Case Presentation
The Impact of Nutrition on TB Treatment Outcomes

Case History:

A 49 year old male was diagnosed with recurrent pulmonary tuberculosis after presenting to an emergency room with a 3 month history of malaise, chills, subjective fevers, shortness of breath, productive cough; and weight loss over the past year. A sputum specimen was positive for AFB and grew *M. tuberculosis* susceptible to all first line drugs. The chest radiograph was abnormal with bilateral patchy alveolar opacifications in the upper lobes and a CT scan of the chest noted tree-in-bud parenchymal opacifications and consolidation bilaterally, cavitation in the right apex and right lower lobe, and diffuse centrilobular nodules in both lungs. The patient was coughing and appeared malnourished and chronically ill. His height was 5’7 1/2” and weight at diagnosis was 114lbs. His BMI was 18 (underweight). Labs indicated anemia, with a borderline low serum folate level (3.6, normal >5.4), and iron deficiency (iron 28, normal range 50-160).

His previous episode of tuberculosis was treated by directly observed therapy 7 years earlier. Because of a presumed allergic reaction to pyrazinamide (PZA), he received treatment with isoniazid (INH), rifampin (RIF), and ethambutol (EMB) alone. For unclear reasons, treatment was stopped after only 8 months despite a slow clinical and bacteriological response. His weight gain was poor and sputum cultures took more than 2 months to convert to negative.

Treatment was reinstituted with the standard four drug daily regimen of INH, RIF, EMB, and PZA but he was not able to tolerate the PZA and it was discontinued. Without PZA, a minimum of 9 months of treatment was planned. After 2 months of treatment, he had not gained any weight and during the third month he only gained 1 pound. A CBC indicated mild anemia. Serum drug levels showed a rifampin level of 8.01mcg/ml which was at the low end of normal (8-21 mcg/ml normal range), and a borderline low INH level of 3.14 mcg/ml (normal 3 – 5). Rifampin was increased to 750 mg daily. Repeat rifampin serum drug levels were normal at 20.17 mcg/ml. The patient tolerated the increased rifampin dose without any evidence of toxicity so INH was increased to 450 mg daily. Repeat levels were within normal limits.

Sputum smears and cultures were positive through the third month of therapy but converted to negative before the fourth month. Treatment was complicated by poor appetite, intermittent nausea, and vomiting after taking his TB medications. He improved with decreased cough, resolution of fevers and night sweats, and increased energy. After 4 months of treatment, he had gained 2 additional pounds and his appetite improved. By the fifth month, the weight was 119lbs, but his chest x-ray showed increased lucencies, necrosis, and cavitations. His weight increased further by month 7 of treatment but he continued to note mild daily nausea and at least 2 episodes of vomiting each week.

Treatment was extended to 12 months due to treatment without PZA, slow clinical and bacteriological response, and extensive radiographic disease. He continued on daily therapy throughout the course of his treatment.
Teaching Points:

This patient had several risk factors for a poor treatment outcome. We will note these but focus our discussion on the impact of nutrition on TB treatment outcomes.

- One primary treatment-related risk factor present in our patient was a regimen without PZA. The risk of TB relapse is increased in regimens that do not include PZA as this drug is critical to short course regimens because it targets bacterial persisters. When treatment does not include PZA for 8 weeks, treatment must be extended to at least nine months. Other treatment-related factors associated with an increased relapse risk include intermittent dosing, adherence, a non-rifampin regimen, and the duration of therapy.

- Medical risk factors present in our patient included: a low BMI and slow weight gain in the initial months of therapy; extensive radiographic or cavitary disease; prior TB treatment; and slow sputum culture conversion (> 2 months). Other medical factors associated with relapse include: associated medical conditions like diabetes or HIV, tuberculosis lymphadenitis, drug resistant disease, and prior treatment for tuberculosis.

- Patients who are underweight at diagnosis have an increased likelihood of treatment failure and/or relapse. Body weight has long been recognized as associated with an enhanced risk of progression of latent TB infection to disease. Studies of over 823,000 navy recruits found that tuberculosis developed three times more often in young men 10% or more below their ideal body weight than in those 10% or more above it.¹

- Underweight is defined by the Metropolitan Life Table as: 10% or more below ideal body weight at diagnosis. The patient from this case study was underweight at the beginning of treatment. According to the BMI chart, his BMI was 18. Relapse of TB is higher among persons who are underweight at diagnosis or who have a body mass index of less than 18.5 Kg/m².

- Underweight patients, at the beginning of treatment, are at high risk to relapse if given a standard treatment regimen. In the case study, the therapy was prolonged from 9 to 12 months to limit the impact of his poor weight gain during treatment.

- Lack of weight gain during TB therapy increases the risk of relapse. Khan and coworkers concluded that among persons who were underweight at diagnosis, a weight gain of 5% or less between diagnosis and completion of 2 month intensive phase therapy was moderately associated with an increase relapse risk (18.4 vs. 10.3%). Our patient was very close to treatment failure (treatment failure is defined as positive sputum cultures after 4 months of therapy) as he only converted his culture to negative during the third month of treatment. His slow bacteriological response was likely related at least in part to his poor nutritional status and failure to gain weight during the initial months of therapy.

- Wasting has long been recognized as a cardinal feature of tuberculosis. It is likely caused by a combination of reduction in appetite leading to a decrease in energy intake and increased weight loss due to altered metabolism as part of the inflammatory and immune responses.

- Early increase of nutritional intake has been shown to increase body weight, total lean mass, and physical function.
Clinical staff and TB case managers play a critical role in encouraging patients to increase their nutritional intake. Nutritional supplementation can be facilitated through the introduction of financial aid and incentives as part of the holistic care for patients during TB therapy. However, it is important to keep in mind the patient’s economic status and the family’s food habits. Resources and referrals should be given as needed.

If the initial chest radiograph shows cavitation and the two-month sputum culture is positive, there is a 50% chance of relapse. Prolongation of the continuation phase should be considered if a patient is slow to respond clinically or radiographically, or has a positive sputum culture at 2 months of treatment. If there is either a positive two-month culture, cavitary disease, or the patient is < 10% of his ideal body weight, extending therapy can be considered.

**FOOTNOTES:**


**REFERENCES:**


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Heartland National TB Center provides a **Medical Consultation Line** that is staffed Monday to Friday, 8:00 AM to 5:00 PM (CST). After business hours, voice mail is available and will be returned in one business day:

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