Ministery of Higher education and scientific research

University of Tikrit

College of science

Department of Biology

Lectures of Pathogenic Bacteria

For Diploma students – Pathological analyses - 2024-2025

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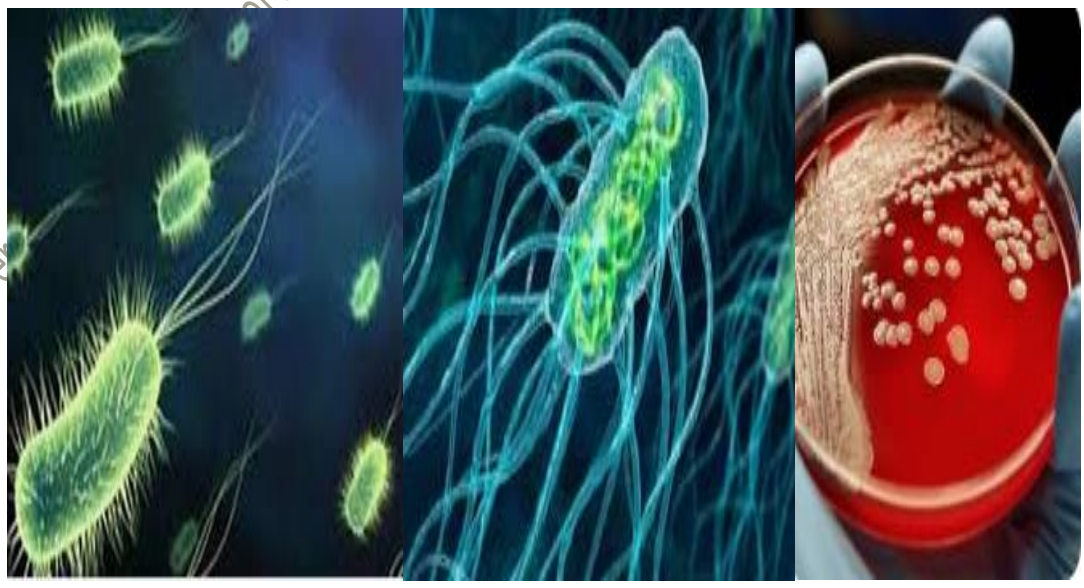

Mycobacterium Tuberculosis

Mycobacterium tuberculosis (MTB) is a slim, strongly acid–alcohol–fast rod. It frequently shows irregular beading in its staining, appearing as connected series of acid-fast granules It grows at 37o C, but not at room temperature, and it requires enriched or complex media for primary growth.

The classic medium, Löwenstein-Jensen, contains homogenized egg in nutrient base with dyes to inhibit the growth of nonmycobacterial contaminants. Growth is very slow, with a mean generation time of 12 to 24 hours. The dry, rough, buff-colored colonies usually appear after 3 to 6 weeks of incubation. Growth is more rapid in semisynthetic (oleic acid–albumin) and liquid media. Of particular importance is the ability of MTB to produce large quantities of niacin, which is uncommon in other mycobacteria.

Because of its hydrophobic lipid surface, MTB is unusually resistant to drying, to most common disinfectants, and to acids and alkalis. Tubercle bacilli are sensitive to heat, including pasteurization, and individual organisms in droplet nuclei are susceptible to inactivation by ultraviolet light. As with other mycobacteria, the MTB cell wall structure is dominated by mycolic acids and LAM. Its antigenic makeup includes many protein and polysaccharide antigens, of which tuberculin is the most studied. It consists of heat-stable proteins liber ated into liquid culture media.

A purified protein derivative (PPD) of tuberculin is used for skin testing for hypersensitivity and is standardized in tuberculin units according to skin test activity.

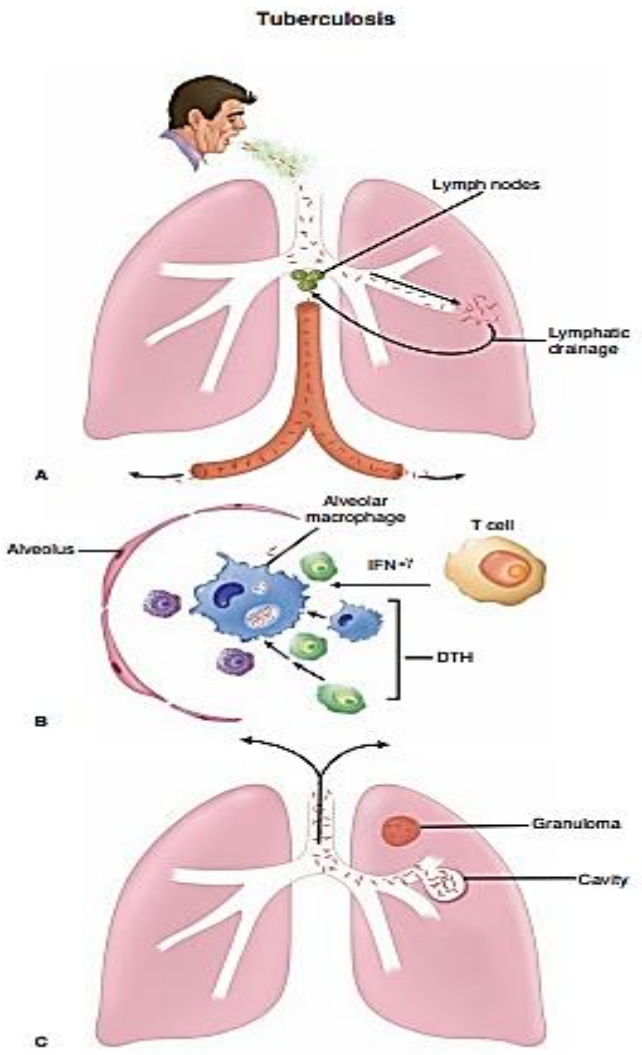

FIGURE 27–4. Tuberculosis. A. Primary tuberculosis. *Mycobacterium tuberculosis* is inhaled in droplet nuclei from an active case of tuberculosis. Initial multiplication is in the alveoli with spread through lymphatic drainage to the hilar lymph nodes. After further lymphatic drainage to the bloodstream, the organisms are spread throughout the body. **B. Alveolar macrophage.** The two-front battle being carried out between A and C is shown. Ingested bacteria multiply in the nonactivated macrophage. (1) T_H1 cellular immune responses attempt to activate the macrophage by secreting cytokines (interferon gamma [IFN-γ]). If successful, the disease is arrested. (2) Inflammatory elements of delayed-type hypersensitivity (DTH) are attracted and cause destruction. If activation is not successful, DTH injury and disease continue. **C. Reactivation tuberculosis.** Reactivation typically starts in the upper lobes of the lung with granuloma formation. DTH-mediated destruction can form a cavity, which allows the organisms to be coughed up to infect another person.

DIAGNOSIS

1-Tuberculin Test

2-AFS

Introduction to AFB Test

Are you feeling sick or weak these days? Have you recently lost weight without any specific reason or cause? You must not ignore these symptoms as they may affect your body long-term. These might be signs of Tuberculosis. Every year, Tuberculosis affects millions of people worldwide. Your doctors might recommend you take an AFB test to get tested for TB or Tuberculosis.

Acid-fast bacillus (AFB) is a type of bacteria that causes tuberculosis and other chronic infections. Tuberculosis is commonly called TB, a bacterial infection that affects the lungs. It also affects all body parts, including the brain, spine, and kidneys. The person suffering from TB

majorly shows symptoms of coughing and sneezing. AFB tests are usually recommended for people who have symptoms of active TB. These tests help to diagnose the presence of AFB bacteria in your sputum. Sputum is a thick mucus that is coughed up in the lungs. It is different from split or saliva

Procedure of AFB Testing

The Acid-Fast Bacillus test is used to detect the presence of acid-fast bacilli, particularly Mycobacterium tuberculosis, which causes tuberculosis (TB). Here's an overview of the procedure for the AFB test:

- **Sample Collection:** The AFB stain test requires a sputum sample, the mucus from deep coughing. To collect the sample:
  - Gargle with water to clear your mouth.
  - Take a deep breath and cough forcefully to produce sputum from your lungs.
  - Spit the sputum directly into a sterile, wide-mouthed container provided by the healthcare facility.
  - The collected sputum will be transported to the laboratory for analysis.

Several types of AFB are detected with this testing, like **Mycobacterium**. Mycobacterium tuberculosis is one of the most prevalent and infectious species of mycobacteria. The AFB test specifically aims to identify the acid-fast bacilli in clinical samples, such as sputum, bronchial washings, tissue biopsies, and other body fluids. Other mycobacteria, known as **nontuberculous (NTM)**, also cause infection. However, this caused lung infection and disseminated disease in people with weakened immune systems.

Interpretation of AFB Test Reports

The presence of acid-fast bacilli in the sample indicates a positive result, suggesting the possibility of an active mycobacterial infection, such as TB. However, it's important to note that a positive Acid Fast Bacilli Test does not confirm TB diagnosis by itself. Further tests, such as culture and molecular tests, are often performed to confirm the presence of Mycobacterium tuberculosis and identify drug-resistant strains, if necessary. Here's how to interpret AFB stain test reports:

- **Positive result:** A positive Acid Fast Bacilli Test result indicates the presence of acid-fast bacilli in the sample. This shows the possibility of an active pulmonary TB infection in respiratory samples like sputum. However, a positive AFB test does not confirm the TB diagnosis alone. Additional tests, such as culture and molecular tests (e.g., PCR), may be needed to identify the specific mycobacterial species and confirm the diagnosis.
- **Negative Result:** A negative AFB test result means the sample did not detect acid-fast bacilli. The negative AFB stain test does not completely rule out TB, as the bacteria may not always be detectable in early or paucibacillary infections. However, if clinical suspicion remains high, further testing and clinical evaluation may be necessary to determine the cause of the symptoms

Treatment

TABLE 27–2 Antimicrobics Commonly Used in Treatment of Tuberculosis

FIRST-LINE DRUG	SECOND-LINE DRUG[a]
Isoniazid	*para*-Aminosalicylic acid
Ethambutol	Ethionamide
Rifampin	Cycloserine
Pyrazinamide	Fluoroquinolones

[a]Second-line drugs added to combinations if resistance or toxicity contraindicates first-line agent.

Tuberculosis Vaccine

Bacille Calmette-Guérin (BCG) is a vaccine for tuberculosis (TB) disease. The vaccine is not generally used in the United States

Many people born outside the United States have been vaccinated with BCG. It is given to infants and small children in countries where TB is common. It protects children from getting severe forms of active TB disease, such as TB meningitis. The vaccine's protection weakens over time.

Tell your health care provider if you have received the TB vaccine, especially if you are getting tested for TB infection. The vaccine can cause a false positive TB skin test reaction.

TB blood tests are the preferred tests for people who have received the BCG TB vaccine. Unlike the TB skin test, TB blood tests are not affected by BCG TB vaccination.

In the United States, BCG is only considered for people who meet specific criteria and in consultation with a TB expert. Talk to your health care provider if you have questions about the vaccine.

Health care providers can consult their state or local TB control program for questions about BCG vaccination for their patients.