the initial admission, this patient has experienced thrombocytopenia, with platelets ranging from 70,000 to 80,000/ul. Corrective therapy has been administered via platelet transfusions until the target platelet count reaches at least 100,000/ul. Thrombocytopenia occurs due to

reduced platelet production from various causes, including spinal inflammation, DIC, or the severe effects of TB therapy (Alkhatib et al., 2021). Thrombocytopenia is not always associated with an immune deficiency, as pancytopenia can result from bone marrow inflammation, which is not always related to an immune deficiency (Khan et al., 2021). Disseminated TB can be life-threatening because it can spread the Tuberculosis bacteria massively through hematogenous spread (Khan, 2019).

Disseminated TB accounts for only 1-2% of all TB cases (Huang et al., 2024). It frequently results from untreated or interrupted TB treatment, leading to spread to multiple organs, including the lungs, meninges, and intestines. This dissemination can also occur via the lymphatic system, often due to discontinuation of TB treatment (Esposito et al., 2020). In this case, the patient experienced complications and died on the 14th day of ICU treatment (Nakao et al., 2016). Disseminated TB is responsible for up to 19.8% of TB-related mortality, especially when it causes meningitis (Manyelo et al., 2021). Mortality is exacerbated when dissemination causes meningitis. Meanwhile, the ARDS mortality rate in TB patients is reported to reach 75% within 14 days after symptoms appear (Kilaru et al., 2019).

## 4 CONCLUSION:

Patients who discontinue TB treatment may face several complications impacting multiple organs, such as tuberculoma, SOL, and hydrocephalus. These issues can escalate to disseminated TB, which can be deadly even in young patients without autoimmune conditions.

## ACKNOWLEDGEMENTS

This study is dedicated to tuberculosis survivors.

## ETHICAL CONSIDERATION

Ethical approval for this study has been obtained from the Dr. Hasan Sadikin Tertiary Hospital Institutional Review Board (DP.04.03/F.XXVI.17/0283/2024). Informed consent will be obtained in this research to protect participants and to fully uphold ethical principles.

## CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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