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Case Report

Early management of pediatric pulmonary tuberculosis with iron deficiency anemia: a case report

Putu A. Hartadi*, Putu S. Suryaningsih

Department of Paediatrics, Wangaya Regional Hospital, Denpasar, Bali

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***Correspondence:**
Dr. Putu A. Hartadi,
E-mail: hartadi.putuardy@gmail.com

ABSTRACT

Tuberculosis (TB) in children is often difficult to diagnose due to nonspecific symptoms and limited microbiological testing. Severe anemia in children is usually evaluated for nutritional deficiencies or hematological disorders, but can also be an indicator of chronic infections such as TB. In this case, a child with severe anemia without typical respiratory symptoms was finally diagnosed with TB after further evaluation. This case report emphasizes the importance of high suspicion of TB in unclear anemia, as well as the role of transfusion in stabilization and diagnosis. A 4-year-old girl was referred to Wangaya with moderate hypochromic microcytic anemia, suspected iron deficiency anemia (IDA). The patient had fever, cough, and runny nose since 23 November 2024, accompanied by a decrease in haemoglobin (Hb) to 6.7 g/dl. Peripheral blood examination showed hypochromic microcytic with poikilocytosis, suggesting IDA or possibly thalassemia. Nutritional status was good, but there was underweight and short stature. The patient was admitted for further evaluation. In this case, continued evaluation of the unimproved anemia led to the diagnosis of tuberculosis, despite the absence of prominent respiratory symptoms. This emphasizes the importance of considering TB as a differential diagnosis in children with anemia of unclear etiology. Blood transfusion can play an important role in clinical stabilization while supporting the diagnosis and management process.

Keywords: Iron deficiency anemia, Pediatric, Tuberculosis

INTRODUCTION

Pediatric tuberculosis (TB) continues to pose a significant diagnostic challenge, primarily due to its often nonspecific clinical manifestations and limited sensitivity of microbiological tests in children.[1,2] According to the World Health Organization (WHO), approximately one million children develop TB each year, yet most remain undiagnosed or diagnosed late, as the disease often mimics other chronic infections.[3] Symptoms such as persistent fever, weight loss, chronic cough, and lymphadenopathy are often indistinguishable from other pediatric conditions, requiring a systematic and multi-layered diagnostic approach.[1,2]

In clinical practice, children presenting with severe anemia are often evaluated for nutritional deficiencies, hemolytic processes, or bone marrow suppression. However, anemia may also serve as an early non-specific indicator of underlying chronic infections, including TB.4 Among the pediatric population, iron deficiency anemia (IDA) is still the most common cause of anemia, but is increasingly associated with chronic infectious conditions.[5] In TB, systemic inflammation, malnutrition, and altered iron metabolism are thought to contribute to the development or worsening of IDA through hepcidin-mediated iron sequestration and impaired iron absorption.[6,7]

In addition, TB-induced inflammation can lead to elevated inflammatory markers, suppression of erythropoiesis, and dysregulation of iron utilization, resulting in an anemia profile that often overlaps with anemia due to chronic disease.[4,8] This overlap requires careful diagnostic distinction through laboratory parameters such as serum ferritin, transferrin saturation, erythrocyte index, and inflammatory markers.[5,9] Nonetheless, in resource-limited

or time-sensitive settings, clinical decision-making must often rely on a synthesis of clinical presentation, epidemiologic risk, and initial therapeutic response.[10,11]

In this case, a pediatric patient with severe anemia was evaluated through a comprehensive infectious work-up, which ultimately led to the diagnosis of tuberculosis. The absence of obvious respiratory symptoms initially complicated the clinical picture; however, diagnostic reassessment based on laboratory and radiology findings directed the investigation towards TB. This report underscores the importance of maintaining a high index of suspicion for TB in pediatric patients with unexplained anemia and chronic symptoms. The role of iron deficiency anemia as a clinical manifestation and confounding variable in pediatric TB cases is also highlighted. Furthermore, the rationale for red blood cell transfusion is discussed in the context of clinical stabilization, diagnostic clarification, and therapeutic decision-making in patients with concurrent TB and severe anemia.

CASE REPORT

The female patient aged 4 years, came to the pediatric polyclinic of Wangaya General Hospital accompanied by her parents, was a referral patient of local clinic with a diagnosis of moderate hypochromic microcytic anemia susp IDA. The patient was initially said to have a fever since the evening of 23 November 2024 accompanied by a cough with phlegm and a runny nose. The patient was given medicine for cough, runny nose and fever. On 27 November 2024 the patient returned to local clinic because it was felt that the complaints had not improved and was advised to do the complete blood counts check, then the patient was found to be anemic with Hb 7.2, so he was referred to a pediatric specialist. The patient was given antibiotics, cough medicine, and inflammation medicine. After that, the patient was said to have no fever. The patient was said to have a fever again since the evening of 07 December 2024 accompanied by a cough with phlegm and a runny nose and said that the fever began to fall but rose again every night. On 09 December 2024 the patient was then referred to the pediatric clinic of Wangaya General Hospital for anemia therapy. The patient was hospitalized starting on 10 December 2024. The patient's appetite and drinking are good. There were no complaints of urination and defecation. Complaints of recurrent fever were denied.

The patient was the third of three children, living in a house with five family members. History of the patient was born by sectio caesaria at Local Hospital, birth weight 2.7 kg, the patient was said to have been yellow at birth. History of previous illness, history of food and drug allergies is denied. Immunization history was complete according to patient's age. There was no history of hospitalization or developmental delay.

Present status, the patient's body temperature is 36°C. Anthropometric status: body weight: 12.6 kg, body height: 95 cm. According to patient's general examination was found within normal limit.

The patient had a supporting examination in the form of complete blood count on 27 November 2024 with the results of WBC 7.1; HB 7.2 (low); HCT 24.9 (low); PLT 274, MCV 51.7 (low); MCH 14.9; and MCHC 28.9. Re-examination was carried out during the first day of hospitalization 10 December 2024 with the results of WBC 7.7; HB 6.7 (low); HCT 24.9 (low); PLT 333, MCV 54.5 (low); MCH 14.7 (low); MCHC 26.9 (low). LED: 32 (High), urinalysis: color: yellow, clear, specific gravity: 1.015, pH: 5.5, leukocyte esterase: negative, nitrite: negative, protein: negative, glucose: normal, ketone: negative, urobilinogen: normal, bilirubin: negative, blood: negative, erythrocyte sediment: 0-1, leukocytes: negative, cylinders: negative, flat epithelium: 0-2, crystals: negative, and bacteria: negative.

Peripheral blood smear 10 December 2024 showed erythrocytes: hypochromic microcytic poikilocytosis (ovalocyte cells, pencil cells tear drop cells, helmet cells), polychromasia cells (-), normoblast cells (-). Leukocytes: normal count, predominantly mature lymphocytes, atypical lymphocytes (-), immature granulocytes (-), blast cells. Platelets: normal count, giant platelets (-), platelet clumps (-). Impression: obtained blood cell morphology, periphery with a suspicious picture of iron deficiency anemia dd/thalassemia. Based on the results of the physical and supporting examinations, the patient was initially diagnosed with febrile observation of moderate hypochromic microcytic anemia with suspected IDA.

With this condition, the patient was decided to be given inpatient therapy with therapy given in the form of D5 1/2NS 10 drops per minute, paracetamol syrup 6 ml three times daily if fever, ambroxol syrup 2 ml three times daily, and packed red cell (PRC) transfusion plan when the lab results are complete. The patient was planned to have a complete blood count test, ESR, serum iron (SI), total iron binding capacity (TIBC), peripheral blood smear, and urinalysis (UL).

The results of the thorax X-ray examination obtained the impression of visible infiltration in both perihilus and lung basal, appearing thickening in both hilus, right and left sharp costoprenic sinuses, normal right and left diaphragms, normal bones and soft tissues. The examination revealed bronchopneumonia and pulmonary tuberculosis.

The patient was given IVFD D51/2NS 10 tpm macro therapy, with fluid requirements of 1130cc / day, protein requirements of 1 gram/kg/day, calorie requirements of 90 kcal/kg/day. Ceftriaxone antibiotics 500 mg twice daily were stopped and replaced with ampicillin antibiotics 600 mg twice daily, gentamicin 100 mg a day, diphenhydramine injection 15 mg three times daily, ranitidine injection 15 mg three times daily, paracetamol syrup 6 ml three times daily if fever, ambroxol syrup 2 ml

three times daily, PRC transfusion 150 cc twice in two days without premedication The results of complete blood counts after the transfusion were leukocyte count: 6.95×103/ul, erythrocyte count: 5.5×106/ul (H), haemoglobin: 9.6 g/dl (l), haematocrit 33.2% (l), MCV: 60.4 fL (l), MCH: 17.5 pg (l), MCHC: 28.9 g/l (l), platelets: 265×103/ul, RDW-SD: 58.9 fL (h), RDW-CV: 28.2% (h), neut%: 38.5%, lymp%: 53.5%, mono%: 5.3%, eos%: 2.6%, baso%: 0.1%, IG%: 0.3% (h), neut# 2.67 103/ul, lymp# 3.72×103 ul (h), mono#: 0.37×103 ul, eos#: 0.18×103, and baso#: 0.01×103/ul.

Figure 1: Chest X-ray (AP view).

DISCUSSION

TB remains a significant health challenge worldwide, especially among the pediatric population. The epidemiology of TB in pediatrics differs substantially from adults, mainly due to variations in exposure and immune response of pediatric patients. Statistics show an increasing incidence, especially in low- and middle-income countries where environmental factors and access to healthcare are suboptimal. In regions such as sub-Saharan Africa and South Asia, the prevalence of TB in pediatrics may be exacerbated by HIV co-infection, malnutrition, and other socio-economic determinants.[12] The WHO emphasizes the importance of early detection and treatment in the pediatric population to curb transmission of the disease and reduce the burden of long-term morbidity associated with TB.[13]

Clinical manifestations of TB in pediatrics are often vague and can differ from adults. Common symptoms are chronic cough, weight loss, and fatigue; however, in children, non-specific symptoms such as failure to thrive and fever may predominate.[14] Unfortunately, this non-specific presentation often leads to delayed diagnosis. In this case, at initial presentation, the patient presented with a diagnosis of moderate anemia with a history of fever since 2 weeks at night and cough with phlegm and runny nose since 2 weeks ago. Physical examination also revealed underweight, and stunted stature suggesting nutritional problems.

As per the history, signs and symptoms found, the patient is likely to have an infectious condition such as TB which may be the underlying cause of the patient's current complaints, including anemia. Some of the most common symptoms reported in children with TB include fever, cough, weight loss, fatigue, and night sweats. Some previous studies have shown that as many as 40% of children with TB have a fever that can last more than three weeks.[15,16] Cough is another important symptom, especially if it lasts more than two weeks, but can also be atypical or absent.[16] The co-occurrence of respiratory symptoms, such as dyspnea, may also be one of the diagnostic considerations indicating possible pulmonary involvement.[15] Other systemic symptoms may include failure to thrive, especially in younger children.[17]

In this case, to help establish the diagnosis, several supporting examinations were performed, both to confirm the suspicion of TB infection (AP thoracic X-ray and Mantoux test) and to confirm the patient's anemia (CBC, ESR, SI, TIBC, peripheral blood smear). The results of the supporting examination showed that the patient had suspected bronchopneumonia and pulmonary TB, so finally confirmation was made with TB scoring in pediatrics. A negative Mantoux test result resulted in the patient receiving a score of 4, which was positive for weight/nutrition parameters, fever of unknown cause, enlarged lymph nodes, and a thoracic photograph suggestive of pulmonary TB. The patient's diagnosis became pulmonary TB.

Establishing the diagnosis of pulmonary TB in pediatric patients is crucial in the management of these patients. This is because patients often present with complaints that are not directly related to TB as found in this case. Therefore, the use of a TB scoring system will greatly assist in establishing an objective diagnosis. In addition, several factors such as history of contact with TB patients, vaccination history, socioeconomic conditions, and living environment are also important factors in confirming the diagnosis of TB in pediatrics. In this case, the patient's score is 4, which is actually <6, but some typical clinical symptoms and supporting examination findings can help establish the diagnosis of pulmonary TB in this patient.

In addition to pulmonary TB, this patient also had anemia, where the results of the supporting examination showed a low Hb level (6.8 gr/dl), iron ferozine: 35, and TIBC: 394, along with hypochromic and microcytic erythrocyte features suggestive of iron deficiency anemia dd/chronic disease. In fact, definitive diagnosis requires further supporting examinations, namely SI, TIBC, ferritin, Hb electrophoresis. ADB is characterized by decreased iron stores, leading to low serum ferritin levels, low serum iron, and reduced transferrin saturation.[18,19] The diagnosis relies heavily on laboratory markers, where serum ferritin levels <15 ng/ml are indicative of iron deficiency.[20] In contrast, ACD often presents with normal or elevated ferritin levels but low serum iron and transferrin saturation. This discrepancy occurs due to iron uptake during inflammatory states, driven by cytokines such as hepcidin, which inhibit iron availability for erythropoiesis. Elevated

levels of hepcidin are often found in ACD, which inhibits iron absorption and leads to functional iron deficiency despite normal or increased iron stores.[21]

IDA has been identified as a significant complication among pediatric patients with TB. The inflammatory response triggered by TB can lead to iron absorption and impaired erythropoiesis, contributing to the development of anemia.[22] The prevalence of anemia in children with TB is reportedly high, with studies suggesting that a large proportion of these pediatric patients also have iron deficiency. This comorbidity not only complicates the clinical picture but also negatively impacts the health and recovery of affected patients. The implications of anemia on cognitive development and physical growth must be taken into account in the management strategy of pediatric TB patients.[22]

This patient was eventually treated with ampicillin antibiotics 600 mg twice daily, gentamicin 100 mg a day, paracetamol syrup 6 ml three times daily if fever, ambroxol syrup 2 ml three times daily, intensive phase FDC OAT 3 tabs a day for TB and PRC transfusion without premedication. The treatment of pediatric TB has evolved significantly with the introduction of fixed-dose combinations (FDCs), which play an important role during the intensive phase of therapy. The intensive phase usually consists of four first-line anti-tuberculosis drugs: rifampicin, isoniazid, pyrazinamide, and ethambutol, given during the first two months of treatment. This combination is designed to simplify the treatment regimen, improve adherence, and minimize the risk of developing drug resistance due to an incomplete treatment program.[23,24] The new formulation is designed with precise dosing, including fixed doses such as 50 mg isoniazid, 150 mg pyrazinamide, and 75 mg rifampicin per tablet, ensuring that children receive the recommended doses more easily, thus reducing pill burden and improving adherence.[25]

On the other hand, patients also receive blood transfusion therapy to manage anemic conditions. Blood transfusion for anemia in pediatric patients is a complex intervention, which is influenced by various factors, including the cause of the anemia, the clinical presentation, and potential complications associated with the anemia and the transfusion itself.26 In the context of severe anemia (Hb level 7-8 gr/dl), transfusion may be necessary to avoid complications such as organ ischemia and impaired cognitive development.[27,28] However, the decision to transfuse must balance the immediate benefits of increased hemoglobin levels with potential side effects such as alloimmunization, infection, and other transfusion-related complications.[26]

In addition, IDA treatment in pediatric patients diagnosed with TB requires a multifaceted approach. Nutritional interventions that focus on increasing dietary iron intake, as well as iron supplementation, are important components of the treatment strategy.[29] In cases where gastrointestinal disorders or chronic inflammation are suspected, more comprehensive clinical assessment and treatment may be required. Management of IDA should also involve educating the family on appropriate dietary choices and timing of iron supplementation to maximize absorption and efficacy. This approach should be accompanied by monitoring of response to treatment, especially in the context of ongoing TB therapy, which can complicate treatment outcomes.[29]

The prognosis of TB with ADB dd anemia/chronic disease in pediatrics is closely related to the underlying cause and the speed at which intervention is initiated. Early detection and effective management can significantly improve recovery outcomes. If not treated appropriately, TB and ADB can cause long-term effects on physical and cognitive development, potentially affecting a child's educational achievement and overall quality of life.[30] With prompt and appropriate treatment, prognosis can improve markedly, highlighting the need for an integrated strategy that includes anti-TB treatment and anemia management.[31]

CONCLUSION

The conclusion in this case is that continued evaluation of unimproved anemia leads to the diagnosis of tuberculosis, even though respiratory symptoms are not prominent. This emphasizes the importance of considering TB as a differential diagnosis in children with anemia of unclear etiology. Blood transfusion can play an important role in clinical stabilization while supporting the diagnosis and management process.

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