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### Review

## A review on novel treatment of tuberculosis

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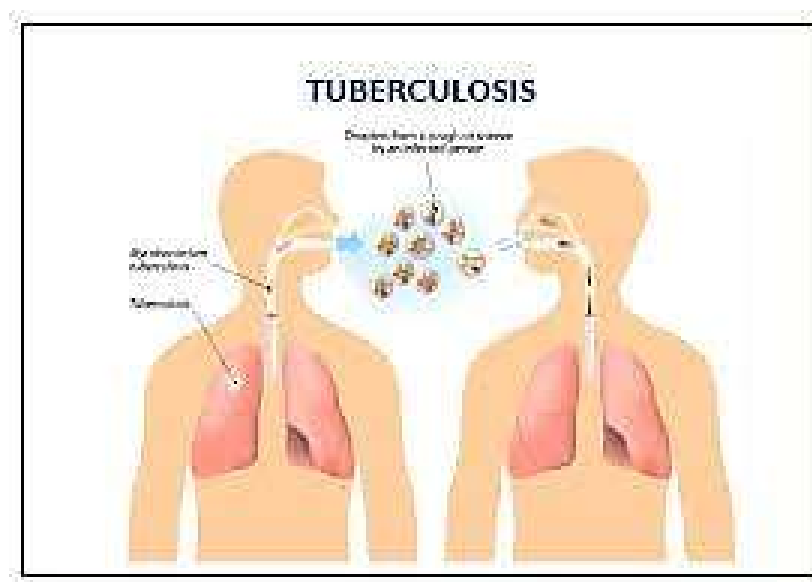
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	<b>Abstract</b>
Published on: 13 Dec 2023	<p>Tuberculosis (TB) is a contagious airborne disease caused by Mycobacterium tuberculosis, which primarily affects human lungs. The progression of drug-susceptible TB to drug-resistant strains, MDR-TB and XDR-TB, has become worldwide challenge in eliminating TB. The limitations of conventional TB treatment including frequent dosing and prolonged treatment, which results in patient's noncompliance to the treatment because of treatment-related adverse effects. The non-invasive pulmonary drug administration provides the advantages of targeted-site delivery and avoids first-pass metabolism, which reduced the dose requirement and systemic adverse effects of the therapeutics. With the modification of the drugs with advanced carriers, the formulations may possess sustained released property, which helps in reducing the dosing frequency and enhanced patients' compliances. The dry powder inhaler formulation is easy to handle and storage as it is relatively stable compared to liquids and suspension. This review mainly highlights the aerosolization properties of dry powder inhalable formulations with different anti-TB agents to understand and estimate the deposition manner of the drug in the lungs. Moreover, the safety profile of the novel dry powder inhaler formulations has been discussed. The results of the studies demonstrated that dry powder inhaler formulation has the potential in enhancing treatment efficacy.</p>
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	<p><b>Keywords:</b> Tuberculosis, lung physiology, advanced drug delivery, lung delivery.</p>

## INTRODUCTION

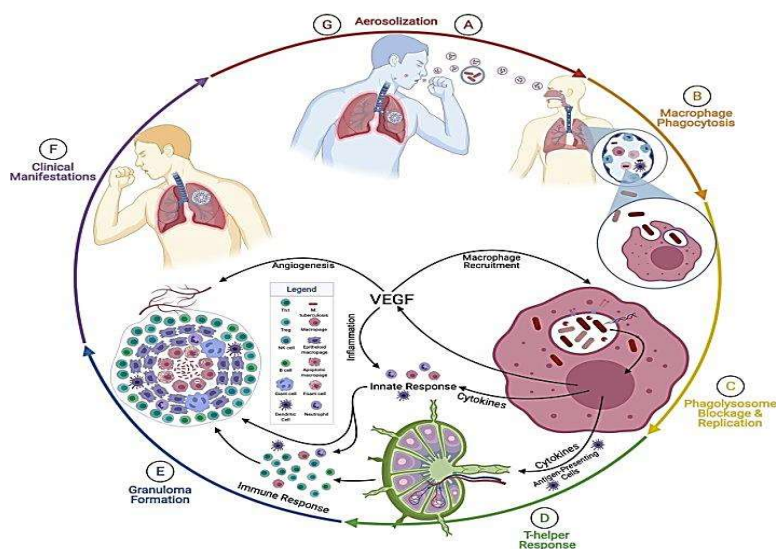
- ❖ Tuberculosis is the infectious diseases primarily affecting lung parenchyma.
  - ❖ It is caused by mycobacterium tuberculosis .
  - ❖ It may spread to any part of the body including meninges, kidney, bones and lymph nodes.
  - ❖ It is caused by germs that are spread from person to person through the air .
  - ❖ TB usually affects the lungs.
  - ❖ It can be treated with antibiotics.
  - ❖ A person with TB can die if they do not get proper treatment.
  - ❖ In 2021, 10.6 million people are suffered with tuberculosis world- wide.
  - ❖ Mostly tb occurs in the regions of the following
1. South-east asia (44%)

2. Africa (24%)
3. Western pacific (18%)



### Pathophysiology

The pathophysiology of *Mycobacterium tuberculosis* infections, known as tuberculosis, is a concert of interplay between pathogenic and physiological processes. *M. tuberculosis* has evolved to thrive by using the human immune system to gain access to the host and remain within the host for years. *M. tuberculosis* is an intracellular pathogenic bacteria that has a mycolic acid coating, is non-motile, and undergoes cell division once every 18–24 h. Tuberculosis is the disease caused by *M. tuberculosis*. This disease causes over 4,000 deaths per day, 1.2–1.5 million deaths per year, and has infected 1.7–2 billion people worldwide, with as many as 13 million people in the United States having latent tuberculosis infections (LTBI). 5–10% of these persons with LTBI will develop active tuberculosis. There are approximately 15 million active tuberculosis cases every year, with the heaviest burden occurring in India, Indonesia, South Africa, Nigeria, the Philippines, Pakistan, Bangladesh, and China. Immunocompromised persons have a more significant risk for active tuberculosis - such as those with human immunodeficiency virus (HIV), organ transplants, diabetes mellitus, and silicosis, among others.



### Symptoms

A person should see a doctor if they experience Trusted Source:

- a persistent cough, lasting at least 3 weeks
- phlegm, which may have blood in it, when they cough

**Latent TB:** A person with latent TB will have no symptoms, and no damage will show on a chest X-ray. However, a blood test or skin prick test will indicate that they have TB infection.

**Active TB:** An individual with TB disease may experience a cough that produces phlegm, fatigue, a fever, chills, and a loss of appetite and weight. Symptoms typically worsen over time, but they can also spontaneously go away and return.

#### **Early warning signs**

- appetite and weight
- A general feeling of fatigue and being unwell
- swelling in the neck
- fever
- night sweats

#### **Beyond the lungs**

TB usually affects the lungs, though symptoms can develop in other parts of the body. This is more common in people with weakened immune systems.

TB can cause:

- persistently swollen lymph nodes, or “swollen glands”
- abdominal pain
- joint or bone pain

When the bacterial infection is active, a person may notice many symptoms, including:

- night sweats
- persistent cough
- loss of appetite

#### **Causes**

*M. tuberculosis* bacteria cause TB. They can spread through the air in droplets when a person with pulmonary TB coughs, sneezes, spits, laughs, or talks. Only people with active TB can transmit the infection. However, most individuals with the disease can no longer transmit the bacteria after receiving appropriate treatment for at least 2 weeks.

#### **Treatment**

With early detection and appropriate antibiotics, TB is treatable. The right type of antibiotic and length of treatment will depend on:

- The person’s age and overall health
- Whether they have latent or active TB
- The location of the infection
- Whether the strain of TB is drug resistant

Treatment for latent TB can vary. Trusted Source It may involve someone taking an antibiotic once a week for 12 weeks or every day for 9 months. Treatment for active TB may involve taking several drugs for 6–9 months. Trusted Source. When a person has a drug-resistant strain of TB, the treatment will be more complex.

It is essential for people to complete the full course of treatment, even if symptoms go away. If a person stops taking their medication early, some bacteria can survive and become resistant to antibiotics. In this case, the person may go on to develop drug-resistant TB. Depending on the parts of the body that TB affects, a doctor may also prescribe corticosteroids.

#### **Prevention**

Ways of preventing TB from infecting others include:

- getting a diagnosis and treatment early
- staying away from other people until there is no longer a risk of infection
- wearing a mask, covering the mouth, and ventilating rooms

#### **Risk factors**

People with weakened immune systems are most likely to develop active TB. The following are some issues that can weaken the immune system.

## HIV

For people with HIV, doctors consider TB to be an opportunistic infection. This means that a person with HIV has a higher risk of developing TB and experiencing more severe symptoms than someone with a healthy immune system. Treatment for TB can be complex in a person with HIV, but a doctor can develop a comprehensive treatment plan that addresses both issues. TB can become a complication of HIV. Learn about other HIV complications [here](#).

## Smoking

Tobacco use and secondhand smoke increase the risk of developing TB. These factors also make the disease harder to treat and more likely to return after treatment. Quitting smoking and avoiding contact with smoke can reduce the risk of developing TB.

## Other conditions

Some other health issues that weaken a person's immune system and can increase the risk of developing TB include:

- low body weight
- substance abuse disorders
- diabetes
- silicosis
- severe kidney disease
- head and neck cancer

## Diagnosis

There is room for error with TB skin tests. Doctors use them as one part of a more detailed diagnosis, as opposed to stand-alone tests. The results of a TB skin test help determine the next steps in a person's treatment. If someone has TB, they may be started on medication immediately. If the diagnosis is unclear, the doctor will use other methods to reach a correct diagnosis.

## X-rays and CT scans

One of the next steps will involve looking for signs of TB in the lungs, by using either an X-ray or CT scan. TB causes changes in the lungs. Most commonly, little white spots will be visible, which means the body is fighting bacteria.

## Sputum test

If the X-ray or CT scan images show evidence of TB, a doctor will usually test the person's sputum. This is the mixture of saliva and mucus that is coughed up due to an infection. A sputum test is used to determine what type of TB bacteria is attacking the body. This also helps decide how best to treat it.

## Blood tests

Some people may have a bad reaction to the TB skin test. In these cases, they may be given a blood test called the Interferon Gamma Release Assay (IGRA). Although this test suits some people, it is not right for everyone. As such, people should always talk to a doctor to determine which test is best for them.

## CONCLUSION

A promising new era in tuberculosis drug development has begun. It is now critical to consolidate recent progress and ensure that new drugs/regimens for treatment of all forms of tuberculosis are suitably introduced in countries in a way that guarantees access to best treatments for all those in need and avoids inappropriate use of new drugs. The WHO will need to build evidence-based strategies for postapproval introduction of drugs to ensure affordability and access while preserving drug efficacy. Programmatic implementation should be aligned with ongoing efforts that aim to maximize the efficiency and effectiveness of DS and DR tuberculosis treatment by optimizing drug regimens, advancing point-of-care and other simplified platforms for diagnosis and monitoring, reducing costs, adapting delivery systems, and mobilizing communities. In an effort to facilitate rational introduction of new tuberculosis drugs into tuberculosis-endemic countries and ensure wide access to optimal treatment, the WHO has initiated a process that includes discussions among and actions from main concerned parties, including drug developers, regulatory authorities, national tuberculosis control program managers, scientists, public health officials, nongovernmental organizations, research agencies, donors, and community representatives. Drug developers must ensure that appropriate studies are being carried out early in the drug development pathway to identify suitable treatment combinations. This includes drug-drug interaction studies of novel compounds with approved tuberculosis agents, as well as interaction with ARVs, and early combination

EBA studies. Tuberculosis drug developers should also allow access to new tuberculosis agents prior to approval for preclinical and clinical studies to evaluate promising new combinations of drugs and development of appropriate drug resistance assays.

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