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Review Article

AN OVERVIEW OF TUBERCULOSIS

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TB remains one of the biggest health problems in the world and especially in low and middle-income nations even though it is a preventable and a curable condition. Transmission occurs by air in cases where an infected person sneezes, coughs, or speaks and expels the droplets with the bacteria. When inhaled, the bacteria can cause a lung infection where it may stay in an inactive state or develop active disease based on the immune system of the host. Tuberculosis clinically has a diverse list of symptoms, the most common of which are persistent cough, fever, night sweats, weight loss, and fatigue. The TB may be present in two broad forms; latent tuberculosis infection, where the person carries the bacteria without any symptoms or contagion, and active tuberculosis, which is symptomatic and contagious. Moreover, extrapulmonary TB has an affinity to other tissues like lymph nodes, bones, and central nervous system that complicates the diagnosis and treatment of this disease. The pathogenesis of TB is associated with the complicated interactions between the pathogen and the host immune system. After being infected, the immune cells strive to limit the bacteria by building granulomas. Tuberculosis is diagnosed by a mix of clinical assessment and laboratory procedures including sputum smear microscopy, culture procedures, chest radiography, and molecular diagnostics such as GeneXpert that enables the quick identification of the organism and drug resistance. The diagnosis of the disease is essential to prevent the spread of the disease and treat it in a timely manner. The management of TB involves the use of a combination of various antibiotics, which are normally used through a span of six months or more. The most popular first-line medications are isoniazid, rifampicin, pyrazinamide, and ethambutol. To achieve full-scale treatment and to avoid the development of drug-resistant strains, the treatment regimen must be adhered to. MDR and extensively drug-resistant (XDR) tuberculosis is an important issue that needs more complicated and prolonged courses of treatment.

Keywords: Tuberculosis; *Mycobacterium tuberculosis*; Pulmonary TB; Extrapulmonary TB; Latent TB; Airborne transmission; Granuloma; Acid-fast bacilli; Sputum microscopy; GeneXpert; Chest X-ray; Antitubercular therapy; Isoniazid; Rifampicin; Pyrazinamide; Ethambutol; DOTS strategy.

INTRODUCTION

Tuberculosis (TB) is one of the oldest known infectious diseases and it still afflicts millions of individuals in the world. It is due to a bacterium known as Mycobacterium tuberculosis, which is found in the lungs, but spreading to other body parts may occur. Even with the significant progress achieved in the medical field, TB is still a major health issue in the world, particularly in the developing nations where overcrowding, poor nutrition and access to medical care are the norm.

The disease has long been known and was at one point known as consumption due to the extreme weight loss and wasting that it produced. Nowadays, TB is one of the most common causes of death by contagious disease despite the existing effective treatment. Its endurance has been greatly attributed to the

social, economic, and environmental circumstances that provide the bacteria with an easy spread within the communities.

Tuberculosis is mostly spread airborne. When an individual who has an active TB sneezes, or even speaks, minute droplets that hold the bacteria are spread to the environment. Other people may inhale these droplets, which can result in the spread of the infection between people. Not all people who get infected however develop the disease. Mostly the immune system of the body can contain the infection which leaves behind a condition termed latent tuberculosis. Latent TB patients have no symptoms and can not be spread but have a risk of being infected with active TB in the future particularly when their immune system is compromised.

The capability of the Mycobacterium tuberculosis to survive within the human body is one of the major factors that make TB so hard to manage. The bacterium possesses an exceptional structure whereby the cell wall is thick and waxy and therefore resists numerous external attacks such as even some antibiotics and immune response. It may take long periods once in the lungs and in some cases may not be activated but may take years to activate again. This causes TB to be not only an infection disease, but also a persistence disease.

The other major facet of tuberculosis is that it is closely related to the diseases that compromise the immune system. HIV/AIDS, diabetes, malnutrition, and other chronic diseases predispose people to active TB. The body of such people is less able to hold the bacteria, which is why the disease develops faster, and the risk of complications increases. This connection underscores the need to deal with underlying health and social problems as an element of TB control activities.

Regarding the public health, tuberculosis is not only a health issue but also a social one. Poverty, ignorance, stigma and poor healthcare facilities are some of the factors that result in late diagnosis and incomplete treatment. Failure to adhere to treatment may result in emergence of drug resistant TB that is incredibly harder and costlier to treat.

Over the past years, the international efforts have been initiated to lighten the load of tuberculosis and shift to its eradication. Early detection and effective treatment programs, vaccination and public awareness have proven to be effective in most areas. Nevertheless, the struggle against TB is not over. The living conditions, the state of the healthcare systems, and the opportunity to provide all patients with timely and full treatment all have to be enhanced through continuous work.[1-15]

2. Causative Agent

The bacteria that causes tuberculosis is called Mycobacterium tuberculosis; it is a highly

specialized microorganism that has been adapted very well to survive in the human body. It is a member of a group of bacteria known as the acid-fast bacilli and they are a group of bacteria that retain certain dyes despite their treatment with acid during the staining processes. This unique property plays an important role in laboratory diagnosis. Mycobacterium tuberculosis is a rod-shaped bacteria that is very slow growing as compared to many other bacteria.

Due to this low rate of increase, tuberculosis grows slowly and its symptoms might take weeks or even months before they can show. This gradual development usually results in late diagnosis and thus silent spread of the disease. The cell wall structure is one of the most significant properties of this bacterium. A thick and waxy cell wall is caused by the presence of substances known as mycolic acids. These lipids render the bacterium very resistant to drying, disinfectants and most antibiotics. This shield also ensures that the organism is able to survive within the immune cells of the host, especially the macrophages which would otherwise kill the attacking pathogens. Consequently, the Mycobacterium tuberculosis may stay in the body over prolonged periods of time and may be dormant without any active disease.

Its other notable characteristic is the ability to avoid the immune system. The bacteria are then surrounded by macrophages after getting into the lungs. They can however survive and reproduce in these cells rather than being destroyed. The immune system tries to contain the infection by building structures known as granulomas over time and these structures resemble fences that surround the bacteria. Although such reaction can restrict the propagation, not all the organism is killed. The bacteria grows well in the presence of high oxygen density and that is why it mainly attacks the lungs. Nonetheless, it may be transmitted to other parts of the body by the bloodstream or lymphatic system resulting in extrapulmonary tuberculosis. Later on, organs involved may include the lymph nodes, bones, kidneys and the brain.

The cattle are usually related to M. bovis, and it can infect humans by consuming unpasteurized milk or by direct contact with infected animals.

It is difficult to contain the pathogen due to its persistence and adaptability to the environment, which is the case with Mycobacterium tuberculosis. Its capacity to survive environmental pressure and its dormancy add to its further proliferation among populations. Moreover, there is a risk of the development of drug-resistant strains due to faulty or insufficient treatment, which is even more challenging to cope with.[15-20]

3. Transmission

Tuberculosis (TB) is an infectious disease that

is mostly spread via air and can be easily spread in the close-contact areas. The cause, Mycobacterium tuberculosis, is expelled into the air whenever an individual with active pulmonary TB coughs, sneezes, talks or even laughs and releases respiratory droplets. These are very minute droplets that may stay longer in the air particularly in places with poor ventilation. Once these airborne droplets are inhaled by another individual, the bacteria can get into the respiratory system and reach the lungs where the infection process can start. Transmission however, is not just as a result of casual contact like touching, food sharing or hand shaking. It involves specifically the inhalation of infected airborne particles and that is why the risk of infection with this disease is great in case of a prolonged contact with an infected person.

The chance of transmission is dependent on a number of factors. Among the most significant ones is the infectiousness of the source patient. They are the people with untreated or active pulmonary TB and those who bring sputum with a large number of bacteria to the forefront.

It is also important that the environmental conditions are considered. Having too many people in a small space, bad ventilation, and lack of sunlight exposure provide the best conditions in which the bacteria can survive and multiply. This is the reason TB is more prevalent in congested regions, slum regions, jails, and shelters. Conversely, open spaces and well-ventilated spaces lessen the concentration of infectious droplets hence the risk of spreading the infection is minimized. Host factors also have a significant role in exposures in the determination of whether to be infected or not. Not all people that are exposed to the Mycobacterium tuberculosis become infected. It is possible that a good immune system may destroy or suppress the bacteria before they become infected. But those with depressed immunity are more prone to infection and transforming into active disease, including malnourished people, HIV/AIDS, diabetes, and other chronic diseases. The distinction between the latent infection and active disease in terms of transmission is also to be understood. Individuals who have latent TB possess the bacteria in dormant form, which are not transmitted to other people. Contrarily, patients with active pulmonary TB are infectious and can spread the infection to several individuals unless they are treated timely.[20-25]

The duration and proximity of exposure is also another important factor in TB transmission. Shorter duration of contact is usually less risky whereas longer and repeated exposure like cohabiting with an infected individual is more prone to induce infection. High-risk groups are therefore the healthcare workers and family members of TB patients. The prevention of

transmission is a complex of personal health and social health. The most significant step is early diagnosis and effective treatment of active TB cases since treated patients become less infectious soon. Also, there are such practices like covering the mouth when coughing, wearing masks, and proper ventilation which can significantly help to avoid the spread of infection.

4. Types of Tuberculosis

Tuberculosis is not an identical disease, so it occurs in various forms based on the locality of infection, the immunity of the affected person, and the development of the bacteria in the body. Different types of TB are significant to be understood in order to diagnose, treat, and prevent it.

Pulmonary Tuberculosis

The most prevalent and known type of TB is pulmonary tuberculosis. It infects mostly the lungs that create an oxygen-rich environment where the growth of the bacteria is possible, i.e. the growth of Mycobacterium Tuberculosis. This one is also the most contagious as the bacteria can be easily transmitted by coughing and other respiratory processes. Pulmonary TB usually presents in patients with a persistent cough, chest pain, fever, night sweats and weight loss. Even in severe situations, they can spit up blood (hemoptysis). This form is the cause of most transmission cases hence it is important that it is detected and treated early enough to contain its transmission.[25-30]

Extrapulmonary Tuberculosis

Extrapulmonary tuberculosis is the disease that arises when the infection is transmitted outside the lungs to other body parts. This may occur via blood or lymphatic system.

- Bone and joint TB: Bone and joint TB can often attack the spine, which is referred to as Pott's disease.
- Extrapulmonary TB is prevalent in people with compromised immune systems including HIV-positive people. ---

Latent Tuberculosis Infection (LTBI) is another term used to describe the disease.

- there are no symptoms. Patients with latent TB do not feel unwell and they are not capable of transmitting the disease to others. Nevertheless, this latent TB may reoccur later in life particularly when the immune system is weakened.
- This causes it to be relevant to detect and follow such people, especially in high-risk groups.

Active Tuberculosis

The active TB is in case the bacteria reproduce and give visible symptoms. This phase of the disease may arise soon after infection, or due to reactivation of TB latency. Active patients of pulmonary TB are contagious and capable of transferring the illness to others.

Active TB can cause serious damage to organs without appropriate treatment and can be fatal.

Drug-Resistant Tuberculosis

The drug-resistant TB occurs when the bacteria grows resistant to the regular anti-tubercular drugs, which may be as a result of incomplete or improper treatment. This type presents a severe threat to international health.

Types include:

- Drug-resistant TB is a disease that has a longer treatment period, higher costs, and more side effects, which is why prevention by diligence in treatment is of paramount importance.

Miliary Tuberculosis

Miliary TB is a serious and common type of the disease whereby the bacteria spread in the body through the blood. It involves several organs at the same time and is manifested in small nodules in the form of millet seeds on x-ray.[25-30]

5. Signs and Symptoms

Tuberculosis (TB) signs and symptoms are usually slow to develop and might not be evident during the initial stages. This progressive development is one of the reasons why many cases are not diagnosed promptly and the disease develops and spreads. The symptoms may change depending on whether the infection is localized to the lungs (pulmonary TB) or other body body parts (extrapulmonary TB).

During the initial stages, the patients tend to have general or constitutional symptoms, which are not TB-specific. These are chronic exhaustion, weakness, and general malaise. Loss of appetite is typical and is normally accompanied by progressive and unintended weight loss. A low-grade fever is also noted in many of them, and it usually increases in the evening. Another typical manifestation is the presence of night sweats, when the patient can wake up sweating too much, even in the cold. These signs are an indication of how the human body reacts to a chronic infection and constant inflammation. In case of tuberculosis of the lungs, there are more specific respiratory symptoms. The symptom most significant and prevalent is the persistent cough that takes over two and three weeks. The cough can be initially mild and dry, but with time it turns to be productive, with sputum being released. In general, the disease is characterized by chest pain as the disease advances, particularly when a patient inhales or coughs.[30-35]

A large part of the lung can also be impacted leading to shortness of breath. With extrapulmonary tuberculosis, the symptoms differ according to which organ is affected. As an example, in case of lymph node involvement, the swelling can be painless and especially on the neck. The bones and joints develop tuberculosis that may lead to chronic pain, stiffness and limited movement. When it

affects the spine, it can cause back pains and in extreme cases deformity. TB meningitis or Tuberculosis of the brain has symptoms which include headache, vomiting, confusion, and knee stiffness. In the case of genitourinary involvement, patients can complain of pain with urination or blood in the urine. It is worth mentioning that patients with the latent tuberculosis are not symptomatic. This condition is characterized by the bacteria being dormant in the body and the individual looks absolutely healthy. Nevertheless, it is always possible that the infection can become active in the future, particularly in case the immune system is weakened.

TB may not have the characteristic manifestations in children, older people and patients with weakened immunity like HIV-positive or malnourished patients. The symptoms in such a situation can be benign or similar to other common diseases and hence are difficult to diagnose. In general, the symptoms of tuberculosis are very heterogeneous and may be unspecific at the onset. This renders consciousness and early identification to be quite vital. Early diagnosis and proper treatment can be realized through timely detection of the symptoms, which will eventually limit complications and further transmission of the disease.

6. Pathophysiology

Tuberculosis (TB) pathophysiology is a complicated interaction of the immune system of the host with the microorganism of the disease, Mycobacterium tuberculosis. The infection starts with the inhalation of infectious droplets holding the bacteria and getting into the alveoli of the lungs. These small air sacs give an appropriate environment that the bacteria can settle and thus cause infection. When the bacteria enter the lungs, they are surrounded by the immune cells which are called macrophages. In normal conditions, the macrophages eliminate the invading microorganisms. But M. tuberculosis can survive and reproduce within these cells. It achieves this by inhibiting the normal mechanisms of destroying by macrophages, which enable it to survive in the host. The immune system reacts to the multiplication of the bacteria by bringing more immune cells to the point of infection. This causes a granuloma to develop in a well organized lesion.

This granuloma in most healthy immune system individuals is effective to contain the infection thus making the bacteria not spread. The infection lies inactive in this state, and it results in the so-called latent tuberculosis. The bacteria are dormant and yet alive, and the individual does not exhibit any symptoms. The granuloma can however disintegrate when the immune system is weakened by malnutrition, old age, HIV infection, or chronic illness. Once this occurs, the bacteria are discharged and

they start to proliferate actively resulting in active tuberculosis. Lung tissue destruction during the stage may lead to cavities, which are empty spaces in the lungs that are occupied by bacteria. These cavities help in spreading infection in case the patient coughs spewing out big numbers of bacteria into the air.[35-40]

In others, the bacteria can be transferred outside the lungs either by blood or lymphatics. Such spread may result in extrapulmonary tuberculosis, as organs can be infected by this disease, including lymph nodes, bones, kidneys, or brain. The worst type of this dissemination is called the milatory tuberculosis in which many small spots are created in the body. Balance between bacterial virulence and immune response of the host is a major determinant of the outcome of infection. The infection can be contained by a strong immune system and the disease is not able to propagate due to a weak immune system. Also, recurrence or reinfection may complicate the disease process even more.

7. Diagnosis

Tuberculosis (TB) diagnosis is a critical measure in managing the disease and its transmission. As the symptoms of TB may be mild or similar to other respiratory diseases, laboratory confirmation is used to detect it accurately.

Patients who appear with a stubborn cough, fever, loss of weight and night sweats are suspected of having TB. Physicians also pay attention to such risk factors as personal contact with TB patients, inadequate life, and immunosuppression caused by other diseases like HIV or diabetes. Sputum smear microscopy is considered one of the most frequently utilized techniques of diagnosing pulmonary TB. This test involves collecting a sample of sputum in the patient and under a microscope after special staining e.g. Ziehl-Neelsen stain. In case of acid-fast bacilli, it is an indication of the presence of Mycobacterium tuberculosis. This is an easy approach that is cheap and is very common in resource constrained environments. Its sensitivity however might be low when there are fewer bacteria.

The other useful diagnostic test is the chest X-ray, which is used to identify abnormalities in the lungs. Cavities, infiltrates and nodular lesions (especially in the upper lobes of the lungs) are typical findings in TB. Even though X-rays cannot confirm TB by themselves, they are helpful pieces of evidence and can be used in determining the level of disease. In the recent years, molecular diagnostic methods like GeneXpert (CBNAAT) have transformed TB diagnosis. This test is able to detect the genetic content of Mycobacterium tuberculosis in a couple of hours and can even determine resistance to rifampicine which is one of the major anti-TB medications. GeneXpert is sensitive and specific, and can therefore be

used as a preferred technique in a rapid diagnosis, especially in the case of suspected drug resistance

The tuberculin skin test, also referred to as the Mantoux test, is a test that is administered to detect latent TB infection. In this test a small volume of purified protein derivative (PPD) is placed into the forearm skin. The site of injection is assessed after 4872 hrs, either swollen or indurated. A positive result will show that it has been exposed to the bacteria previously, yet it will not differentiate active infection and latent infection. Culture methods are regarded as a gold standard in the diagnosis of TB since they enable such bacteria to grow under a controlled laboratory setting. This does not only confirm the diagnosis but assists in the testing of drug susceptibility. The culture methods are however, laborious and can take several weeks because the organism grows at a slow rate.[40-45]

Where there is extrapulmonary TB, further tests like biopsy, fluid analysis, CT scan or MRI might be necessary based on the organ affected. Blood tests and other supportive studies could also help in the diagnosis.

8. Treatment

Tuberculosis (TB) is a highly effective treatment that is well established when attended to appropriately. It entails administration of various antibiotics in an extended course in order to ascertain total eradication of the body of the organism, Mycobacterium tuberculosis. Given that the bacterium develops gradually and may remain within the cells, long-term treatment is necessary to avoid recurrence and resistance. The normal course of treatment of drug-sensitive TB usually takes a minimum of six months and is split into two stages: the intensive stage and the continuation stage. The intensive phase lasts during the first two months and combines four first-line medications. Such medications are isoniazid, rifampicin, pyrazinamide, and ethambutol. This combination will assist in reducing the number of bacteria as quickly as possible and contain the infection.

The continuation phase is preceded by the intensive phase and it typically takes four months. Less common drugs (typically isoniazid and rifampicin) are also maintained at this time to kill any remaining bacteria and prevent reoccurrence of an illness. It is very important to complete the entire course of treatment although the patient may begin to feel better at an early stage of the therapy. Patient adherence is one of the greatest problems of TB treatment. Some patients may drop out of the medications due to the duration of therapy and some side effects. This may result in the failure to treat and drug-resistant TB.

In this model, the medical personnel monitors

the patients as they take their medication, thus ensuring that they are treated regularly and thoroughly. Anti-tubercular drugs may have side effects and these effects differ according to the drugs taken. The side effects are common such as nausea, liver toxicity, skin rashes and visual disturbances. These effects need to be controlled through regular checkups and proper medical advice in order to have safe treatment. When a patient has a drug-resistant tuberculosis then treatment is more complicated. Multidrug-resistant TB (MDR-TB) is a disease that needs second-line medications that tend to be costly, less efficient and have more serious side effects. Such cases can be treated up to 9-24 months and more.

Patient education and counseling are important in promoting compliance and lessening stigma related to the disease. In most countries including India, TB treatment has been made very accessible through government programs and global health initiatives which are usually free of charge. These initiatives target at early diagnosis and standard treatment procedures as well as constant follow up of patients.[45-50]

9. Material and Methods

The given work is founded on the overall analysis of the available literature connected with the topic of tuberculosis, and the purpose should be to obtain a clear and up-to-date vision of the disease. The sources of relevant information were diverse and quite credible and authentic, comprising peer-reviewed scientific journals, standard medical textbooks as well as official reports by international health organizations like the World Health Organization (WHO). In order to make sure that the information used in this research corresponds to the latest findings and improvements in the sphere, the emphasis was made on the recent publications.

Well-established scientific databases like PubMed, Google Scholar, Scopus, and ScienceDirect were used to conduct the literature search. The keywords that were employed in the search process were as follows: tuberculosis, Mycobacterium tuberculosis, TB diagnosis, TB treatment, drug-resistant tuberculosis, and public health strategies. The search was narrowed down to the most relevant articles using the help of Boolean operators. Articles published in English and those that have the full-text were only considered to be included.

The literature was selected carefully in order to preserve the quality and reliability of information. The inclusion criteria were the relevancy of the studies to the topic, the clarity of the methodology, and the credibility of the source. Duplicated studies and articles with inadequate or ambiguous data were eliminated. The recent publications of the period 2020-25 were prioritized, and some classical sources

were also included that could help to offer the background information concerning tuberculosis.

The data obtained were well organized into various thematic areas such as etiology, transmission, pathophysiology, clinical features, diagnosis, treatment, and prevention. Every section was constructed through comparisons and analysis of findings of various sources to maintain accuracy and consistency. Such a comparative method was useful in determining general trends, trends, and gaps in current knowledge.

Despite the fact that this study was not an experimental or clinical trial, critical analytical approach has been used in the interpretation of findings. Data of various researches were estimated and consolidated to make a balanced and meaningful discussion. The statistical data presented in different studies were taken into account on a standard level of significance, which is indicated by the respective authors.[50-55]

Ethics was observed during the course of the study through good consideration of all the sources of information. There was no manipulation and misrepresentation of any data, and all attempts were to present the information in a clear, unbiased, and scientifically accurate way.

10. Critical Review

As noted in the current review, tuberculosis (TB) is still one of the major health issues in the world in spite of the significant advances in its diagnosis and treatment. According to the results of numerous researches, TB remains extremely widespread in the developing countries, where poverty, overcrowding, malnutrition, and the lack of access to healthcare services are the factors that promote its existence. Besides causing physical health, the disease also puts a significant strain on social and economic systems. The literature gathered can be analyzed to reveal that pulmonary tuberculosis is the most widespread and infectious form of the disease, and it is the cause of most transmission cases. TB is very contagious through the airborne mode of transmission especially in poorly ventilated places. Being in close and extended contact with infected persons is a major risk factor of being infected, particularly when one is a family member or a health professional.

The review also highlights the significance of the host immune response in the development of the disease. The immune system is able to contain the infection in most people thus leading to latent tuberculosis. Nonetheless, HIV infection, diabetes, malnutrition, and aging undermine the immune system, exposing the body to the risk of active disease development. The development of diagnostic methods has enhanced the diagnosis of tuberculosis.

Traditional techniques like sputum smear microscopy are simple and cost effective, thus still in use. Recent molecular methods, however, such as GeneXpert, have dramatically raised the accuracy of the diagnosis, and lowered the amount of time it takes to be detected. Drug resistance can also be identified using these modern methods that is important in effective planning of the treatment. The response of treatment has revealed that tuberculosis is a curable disease in case proper drug regimens are used. First-line drug combination therapy has proven to be very successful in the standard combination therapy. The introduction of the DOTS strategy has even increased the treatment adherence and the default rates. Non-adherence to treatment is however a significant problem and usually results in relapse and development of drug-resistant types of TB.

The rise of the multidrug-resistant (MDR) and extensively drug-resistant (XDR) tuberculosis is one of the major TB control challenges. These forms also take more time to treat, cost more and are linked to more side effects. The results indicate that the main causes of drug resistance are improper use of antibiotics and incomplete treatment, and it is important to follow the given regimens strictly. The use of public health interventions has been critical towards the minimization of the burden of tuberculosis. BCG vaccination, early disease identification, contact tracing, and awareness have also led to better disease control. The success of these measures however differs across the regions, depending on the health care infrastructure and community awareness.[55-60]

CONCLUSION

Tuberculosis (TB) remains to be among the most relevant infectious diseases concerning the global health, even though there are efficient diagnostic measures and treatment procedures. This review notes that TB is not just a medical condition but a complicated disease which depends on biological, social, and economic factors. Its prevalence in most regions of the world indicates the lapses in healthcare systems, ignorance, and difficulties in the provision of early diagnosis and full treatment.

Tuberculosis is an illness caused by a highly adaptable Mycobacterium tuberculosis, which can live in the human body over extended periods. TB is especially hard to control because of its capacity to stay in a dormant state and become active in favorable conditions. Airborne TB further spreads through air dust, and therefore, in overcrowded and under-ventilated places. All these aspects explain why it is necessary to enhance living standards and raise awareness about the health of the population.

Among the most important observations of this

study is that TB manifests in various forms namely pulmonary, extrapulmonary, latent and drug resistant forms. Both forms are associated with their own clinical manifestations and difficulties, and they need proper diagnostics and treatment plans. Although the most prevalent and contagious one, pulmonary TB makes extrapulmonary TB more complicated, as it has a wide range of manifestation and is hard to identify.

The diagnostic methods have also advanced especially the use of molecular tests that have greatly enhanced the accuracy and timeliness of detection of TB. Nevertheless, these technologies remain inaccessible in a number of resource-restrained environments. Traditional approaches such as sputum microscopy still remain critical but there is a need to increase the number of more sophisticated diagnostic equipment to provide early and accurate diagnoses.

Tuberculosis has been effectively treated when patients follow a strict dose of the prescribed drugs. Combination therapy and structured programmes like DOTS have enhanced the results of treatment and the mortality rate. Nevertheless, a significant issue is the adherence to treatment. The partial or incorrect use of medication results in the emergence of drug-resistant manifestations of TB, including MDR-TB and XDR-TB, which are more challenging and expensive to cure.

To sum up, tuberculosis is one of the most significant health issues of the global scope, which is to be addressed with the help of a complex and integrated strategy to control and eliminate it. Enhancing healthcare systems, enhancing treatment and diagnostic facilities, patient adherence, and social determinants are important measures in reducing the TB burden. Governments, healthcare professionals, and communities can work towards achieving a tuberculosis-free future and with more efforts, one can be certain of a brighter future.

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Conflict of Interest

The authors declare that they have no conflict of interest