Journal of Current Medical Research and Opinion
Received 05-05-2024 | Revised 07-05-2024 | Accepted 30-05-2024 | Published Online 01-06-2024

DOI: https://doi.org/10.52845/CMRO/2024/7-6-1 ISSN (O) 2589-8779 | (P) 2589-8760

CMRO 07 (06), 2700-2705 (2024)

Clinical Case Reports

Navigating Multi-Drug Resistant Tuberculosis: A Case Report on Treatment Challenges in a Non-Smoking Male

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Abstract:

A 39-year-old non-smoker man came in with persistent cough, fever, and significant weight loss over the past 5 months. Having previously been treated for pulmonary tuberculosis, he showed signs of malnutrition and lung crackles upon examination. Sputum tests confirmed active multi-drug resistant tuberculosis (MDR-TB), resistant to isoniazid, rifampicin, ethambutol, and streptomycin. Laboratory results indicated anemia and elevated liver enzymes. Chest imaging revealed cavitary lesions and opacities in the lungs. He was initiated on second-line anti-TB drugs with directly observed therapy. Regular follow-ups were scheduled to monitor his progress, highlighting the complexities of managing MDR-TB and the critical importance of treatment adherence.

Keywords: MDR, TB, tuberculosis, drug resistance

Introduction

Tuberculosis (TB) is an airborne infectious disease which is caused by microorganisms that can be contracted from one person to another. While TB primarily affects the lungs, it can also impact other organs like the spine, brain, and kidneys. Most TB cases can be reversed with adequate treatment, but without treatment, it can be life-threatening. When an individual with active TB of the lungs or throat coughs, sneezes, speaks, or sings, they release infectious particles which can be inhaled by those nearby, potentially transmitting the disease [1].

Drug resistance is a biological phenomena that has been observed in the Mycobacterium tuberculosis bacteria ever since the exploration of the first anti-TB drug, streptomycin [2]. TB bacteria that are resistant to fluoroquinolones, rifampin, and isoniazid are classified as causing pre-extensively drug-resistant tuberculosis (pre-XDR TB) [3].

Multidrug-resistant tuberculosis (MDR-TB) can arise when patients fail to complete their prescribed course of the most effective first-line TB medications, isoniazid and rifampicin [4]. Following the introduction of anti-tubercular chemotherapy, drug-resistant tuberculosis (DR-TB) has been a concern, but more recently, MDR-TB has become an increasing threat and a challenge in the global efforts to combat the disease [Cureus].

The patient's case highlights the growing global concern of MDR-TB. As per the World Health Organization (WHO), MDR-TB is classified into five categories: isoniazid-resistant TB, rifampicin-resistant TB, multidrug-resistant TB (MDR-TB), pre-extensively drug-resistant TB (pre-XDR-TB), and extensively drug-resistant TB (XDR-TB) [5].

India is considered a hotspot for Mycobacterium tuberculosis infection and, along with Russia and China, accounts for approximately 62% of the global burden of multidrug-resistant tuberculosis (MDR-TB) [6, 7]. Despite significant improvements in the management and therapy of TB, especially in developing countries, TB remains a serious public health concern. India alone bears about 30% of the world's TB burden [8].

The DOTS (Directly Observed Treatment, Short-course) strategy, which employs standardized short-course chemotherapy with first-line medications, is currently the primary approach for TB control worldwide. However, DOTS treatment may not effectively cure people with MDR-TB [9]. Usage of anti-TB medications becomes essential to address this issue, as traditional TB control strategies like the Bacillus Calmette-Guérin (BCG) vaccine and chemoprophylaxis appear ineffective. The rise in drug-resistant TB (DR-TB) cases poses a significant threat to successful disease treatment [10]. The current threat comes from M. tuberculosis strains that show aversion to potent bactericidal anti-TB drugs, such as rifampicin and isoniazid, which are often used in TB control programs. Despite the early discovery of drug resistance during the usage of streptomycin [10], concerns persist regarding the rise of antibiotic-resistant bacteria and the effectiveness of chemotherapy in treating these infections. [11]

Case Presentation

A 39-year-old man, non-smoker, visited the clinic with a persistent cough, fever, and significant weight reduction that had been persistent for the past 5 months. He had formerly been treated for pulmonary tuberculosis seven years ago and was successful. During the physical examination, he appeared undernourished, and crackling sounds were audible in his right upper lung area. Diagnostic tests revealed the existence of Mycobacterium tuberculosis bacteria in his sputum sample, and further testing indicated that the bacteria were resistant to isoniazid, rifampicin, ethambutol, and streptomycin, confirming a diagnosis of multi-drug resistant tuberculosis (MDR-TB). Laboratory results showed anaemia and slightly elevated liver enzyme levels. A chest X-ray revealed cavitary lesions in the right upper lung lobe and fibronodular opacities in the left upper lobe. The patient was initiated on a second-line anti-tuberculosis drug regimen and enrolled in a directly observed therapy (DOT) program to ensure adherence to treatment. Regular follow-ups were scheduled to monior his clinical condition and laboratory parameters. The prognosis was guarded, emphasizing the critical importance of strict treatment adherence and comprehensive patient care.

Discussion

Tuberculosis (TB) is an airborne infectious disease caused by Mycobacterium tuberculosis, primarily affecting the lungs but capable of spreading to other organs. The main factors contributing to the increasing spread of resistant TB strains are weak healthcare systems, amplification of resistance due to incorrect treatment, and ongoing transmission within communities and healthcare facilities [12]. [Figure 1]

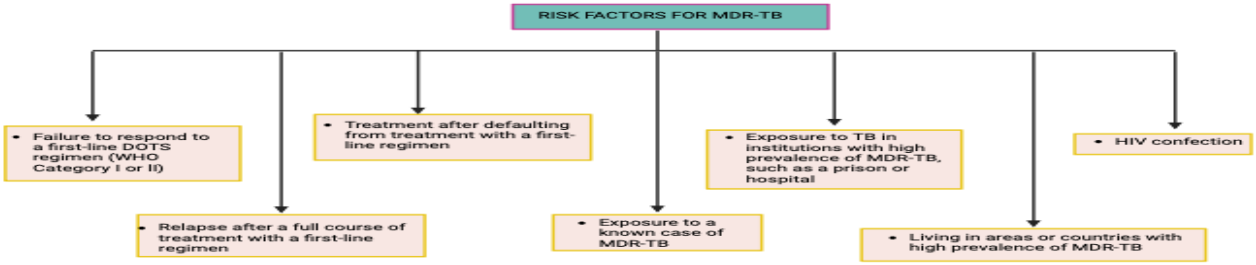

Figure 1: Risk factors for MDR-TB

Drug resistance in TB can be classified into two categories: acquired and primary. Primary drug resistance refers to drug-resistant cases in people who haven't ever received anti-tubercular therapy before. Contrary to it, acquired drug resistance is found to develop in people who have formerly received chemotherapy [13]. The term "acquired drug resistance" is used to describe resistance that emerges in a patient who has formerly gone through chemotherapy [8].

The case report describes a 39-year-old non-smoking man, who came with a complaint of persistent cough, fever, and considerable weight loss over 5 months. He had a history of previously treated pulmonary tuberculosis seven years ago. Clinical examination revealed a cachectic appearance with crackles in the right upper lung lobe, suggesting pulmonary involvement.

Diagnostic tests confirmed the presence of Mycobacterium tuberculosis, and subsequent drug susceptibility testing revealed resistance to several key first-line anti-TB drugs—isoniazid, rifampicin, ethambutol, and streptomycin—confirming the diagnosis of multidrug-resistant tuberculosis (MDR-TB).

Once treatment for multidrug-resistant tuberculosis (MDR-TB) is initiated, ensuring patient adherence and managing potential side effects can be challenging. Recent evidence suggests that MDR-TB is a significant contributing factor to Post-Tuberculosis Lung Disease (PTLD), which may cause disability and suffering, often requiring rehabilitation [14-18]. Half of the lifetime disability-adjusted life-years (DALYs) caused by incident TB are attributed to PTLD [19-21].

This case highlights the clinical and public health challenges posed by MDR-TB. The recurrence of TB in this patient, coupled with resistance to multiple drugs, exemplifies the complexities involved in treating and managing TB in the context of drug resistance. It also emphasizes the need for vigilant monitoring of TB patients even after favourable primary treatment, given the potential for relapse or re-infection with drug-resistant strains. Drug resistance in Mycobacterium tuberculosis was observed since the presentation of the first anti-TB drug, streptomycin. Resistance can develop when patients fail to complete the full course of treatment or due to inadequate drug regimens. MDR-TB specifically refers to strains resistant to at least isoniazid and rifampicin, the two most potent first-line drugs.

Tuberculosis (TB) remains a notable global health issue, especially in high-burden countries like India, Russia, and China, which all in all account for a substantial proportion of the global multidrug-resistant TB (MDR-TB) burden. The increasing incidence of MDR-TB, which is resistant to the most potent first-line anti-TB drugs isoniazid and rifampicin, poses a significant threat to global TB control efforts and emphasizes the necessity for robust diagnostic, therapeutic, and preventive strategies.

While the global burden of MDR-TB is a major public health concern, India, Russia, and China account for a significant proportion of cases worldwide. Traditional TB control strategies like the Directly Observed Treatment, Short-course (DOTS) approach might not be enough for MDR-TB, necessitating the usage of second-line and more expensive drug regimens.

As a result, there has been a demand for well-functioning DOTS programs to provide additional services in areas with high rates of MDR-TB. These "DOTS-plus for MDR-TB programs" may need to modify all five elements of the DOTS strategy: (i) treatment may need to be individualized rather than standardized; (ii) laboratory services may need to provide facilities for on-site culture and antibiotic susceptibility testing; (iii) reliable supplies of a wide range of expensive second-line agents; (iv) operational studies would be required to determine the indications; and (v) financial as well as technical assistance from various international organizations and Western governments would be needed in addition to that obtained from local governments [22-24].

Drug resistance typically arises from genetic mutations in the bacteria that confer a survival

advantage with antibiotics. For example, mutations in the katG gene and the inhA promoter region are often linked with resistance to the drug isoniazid, while mutations in the rpoB gene are linked to resistance to rifampicin. The accumulation of such mutations, often driven by inadequate or incomplete treatment regimens, may lead to the occurrence of MDR-TB.

Effective treatment of MDR-TB requires a comprehensive approach, including a tailored combination of second-line anti-TB drugs, directly observed therapy to ensure patient adherence, and regular monitoring for treatment response and adverse effects. The case report highlights the patient being initiated on a second-line regimen and enrolled in directly observed therapy, with a cautious prognosis because of the challenges associated with managing MDR-TB.

The prognosis for patients with MDR-TB is generally guarded, with successful outcomes heavily reliant on strict adherence to the prescribed treatment regimen and comprehensive patient care, including regular clinical and laboratory monitoring. The rise of MDR-TB and the emanation of even more resistant strains, such as extensively drug-resistant TB (XDR-TB), pose significant challenges to global TB eradication efforts. Public health policies ought to concentrate on enhancing diagnostic capabilities, ensuring access to effective treatment regimens, and implementing preventive measures to curb the spread of drug-resistant TB.

This case of multidrug-resistant tuberculosis (MDR-TB) highlights the necessity for ongoing scrutiny and innovation in TB control and management strategies. It underscores the significance of providing comprehensive patient care, ensuring strict treatment adherence, and integrating robust public health strategies to address the challenges posed by drug-resistant TB. The global health community must remain committed to combating TB through the occurrence of enhanced diagnostic tools, effective treatment options, and robust public health initiatives aimed at ultimately reducing the strain of this formidable disease.

Conclusion:

Overall, this case emphasizes the significance of early diagnosis, prompt initiation of appropriate treatment, and strict adherence to therapy so as to combat the growing threat of drug-resistant tuberculosis. It also highlights the requirement for improved TB control strategies, the evolution of new anti-TB drugs, and continued research efforts to effectively address this significant global public health challenge.

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