

Proper Management of Underweight and Anemia in Tuberculosis Patients Increases The Improvement Time During Two-Week Treatment Follow-Up

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Abstract

Tuberculosis (TB) continues to be the leading cause of disease and mortality caused by chronic pulmonary infection. The World Health Organization (WHO) considers that one-third of the global population is infected with *Mycobacterium tuberculosis* (Mtb). *Mycobacterium tuberculosis* infection results in persistent lung damage, which is characterized by ongoing inflammation that damages lung tissue. The patient additionally experienced a cough for almost one month, with clear mucous, absence of blood, and mild shortness of breath. Patients had decreases in body weight and loss of appetite for about three weeks. Night sweats appeared within one month. There was no specific complaint of gastrointestinal symptoms. The patient's nutritional management was focused primarily on oral intake, with a total daily consumption of 1690 kcal. The daily protein, carbohydrate, and fat consumption is divided into 42.45 grams of protein, 253.5 grams of carbohydrates, and 37.5 grams of fat. There was no history of food allergy from the patient, therefore we decided not to impose any dietary restrictions. The improvement in body weight was used to monitor the outcome of the nutritional intervention. Nutritional issues have emerged as a significant contributor to an increasing percentage of individuals with low hemoglobin (Hb), influencing TB-related morbidity. The most prevalent causes of anemia in tuberculosis are nutritional deficiencies and malabsorption as a result of appetite loss. Poor intake of food has also been linked to an increased risk of disseminated TB. To improve treatment outcomes, nutritional support should be provided in addition to tuberculosis medicine.

Keywords: Anemia, malnutrition, tuberculosis

Penatalaksanaan Berat Badan Kurang dan Anemia yang Tepat pada Pasien TBC Meningkatkan Waktu Perbaikan Selama Dua Minggu Perawatan Lanjutan

Abstrak

Tuberkulosis (TB) masih menjadi penyebab utama penyakit dan kematian akibat infeksi paru kronis. Organisasi Kesehatan Dunia (WHO) menganggap sepertiga populasi global terinfeksi *Mycobacterium tuberculosis* (Mtb). Infeksi *Mycobacterium tuberculosis* menyebabkan kerusakan paru-paru yang persisten, yang ditandai dengan peradangan berkelanjutan yang merusak jaringan paru-paru. Pasien juga mengalami batuk selama hampir satu bulan, dengan lendir bening, tidak ada darah, dan sesak napas ringan. Pasien mengalami penurunan berat badan dan kehilangan nafsu makan selama sekitar tiga minggu. Keringat malam muncul dalam waktu satu bulan. Tidak ada keluhan spesifik gejala gastrointestinal. Penatalaksanaan nutrisi pasien difokuskan terutama pada asupan oral, dengan total konsumsi harian 1690 kkal. Konsumsi protein, karbohidrat, dan lemak harian dibagi menjadi protein 42,45 gram, karbohidrat 253,5 gram, dan lemak 37,5 gram. Tidak ada riwayat alergi makanan dari pasien, oleh karena itu kami memutuskan untuk tidak menerapkan pantangan makanan apapun. Peningkatan berat badan digunakan untuk memantau hasil intervensi nutrisi. Masalah gizi telah muncul sebagai kontributor signifikan terhadap peningkatan persentase individu dengan hemoglobin (Hb) rendah, yang mempengaruhi morbiditas terkait TBC. Penyebab anemia pada tuberkulosis yang paling umum adalah defisiensi nutrisi dan malabsorpsi akibat hilangnya nafsu makan. Asupan makanan yang buruk juga dikaitkan dengan peningkatan risiko penyebaran TBC. Untuk meningkatkan hasil pengobatan, dukungan nutrisi harus diberikan selain obat tuberkulosis.

Kata Kunci : Anemia, malnutrisi, tuberkulosis

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Introduction

Tuberculosis (TB) has long been the most frequent cause of disease and death due to infection by microorganisms. The World Health Organization (WHO) considers that one-third of the global population is infected with *Mycobacterium tuberculosis* (Mtb). *Mycobacterium tuberculosis* infection causes

chronic lung disease, which is characterized by continuous inflammation that damages lung tissue.¹

Despite global attempts to minimize the prevalence of tuberculosis, it remains a major health problem in underdeveloped countries. Several associated diseases, lifestyle habits, and socioeconomic factors have been linked to the

development of tuberculosis. Undernutrition is considered to be the leading cause of new tuberculosis cases. Body mass index (BMI) is the most often indicator used for checking nutritional status. Numerous studies have been conducted to explain the correlation between undernourished individuals and the incidence of tuberculosis.²

Nutritional problems have emerged as an important component of an increasing percentage of patients with low levels of hemoglobin (Hb), and affecting TB-related morbidity. Anemia is defined as Hb counts less than 12.5 g/dL in females and 13.5 g/dL in males. Many factors contribute to anemia, including iron deficiency and chronic inflammation. Anemia has been studied thoroughly as a comorbidity related to tuberculosis. The association between systemic inflammation, nutritional state, and anemia level in tuberculosis should be carefully investigated. We documented the case of underweight patients and anemia in TB who underwent treatment with antimycobacterial drugs as well as nutrition management to optimize the conversion status during antituberculosis therapy.³

Case presentation

A 44-year-old female patient came to clinic with a chief complaint of malaise that started one month ago. The patient additionally experienced a cough for almost one month, with clear mucous, absence of blood, and mild shortness of breath. Patients had decreases in body weight and loss of appetite for about three weeks. Night sweats appeared within one month. There was no specific complaint of gastrointestinal symptoms. The patient reported not having a fever or localized chest pain. There was no history of specific medication or surgical procedures within the patients or their families.

The patient looked weak and pale with a body mass index (BMI) of only 16, indicating an underweight condition due to lack of nutrition. Vital signs showed no specific problems with body temperature was 36.8°C, the heart rate of 116 beats per minute, the blood pressure was 109/62 mmHg, and the respiration rate of 21 times per minute displaying a 97% saturation of

oxygen. The physical exam confirmed both pale conjunctivas. The chest examination demonstrated symmetrical lung expansion, Sonor percussion, and bilateral lung fine crackles. The heartbeat was normal, with no abnormal cardiac sounds.

Laboratory testing confirmed anemia (hemoglobin 7.4 mg/dL), with an erythrocyte count of barely 2.7 million cells/ μ L and a hematocrit level of 22.9%. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were within normal levels. The leukocyte count was within the normal limit (6.600 cells/ μ L), while the platelet count was 127.000 cells/ μ L. The chest X-ray indicated middle and lower lobe infiltrates, along with a cavitary lung lesion in the right hemithorax (Figure 1). The heart visualization appeared to be regular in size. A molecular examination of the sputum confirmed *Mycobacterium tuberculosis* infection with no evidence of rifampicin resistance detected. The patient was treated with an initial diagnosis of bacteriologically confirmed pulmonary tuberculosis, anemia, and malnutrition.

The routine hematological examination result in this patient indicated normochromic, normocytic anemia, which was characterized by low hemoglobin, low red blood cell number, and low hematocrit, together with normal values of MCV, MCH, and MCHC. The tuberculosis infection was suspected to be the origin of the main clinical condition, which developed at least one month ago. This patient subsequently began receiving a 300 ml blood transfusion of packed red cells, which was administered within 24 hours, while investigating the primary source of blood loss.

The patient's nutritional management was focused primarily on oral intake, with a total daily consumption of 1690 kcal. The daily protein, carbohydrate, and fat consumption is divided into 42.45 grams of protein, 253.5 grams of carbohydrates, and 37.5 grams of fat. There was no history of food allergy from the patient, therefore we decided not to impose any dietary restrictions. The improvement in body weight was used to monitor the outcome of the nutritional intervention.

The patient started receiving oral antituberculosis treatment with a fixed-dose combination (rifampicin 150 mg/isoniazid 75 mg/pyrazinamide 400 mg/ethambutol 275 mg) of three pills daily. The patient was monitored for side effects such as nausea, vomiting, skin rash, and icterus. Pyridoxine 10 mg was prescribed to prevent the symptoms of peripheral neuropathy caused by isoniazid

therapy. Treatment was then followed up after two weeks to assess symptom improvement, with a chest X-ray examination serving as an objective assessment. The patient improved significantly as cough symptoms reduced and body weight increased by nearly two kg. Chest X-rays showed improvement with the absence of infiltrates and cavitary lesions in both lung fields (figure 2).

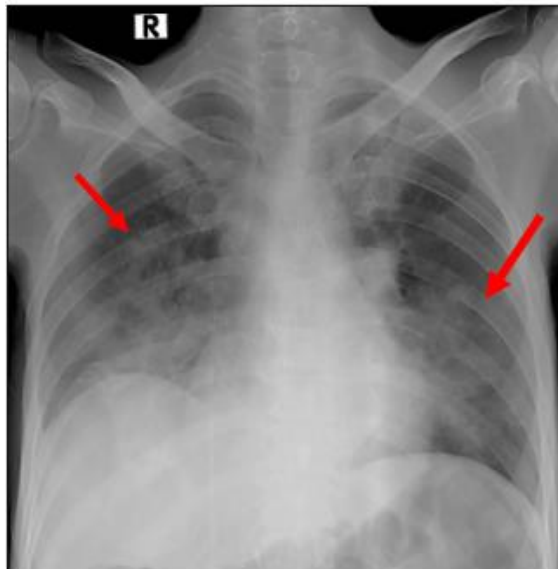


Figure 1. A pre-treatment chest X-ray revealed bilateral infiltrates near the paracardial border in both lung fields (red arrow). Cavitory lesions appeared in the right side hemithorax.

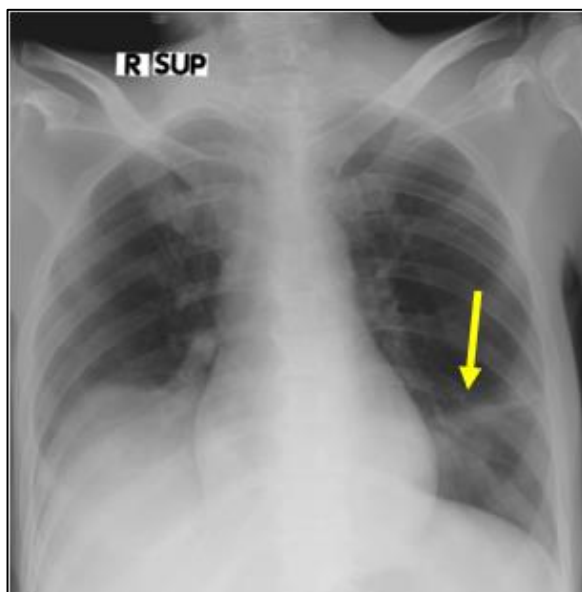


Figure 2. Follow up 2 weeks after treatment, chest X-ray only showed minimal fibrosis in left lung fields (yellow arrow).

Discussion

Anemia is a common TB-related disease and several studies reported a prevalence of anemia at TB diagnosis that varies from 30-80%. The findings here support the theory that anemia is common in active tuberculosis cases and that most TB-associated anemia is caused by chronic inflammation rather than iron shortage. This condition is indicated by elevated levels of Erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and uric acid, as the signs of systemic inflammation.^{4,5}

Mycobacterium tuberculosis infection is known to be associated with an inflammatory state. Hemoglobin levels did not alter significantly as the grade of the AFB smear increased. Instead, in anemic patients, we identified an obvious linear pattern of decreasing hemoglobin levels as AFB smear grades progressively increased. Tuberculosis infection may influence the severity of anemia in more vulnerable individuals than in all TB patients.^{6,7}

Many patients with pulmonary tuberculosis exhibit lower hemoglobin levels, which might have a direct impact on TB morbidity. Criteria from WHO were used to determine if the anemia was mild, moderate, or severe. Anemia of chronic diseases mostly caused by chronic inflammation, is a clinical condition marked by the development of anemia in patients suffering from infectious, neoplastic, or autoimmune diseases. The correlation between tuberculosis and malnutrition is made up by the interactions of the effect of malnutrition on the clinical symptoms of tuberculosis and the effect of immunological dysfunction of tuberculosis on nutritional status.^{8,9}

Many studies have identified that anemia is frequently seen in tuberculosis patients. The most prevalent anemia are iron-deficiency anemia and chronic illness anemia. The most common causes of anemia in tuberculosis are dietary insufficiency and malabsorption. Loss of appetite, a classic sign of tuberculosis, could explain this decreased nutritional intake. Tuberculosis is known to cause systemic inflammation and pulmonary complications. Inflammation-induced anemia is caused by a short erythrocyte life span, inadequate iron

incorporation, and impaired response to absorbing erythropoietin.^{3,10}

TB might trigger systemic inflammation, and anemia from inflammation may worsen as the number of infected sites increases. Malnutrition typically takes time to develop and induces anemia in concomitants. These two problems correspond to one another and should be managed concurrently. Anemia occurs when erythropoietin is inhibited due to aberrant cytokine production and alterations in iron metabolism. The explanation for this could be that iron metabolism abnormalities in anemia patients impair the uptake of iron by macrophages, affecting the innate immune response to Mtb infection. We also discovered that anemia was substantially associated with the occurrence of lung cavitation, as well as an increase in the number of lung lesions in patients.^{11,12}

Anemia due to malnutrition in tuberculosis are major concern in developing countries and it is important to consider how these issues relate to each other. TB and malnutrition have a complementing effect, increasing their prevalence and rates of death. Malnutrition impacts TB prognosis as well as physical recovery. Malnutrition increases the severity, frequency, and mortality of the underlying disease. This low nutritional status affects the change in appetite, decreases the food intake by changing leptin levels, and declines nutrient absorption.^{13,14}

In tuberculosis, low dietary intake and intestinal absorption abnormalities can both create and worsen nutrient deficiencies. Poor dietary status has also been linked to an increased risk of disseminated spreading of tuberculosis. Malnutrition is frequent among the cases of children with tuberculosis. In children, TB causing poor nutrition could be caused by decreased intake, malabsorption, and increased loss (due to vomiting or diarrhea). Therefore, it is likely that infants and adolescents are more susceptible to stunted growth when TB occurs.^{15,16}

Chronic disorders induce anemia through several mechanisms. The mechanism involves less utilization of iron preservation for heme synthesis. Excessive hepcidin protein synthesis by the liver as a result of cytokine activation restricts iron absorption from the digestive

system. The effects of proinflammatory cytokines will also suppress erythropoietin production, impede erythropoiesis in response to hypoxia, and drastically diminish mature erythrocyte survival in circulation.^{12,17}

According to research, the reduced immune function of TB patients at risk of malnutrition could aggravate their illness. Hemoglobin level, albumin, and creatinine are

Conclusion

Anemia was frequent in chronic disease patients, and it was most commonly linked with malnutrition. A high proportion of tuberculosis patients were diagnosed as underweight or malnourished based on multiple factors. This condition could end with a reduction in the success rate of treatment. Proper management of the underlying disease in tuberculosis patients improves treatment conversion rates.

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