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Case Study

Cord factor in Sputum of a Patient with Schizophrenia: a Case Report

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A B S T R A C T

Trehalose 6,6'-dimycolate (TDM), or cord factor, is a glycolipid in the cell wall of Mycobacterium tuberculosis and a key determinant of its virulence. The case report highlights rare detection of cord factor in a 41-year-old female diagnosed with schizophrenia and pulmonary tuberculosis. The patient had typical symptoms of pulmonary tuberculosis and tested positive for acid fast bacilli through Ziehl–Neelsen staining as well as presence of cord. Cord factor may serve as a virulence factor which enables the bacteria to evade immune defense mechanism by inhibiting phagosome-lysosome fusion. The patient was referred for tuberculosis treatment to the nearest (DOT) center. The patient did not come back for follow-up, highlighting challenges in managing tuberculosis in psychiatric patients.

Keywords: Cord Factor, Pulmonary Tuberculosis, Psychiatric Comorbidities

Introduction

Cord factor, a biofilm-like architecture also known as trehalose 6,6'-dimycolate (TDM), is a glycolipid found in the cell wall of Mycobacterium tuberculosis (M. TB) and other mycobacteria.[1] It is composed of two mycolic acid molecules esterified to a disaccharide, trehalose. Its unique structure contributes to its biological activity, including the ability to form highly ordered, rope-like structures called cords (hence the name cord factor), which may serve as virulence factors in mycobacteria.[2] Cord factor acts differentially according to its localization. When present on the organisms, TDM is nontoxic and protects them from macrophage killing, but TDM may become highly toxic on lipid surfaces. TDM inhibits the phagosome-lysosome fusion and contributes to the maintenance of granulomatous response.[3] TDM may also induce the production of proinflammatory cytokines and chemokines. The Mycobacterium tuberculosis complex (MTC) proliferates effectively in liquid culture systems such as the Mycobacteria Growth Indicator Tube (MGIT) under optimal conditions, demonstrating its virulence factors. The serpentine cord is usually seen in Ziehl- Neelsen stain of smears prepared from positively flagged sputum samples due to the ability of the media to aggregate bacteria to align in a rope-like structure.[4] Apart from MTC, other bacteria such as Nocardia and Rhodococcus, and other mycobacteria such as M. marinum and M. kansassi, can also form cords.[5] Detection of cord factor in a direct sputum sample may indicate high pathogenicity of tuberculosis, and therefore urgent initiation of treatment and drug-resistant testing are required. However patient with mental illness may have various comorbidities such as homelessness, depression, avoidance, anxiety, anger issue, substance abuse etc. which may impact the treatment process. Additionally, research has shown that anti-TB drugs such isoniazid, ethambutol, and rifampicin are known to induce mental health issues including psychosis.[6]

Here, we describe a case of pulmonary tuberculosis (TB) in a schizophrenic patient with presence of cord in a direct sputum sample.

Case Presentation

A 41-year-old female was admitted to the psychiatry department of a tertiary care psychiatric institute with chief complaints of not taking food, self-muttering, self-smiling, anger outbursts, irritability, poor social interaction, sleep disturbances, and destructive behavior. The patient had no family history of mental illness. The patient was diagnosed with schizophrenia (F20). The patient also had significant weight loss with no past history of TB, fever with chills on and off (39ºC), night sweats, and a cough for 2-3 months. The patient had worked in a densely populated tea estate with less medical support and a lack of personal hygiene, which makes the individual vulnerable for tuberculosis. A Sputum sample was received in the microbiology laboratory for Ziehl- Neelsen (ZN) staining for acid- fast bacilli and aerobic culture and susceptibility testing. The sputum sample was positive for acid- fast bacilli along with the presence of cord as shown in figures 1 and 2. The aerobic bacterial culture on routine culture media had shown growth of commensal bacteria after 48 hours of aerobic incubation. Modified ZN staining was performed to rule out Nocardia and Rhodococcus and found to be negative. Other investigations for these organisms could not be performed due to resource constraints. The Complete blood count was within normal limits except for the haemoglobin level, which was low (7.3 g/dL). Liver function test, kidney function test, and lipid profile were within normal limits. The viral markers, such as HBsAg, Anti-HCV and HIV I & II antibodies were reported negative. The patient was initiated with antipsychotic drugs for the management of schizophrenia and other supportive psychiatric care. The patient was referred for tuberculosis treatment to the nearest Directly Observed Treatment DOT center due to the unavailability of treatment facilities in our setup.

However, in this case, follow-up could not be performed as the patient did not return for follow- up. This highlights a common challenge in the TB management and elimination program in patients with social or psychiatric challenges, where there are a possibility of poor adherence to the treatment and follow-up.

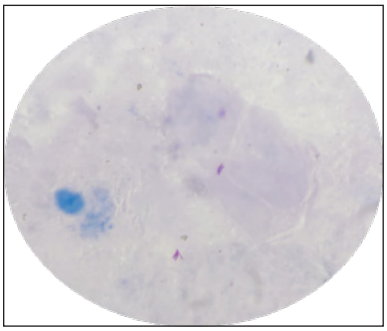

Figure 1.Acid fast bacilli in ZN staining of sputum sample (Magnification 1000x)

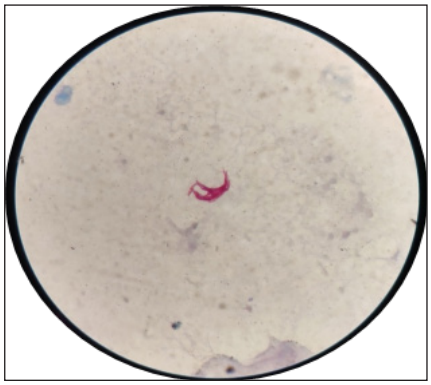

Figure 2.Cord formation in direct sputum sample in ZN Staining (Magnification 1000x)

Discussion

The identification of the cord (trehalose 6,6'-dimycolate or TDM) in a direct sputum sample on Ziehl–Neelsen staining is significant in this case due to its rarity and its implications for understanding the pathogenesis of Mycobacterium tuberculosis (M. tuberculosis). Cord formation in M. tuberculosis may contribute to the bacterium's ability to evade the host immune response and inhibit phagosome-lysosome fusion within macrophages and hence survive within host immune cells and promote the chronicity of the infection without production of visible inflammation.[4] Cengiz M et al. reported cord formation in a biopsy specimen from buccal lesions in a patient from Türkiye.[7] Similarly, Abe et al. detected cord formation in 4 out of 5 direct smears prepared from sputum, which resembles the present case report.[8] These findings highlight the rare but possible direct detection of cord formation in clinical specimens. Cord factor also helps sequester the bacteria by forming granulomas in a dormant state, where the metabolism of the bacilli is reduced. In this latent state, many antibiotics are less effective because they typically target actively growing bacteria and the membrane fluidity of the host cell is altered thus potentially promoting the drug resistance.[9] But in this case the drug resistance pattern could not be investigated due to unavailability of the resources and hence was sent to a nearby (DOT) center for further management and investigation.

Conclusion

The detection of cord factor in a direct sputum sample is a rare but diagnostically significant finding. It provides direct evidence of the presence of virulent M. tuberculosis, which could have prognostic implications. Typically, the presence of TDM might correlate with more aggressive disease and could suggest a need for closer monitoring and drug resistance testing.

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