Journal of Insights in Basic and Applied Sciences
مجلة رؤى في العلوم الأساسية والتطبيقية
Volume 1, Issue 2, 2025, Pages: 31-48
Journal homepage: https://jibas.com.ly/index.php/jibas/en

Epidemiological, Clinical, and Microbiological Profile of Tuberculosis Patients at a National Referral Center in Tripoli, Libya: A Cross-Sectional Study (May–July 2023)

Maesm Ahmed Mohamed Ben Hsin[1 *], Hamza Ahmed Mohammad Emsaed [2], Nagla T. T. Arab [3], Reda Abdulhamid Alhaj S Abo Ain[4]
[1,3] Department of Laboratory, College of Sciences and Medical Technology Tripoli, Libya
[2,4] Libyan Authority for Scientific Research Tripoli, Libya

الملامح الوبائية والسريرية والمكروبيولوجية لمرضى السل في مركز وطني للرعاية المرجعية في طرابلس، ليبيا: دراسة مقطعية (مايو-يوليو 2023)

ميسم أحمد محمد بن حسين[1*]، حمزة أحمد محمد امساعد [2]، نجلاء الطاهر التباني عراب[3]، رضاء عبدالحميد الحاج سالم أبوعين[4]

[1،3] قسم المختبرات، كلية العلوم والتقنيات الطبية، طرابلس، ليبيا
[2،4] الهيئة الليبية للبحث العلمي، طرابلس، ليبيا

*Corresponding author: maesmbenhsin50@gmail.com

Received: September 14, 2025	Accepted: November 25, 2025	Published: December 11, 2025

Abstract:

Background: Tuberculosis (TB) persists as a critical global health issue, with a disproportionate burden in conflict-affected and developing regions like Libya. Current local data on its epidemiological trends, resistance patterns, and associated risk factors are scarce but essential for effective public health intervention.

Objective: This study aimed to investigate the prevalence, demographic distribution, clinical characteristics, microbiological profiles, and antibiotic resistance patterns among TB patients attending the National Center for Disease Control (NCDC) in Tripoli.

Methods: A descriptive cross-sectional study was conducted from May 1 to July 31, 2023. A total of 35 clinically suspected or diagnosed TB patients were enrolled. Data were collected via structured questionnaires, clinical examination, and laboratory analysis of sputum and blood samples. Diagnostic methods included acid-fast bacilli (AFB) microscopy, culture, GeneXpert MTB/RIF assay (as a proxy for PCR), interferon-gamma release assay (IGRA), and chest radiography. Descriptive statistics were used for data analysis.

Results: The male-to-female ratio was 4.8:1, with 83% (n=29) male patients. The most affected age group was 41-50 years (63%, n=22). Smoking was universal among male patients (100% of males, 83% of total sample). Active pulmonary TB was diagnosed in 71% (n=25) of cases, while 29% (n=10) had latent TB infection (LTBI). Antibiotic resistance was detected in 29% (n=10) of cases. Common comorbidities included diabetes mellitus (43%, n=15), chronic kidney disease (34%, n=12), and HIV/AIDS (23%, n=8). Sputum testing was the primary diagnostic tool (43%), followed by blood-based IGRA (37%).

Conclusion: This study reveals a high burden of TB among middle-aged, smoking Libyan males, with concerning rates of active disease and antibiotic resistance. The strong association with non-communicable diseases like diabetes underscores the need for integrated care models. These findings call for strengthened TB control programs focusing on early detection, smoking cessation initiatives, systematic drug susceptibility testing, and comorbidity management in Libya.

Keywords: Tuberculosis, Libya, Epidemiology, Drug Resistance, Smoking, Comorbidities, Cross-Sectional Study

الملخص

الخلفية: لا يزال مرض السل قضية صحية عالمية حرجة، مع عبء غير متناسب في المناطق المتأثرة بالصراع والنامية مثل ليبيا. البيانات المحلية الحالية حول اتجاهاته الوبائية وأنماط المقاومة وعوامل الخطر المرتبطة به شحيحة ولكنها ضرورية للتدخل الصحي العام الفعال.

الهدف: هدفت هذه الدراسة إلى التحقق من معدل الانتشار والتوزيع الديموغرافي والخصائص السريرية والملامح الميكروبيولوجية وأنماط مقاومة المضادات الحيوية بين مرضى السل الذين يرتادون المركز الوطني لمكافحة الأمراض (NCDC) في طرابلس.

المنهجية: أُجريت دراسة مقطعية وصفية في الفترة من 1 مايو إلى 31 يوليو 2023. تم تسجيل 35 مريضًا مشتبهاً أو مُشخصًا بالسل سريريًا. تم جمع البيانات من خلال استبيانات منظمة، والفحص السريري، والتحليل المختبري لعينات البلغم والدم. شملت طرق التشخيص الفحص المجهري للعصيات المقاومة للحامض(AFB) ، والزرع، واختبار GeneXpert MTB/RIF) كبديل لـ) PCR، واختبار إطلاق إنترفيرون-غاما(IGRA) ، والأشعة السينية على الصدر. تم استخدام الإحصاء الوصفي لتحليل البيانات.

النتائج: كانت نسبة الذكور إلى الإناث 4.8:1، حيث كان 83% (ن=29) من المرضى من الذكور. كانت الفئة العمرية الأكثر تأثراً هي 41-50 سنة (63%، ن=22). كان التدخين عاماً بين المرضى الذكور (100% من الذكور، 83% من إجمالي العينة). تم تشخيص السل الرئوي النشط في 71% (ن=25) من الحالات، بينما كان 29% (ن=10) مصابين بعدوى السل الكامنة .(LTBI) تم اكتشاف مقاومة المضادات الحيوية في 29% (ن=10) من الحالات. شملت الأمراض المصاحبة الشائعة داء السكري (43%، ن=15)، ومرض الكلى المزمن (34%، ن=12)، ومرض نقص المناعة البشرية/الإيدز (23%، ن=8). كان اختبار البلغم هو الأداة التشخيصية الأساسية (43%)، يليه اختبار IGRA القائم على الدم (37%) .

الاستنتاج: تكشف هذه الدراسة عن عبء مرتفع للسل بين الذكور الليبيين في منتصف العمر المدخنين، مع معدلات مقلقة للمرض النشط ومقاومة المضادات الحيوية. يؤكد الارتباط القوي بالأمراض غير السارية مثل السكري على الحاجة إلى نماذج رعاية متكاملة. تستدعي هذه النتائج تعزيز برامج مكافحة السل التي تركز على الكشف المبكر، ومبادرات الإقلاع عن التدخين، واختبار الحساسية الدوائية المنهجي، وإدارة الأمراض المصاحبة في ليبيا.

الكلمات المفتاحية: السل، ليبيا، الوبائيات، مقاومة الأدوية، التدخين، الأمراض المصاحبة، دراسة مقطعية.

Introduction

Tuberculosis is a disease caused by an infection caused by a bacterium (Mycobacterium tuberculosis) known as Mycobacterium tuberculosis, small in size and invisible and found everywhere in the body. Most bacteria are beneficial and harmless, but bacteria of this type are contagious, as the bacteria attach themselves to the body and multiply and the body cannot defend it. Therefore, tuberculosis infection occurs, due to a weak immune system (Amere et al., 2018).

Tuberculosis is the second most dangerous disease affecting humans after AIDS in terms of the number of deaths around the world. Tuberculosis can affect any part of the body, such as the skin (tuberculosis) or infecting some other organs. However, pulmonary tuberculosis is the most common, because the germ that causes pulmonary tuberculosis multiplies rapidly in the lungs and causes great damage. Unless the disease is detected and treated early, it can be completely cured. As for those who are not treated with the correct methods in a timely manner, they may die as a result of this disease (Bagcchi, 2023)

Tuberculosis is considered one of the most important and dangerous infectious diseases in the world and is considered the first cause of death, but its image has changed radically with the improvement of the standard of living and the introduction of modern treatments and vaccines that are given to newborns (Bates et al., 2015)
When a person has tuberculosis, the symptoms are coughing, fever, night sweats, weight loss, sputum of blood, and the symptoms may be mild for several months, and this can lead to delays in health care (Chakaya et al., 2022)
The patient may relapse or have immunity against the available drugs, which leads to the emergence of a chronic form of tuberculosis and a decrease in the possibility of recovery from it. Malnutrition, working conditions, living conditions, poor ventilation and poverty contribute to the spread of this disease (McQuaid et al., 2020).
The discovery of people with pulmonary tuberculosis is necessary, but it hinders efforts to defeat tuberculosis, especially in women. It is necessary to detect each case early and treat it completely to limit the spread of this disease. The importance of community support cannot be underestimated as it helps in identifying and diagnosing tuberculosis early and treating them fully and rehabilitating them socially (Dheda et al., 2022)

In Tobruk, a study was conducted at the National Center for Chest and Chest Diseases Control, where it became clear from tuberculosis cases that were identified for about 40 years from 1974 to 2014. The study included 995 cases out of 60.4 % of males and 39.6% of female cases (Pai et al., 2022)
The main objectives of study to find out the extent of tuberculosis and the factors causing it, as well as to know the type of disease, active or latent in cases. while the Place limits research by presenting the results that were obtained from patients ages 21 year to 70 years from national center for disease control in Tripoli.

Material And Methods

Simple collection

This study during the period from May to July 2023. Using a 35 sample were obtained from patients ages 21 year to 70 years of age from national center for disease control \ Tripoli. They are Isolation of mycobacterium tuberculosis in humans' samples are taken from blood and sputum (Furin et al., 2019).

Tests used in the diagnosis of pulmonary tuberculosis

Screening tests or Detection of tuberculosis

Diagnosis of tuberculosis

Screening tests or detection of tuberculosis

Tests to detect or investigate tuberculosis are not conducted for all individuals, so there are reasons for conducting these tests, and obtaining a negative result for one of these tests does not necessarily mean that the bacteria are not present in the body of the person concerned, especially if the person has symptoms and signs associated with tuberculosis or if (Reid et al., 2019). He had risk factors that increase the chance of contracting tuberculosis, and the reasons for conducting these tests and their types can be explained in the following

blood test

The blood test for detecting tuberculosis is called the interferon gamma release assay test, and this test is conducted by taking a blood sample from the vein of the person's arm, and through this test it is possible to detect the presence of the bacteria that cause tuberculosis, the test measures interferon-gamma (IFN-g), a protein produced by a person’s T cells as shown in Figure 1.

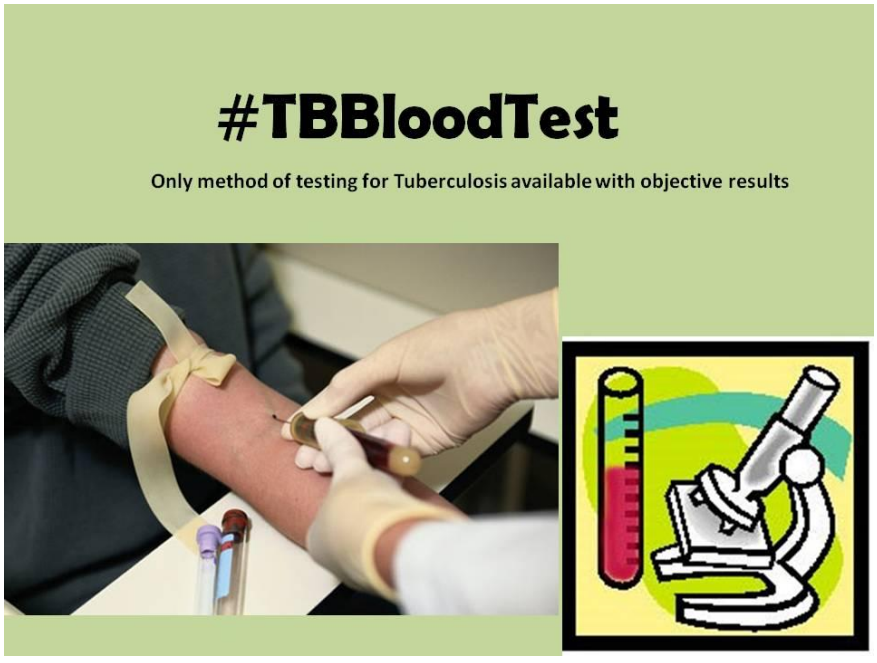

Figure 1: TB blood test

TB blood Test Results

A person receives a negative test result, it means their blood did not react to the TB antigens in the test. This indicates that it is unlikely that they have a TB infection. However, it is possible for people with very advanced cases of TB to have a negative result. This is because later stages of TB disease can suppress the immune reaction, causing a false negative (Horton et al., 2016).

A positive result can indicate that a person has either latent TB or TB disease. Latent TB refers to an inactive TB infection, meaning a person is not contagious and does not experience symptoms but can develop TB in the future. TB disease is when the bacteria are active, and a person is contagious.

Factors affecting the test result

- Infection with any disease or health condition that suppresses the immune system, such as lymphoma, HIV infection that causes AIDS, or kidney disease.
- Taking any of the drugs that suppress the functioning of the immune system, such as: steroids, drugs used in chemotherapy, and cyclosporine.
- Having an infection or fever during the past month, and examples of infection: influenza, measles, and pneumonia.
- Have any vaccinations taken during the past month?
- Previous infection with tuberculosis, or close contact with a person infected with tuberculosis, or traveling to areas where tuberculosis is common, or taking the tuberculosis vaccine.

TB Skin Test

A TB skin test is performed by injecting a fluid test under the skin on the inside of the forearm, between the wrist and the elbow.

1. The test takes two separate visits to complete. The first visit is to administer the test, which typically takes about 5 minutes. The second visit is to interpret the test results. Test results must be read within a 48-to-72-hour window to be considered valid. If the test is not read within that time frame, another TB skin test as presented in Figure 2 that can be administered as soon as possible (Knight et al., 2021).

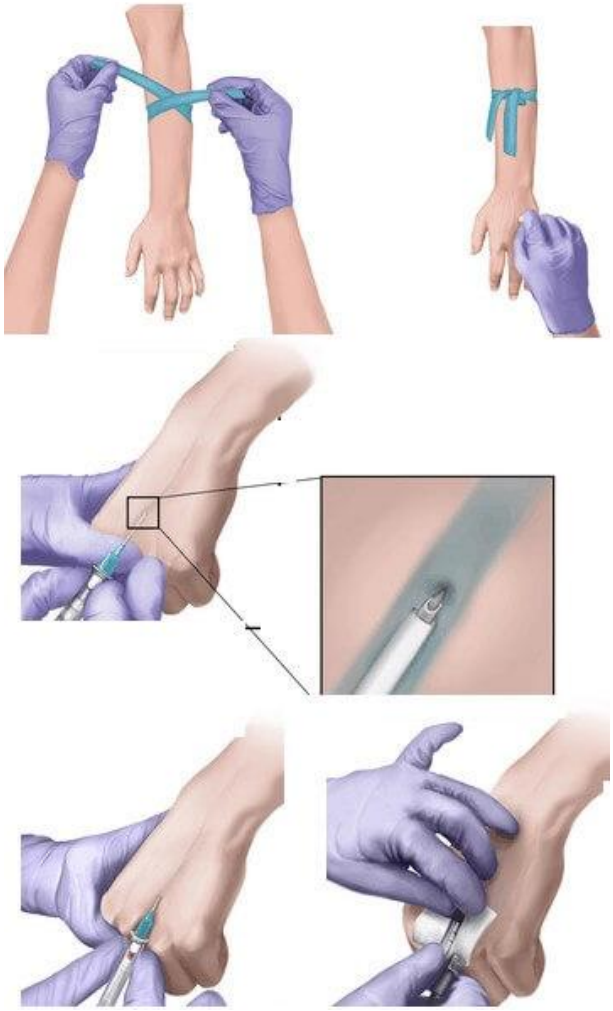

Figure 2: TB skin test.

Before the test

No pre-test preparations are needed for a TB skin test. If a patient has experienced a severe reaction to a previous TB skin test, another type of TB test may be more suitable.

During the test

During a TB skin test, will wipe the inner forearm with alcohol and let the skin dry. Using a syringe and needle, will then inject a small amount of test solution just under the skin. When performed correctly, the injection forms a small elevated spot on the skin. The test site should be left uncovered and undisturbed until the test result can be interpreted after several days.

After the test

After a TB skin test, the site must be examined between 48 and 72 hours later to see if a local skin reaction has occurred (Lönnroth et al., 2009).

TB Skin Test Results

TB skin test results that demonstrated in Figure 3 that are available as soon as 48 hours and up to 72 hours after the test is administered. A TB skin test is read provider between two and three days after the test is administered. if a skin reaction has occurred at the site where the test fluid was injected. If a reaction has occurred, the diameter of the induration, which describes a firm area of tissue, is measured across the forearm (MacNeil et al., 2020).

.

Figure 3: TB test result

Diagnosis of tuberculosis

There are various types of tests of the diagnosis of tuberculosis x-ray, Sputum test as listed below

- **X ray**

A chest X-ray that illustrated in Figure 4 that can show irregular spots in the lungs that are typical signs of active TB.

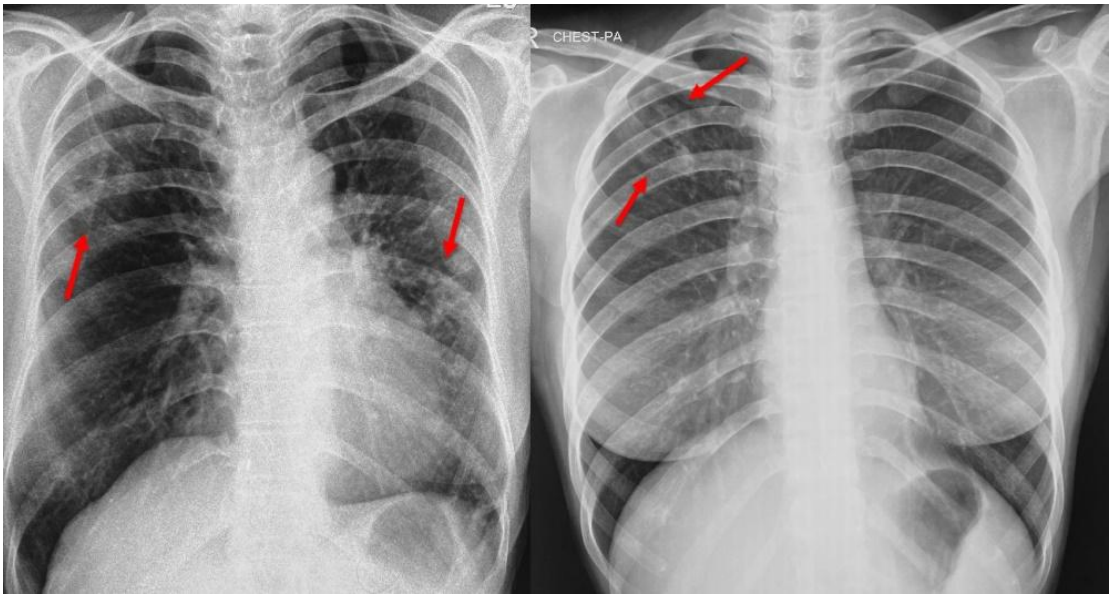

Figure 4: Chest X-ray for tuberculosis patients

- **Sputum test**

Pre-examination instructions that shown in Figure 5

1 Rinse the mouth with water before the examination.

2 Avoid eating before the examination.

3 Stop using some antibiotics or mouthwashes that kill bacteria and thus may affect the validity of the results.

Start the examination

1. Try to cough up some sputum and spit it out into a clean cup to be tested.
2. Try to spit out as much sputum as possible, usually up to 5 milliliters of sputum to be tested, usually a sputum sample mixed with saliva.
3. In the event that the patient is unable to cough, some sputum is extracted using an endoscope, which is a device that contains a light and a small camera, and enters the trachea to take a sample and examine it.

Figure 5: Sputum analysis

Examination and cultivation of a sputum sample:

1. Once a sample of sputum has been collected, it should be taken to the laboratory within 1-2 hours.
2. After looking at the color of the sample, the laboratory technician can conduct tests on the sputum sample to clarify the type of bacteria or cells it contains.
3. The color of the sputum can give an idea of the causes of the sputum.
4. The bacteria normally present in the sample are first distinguished from the pathogenic bacteria.
5. 4cultivation and multiplication of bacteria in a special dish containing a nutrient that helps bacteria or other pathogens present in sputum to grow.
6. In the event that bacteria are present, other laboratory tests will be conducted to determine the appropriate antibiotic to eliminate the bacteria present in the sputum sample.
7. The sputum test process takes several days to get the result.
8. The doctor may ask the patient to do other tests, depending on the results of the examination.

Figure 6: Sputum culture

PULMONARY TUBERCULOSIS

Respiratory system

The respiratory system is considered one of the most important systems in the human body, as the breathing process is considered as a fuel station that provides the body with energy that a person cannot live without at all, as it has an essential role in maintaining the activity and continuity of vital processes. It refers to a lack of oxygen and its deficiency, which infects the brain with perfusion, as abnormal symptoms appear, including dizziness, and the respiratory process is divided into two successive phases (inhalation)**.** As for the other process, it is known exhalation (Uplekar et al., 2015)**.**

It includes parts related to the respiratory process and complements the function of breathing among them: lungs / nose / pharynx / larynx / trachea / bronchi / alveoli.

One of the functions of the respiratory system is to supply the body with oxygen and oxidize oxygen through the lungs, maintain the balance of body temperature from disturbance, and stimulate cells to perform their functions by taking air, entering the body and expelling it.

Diseases affecting the respiratory system:

Mentioned the bacteria *Mycobacterium tuberculosis* is initially transmitted to the lungs, now through polluted air, and spreads through lymph nodes and the bloodstream to many different organs as for the other type of tuberculosis, it is caused by bacteria *Mycobacterium bovis* Which causes disease in cows, and can infect humans when consuming unpasteurized milk.

The germ that causes pulmonary tuberculosis:

The germ that causes the disease is called Mycobacterium tuberculosis, and it is one of the organic germs. It was discovered in 1880 AD by the scientist Robert Koch. Scientists were not able to discover medicines to treat tuberculosis until after World War II. This disease is caused by two types of bacteria:

- **Mycobacterium *Tb:***

It primarily affects humans, and it consists of long, twisted, small tuberculosis bacilli that shown in Figure 7, which are acid fast, preferring to live in tissues that have hot blood.

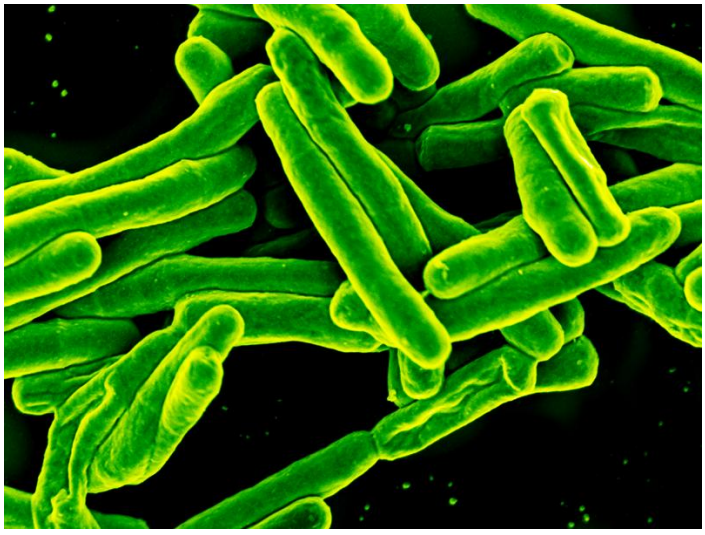

Figure 7: The bacillus of tuberculosis bacteria.

The group of mycobacteria that infect humans are:

1. ***Mycobacterium tuberculosis***
2. **Mycobacterium Boris**
3. **Mycobacterium africanus**
4. ***mycobacterium microti***
5. **B Mycobacterium bovis**

The high value of knowing the type of common diseases between humans and animals is due to the nature of the close relationship between humans and animals since the beginning of creation.

This bacteria is transmitted by drinking uncoiled cow's milk infected with the disease, and eating contaminated meat that is not well cooked, either through the respiratory tract by inhaling air contaminated with the germ and when contacting animals infected with pulmonary tuberculosis, or through the skin, after entering the tuberculosis germ through a wound by a machine contaminated with the germ of the disease, and the microbe begins to appear in the tonsils and lymph nodes and in the neck and rarely in the tongue and throat and also causes tuberculosis of the small intestine and is called mycobacteria Tuberculosis is changed by Mycobacterium bovi (Viney et al., 2021).

Types of pulmonary tuberculosis:

A. Primary or pulmonary tuberculosis

This type of disease is common in children and youth in developing countries, but in industrialized countries it is a disease that affects adults and the elderly. Until now, it is difficult to diagnose primary pulmonary tuberculosis because its symptoms are few, and the patient may not complain of anything.

B. Post-primary pulmonary tuberculosis

It is one of the most common types of tuberculosis, and it is responsible for the death of most patients. It results from previous tuberculosis that has become active, or old tuberculosis that the patient has not fully recovered, or as a result of a new infection in a previously uninfected person.

The infection is in the upper back part of the lung, and sometimes in the upper part of the lower lobe of the lung, where the microbe is transmitted through the bronchi of the lungs.

C. Miliary tuberculosis

Disseminated pulmonary tuberculosis is considered a fatal disease, as it is not treated and in which one of the lymph nodes explodes and tuberculosis reaches the blood and then to all parts of the body. It is of two types:

Acute miliary pulmonary tuberculosis:

It occurs at any age, but especially in children as a result of their immunodeficiency, and there are some diseases that may help spread it, such as measles and whooping cough.

Chronic miliary pulmonary tuberculosis:

It occurs among the elderly, especially in Europe, and there are some diseases that help its spread, such as leukemia present in the body,

Sometimes the bacteria that cause tuberculosis are but the immune system may intervene and protect the body from the occurrence of the disease. This is why two types of pulmonary tuberculosis were found:

Latent infection TB the bacteria remain inside the body in an inactive and non-infectious state and do not cause symptoms for the infected person, but they may turn into an active infection, and here treatment is required to limit the spread of the disease.

Active infection TB and here the symptoms appear clearly on the infected person and the patient is able to transmit the infection to other people. The period of symptoms appearing on the patient may vary from two weeks and may reach months or years (Pai et al., 2022,

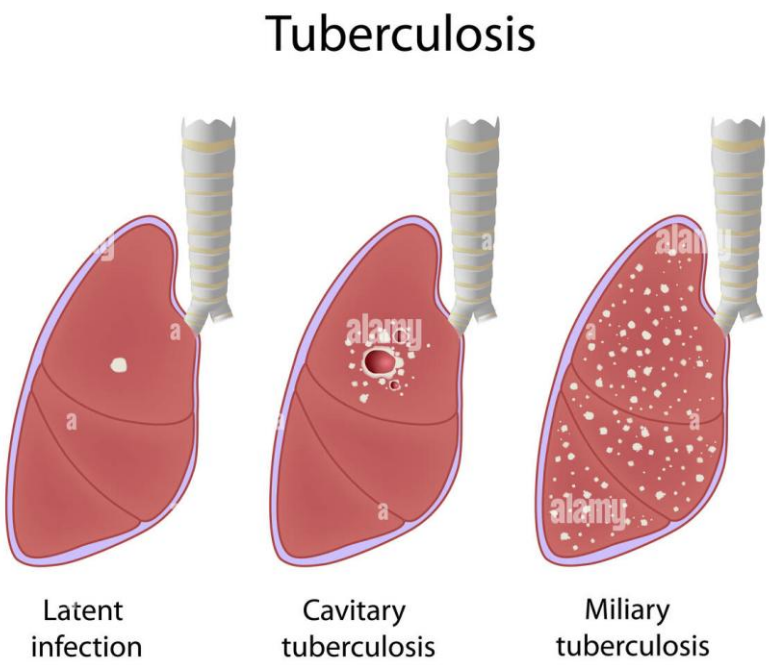

Figure 8: Pulmonary tuberculosis.

Methods of infection with tuberculosis

The most important ways of infection with tuberculosis are the following:

- The droplets dispersed from the mouths and noses of people with tuberculosis of the lungs. When these infected people cough, sneeze, speak, or spit, bacilli of tuberculosis are released into the air, where they can remain suspended for several hours. The possibility of infection is high. When a person is exposed

closely for a long time, especially in a closed place, to a patient with pulmonary tuberculosis, his sputum is positive for tuberculosis bacillus. If it is negative, the possibility of infection is low, Use of contaminated patient tools.

- Tuberculosis is spread, at least in part, by eating raw milk contaminated with Mycobacterium bovis, which gets into the milk from animals infected with bovine TB. By inhaling dust and dust containing the tuberculosis microbe (Uplekar et al., 2015).

Symptoms of pulmonary tuberculosis

Tuberculosis attacks any part of the body, but the lungs fill the site of infection and have cleared up Patients with tuberculosis have some of the following symptoms: They are found on the lung, such as the presence of infections in the pulmonary alveoli in addition to some general symptoms that appear on the patient with tuberculosis, including: feeling, exhaustion, emaciation, loss of appetite, weight loss, irritating coughing that causes distress that lasts for more than three weeks, high body temperature, night sweats, rapid heart rate, and swollen lymph nodes .

In addition to the paleness of the face, a feeling of weakness, and joint pain, and the sputum is sometimes mixed with blood, and in a few cases, bleeding occurs that requires urgent sheltering and persistent fever (Viney et al., 2021).

There are symptoms that depend on the type of affected organ in the body, for example

1. If the pleural membrane of the lungs is affected, chest pain occurs, and then crystalline filtration.
2. If the intestines are affected, diarrhea and sometimes intestinal obstruction occurs.
3. If the kidneys are affected, bloody urination occurs
4. If the brain is injured, vomiting and convulsions occur.

Diagnosis of tuberculosis

Tuberculosis is a complex disease that is difficult to diagnose, and there are several tests in case of doubt about its existence, and there are many different ways to diagnose it, and it is not possible to rely on one method, namely:

1. **Examination of sputum by direct method microscopic examination.**

microscopic examination is done to confirm the presence or absence of tuberculosis bacteria

Acid-fast microscopy

Acid-fast microscopy is “the microscopic examination of stained smears for the presence of organisms that retain the primary stain when the smear is decolorized with an acid alcohol solution”. Biehl-Neilson

staining, Ziehl-Neilson (ZN) staining because it is quicker and easier to read whilst the ZN is more appropriate in determining

microscopic morphology of bacilli in positive TB cultures.

Factors affecting the sensitivity of smears are many and include the staining technique, centrifugal force, decontamination technique used, the infecting species.

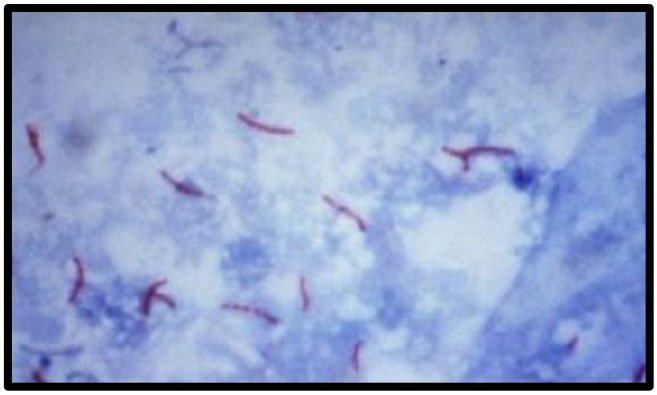

Figure 9: A sputum sample of a person infected with pulmonary tuberculosis after staining it

2-Make a sputum farm if necessary

sputum culture can be done to determine the causative bacteria and their response to antibiotics

3-Xray image of a Broncho scopey

It reveals scars in the lung and lymph nodes in the chest. It may be difficult to distinguish scars from other diseases, which requires more tests. Also, chest x-rays may show signs of active infection with tuberculosis.

Figure 10: X ray of human chest.

4- PCR test

TB PCR (Tuberculosis- Polymerase chain reaction). It is a rapid, reliable, and highly sensitive type of DNA amplification technique that aids in rapid detection of infection with Mycobacterium tuberculosis. Nucleic Acid Amplification test detects TB infection by amplification of nucleic acids and detection using fluorescent dyes

5- AGRA test

TB blood tests, or interferon-gamma release assays (IGRAs), are used to check for TB infection; they are also used to assist with diagnosis when someone is showing signs of TB disease. A TB blood test uses a sample of blood to look for signs of an immune reaction to Mycobacterium tuberculosis.

Complications of pulmonary tuberculosis:

There are many complications that appear, especially in the advanced stage of the disease, including pain in the spine and joints, which leads to their gradual damage, affecting the work of the heart and preventing it from pumping blood in its normal way, and infection with other diseases such as meningitis, which is a type of tumor that affects the brain.

Factors contributing to the spread of the disease

Studies indicated that there are many factors that contributed to the spread of tuberculosis, including:

1- Malnutrition.
2- Lack of good ventilation.
3- Unsanitary housing.
4- crowded places.
5- The weakening of the immune system in people with diabetes, kidney failure, those who take cortisone drugs, alcoholics, drug addicts, and people with AIDS and cancerous tumors.

Where these people are more susceptible to tuberculosis than others, in addition to the elderly and the young, those who suffer from malnutrition and poverty, and those who live in poor economic conditions (WHO, 2023).

Methods of prevention and treatment of pulmonary tuberculosis

The treatment of tuberculosis has existed, is available, and is easy for many years, and the patient must take treatment regularly and without interruption. The stage of treatment of pulmonary tuberculosis begins after

confirming the infection, and in the past, it was an incurable disease. With the development of science and research, the disease has become curable due to the availability of effective medicines needed for treatment. Research confirms the importance of therapeutic factors that accelerate recovery, including the healthy dose and the continuation of taking the medicine according to the period prescribed by the doctor. Some factors also affect the use of preventive medicines:

Including the patient's medical history and the extent of recent contact with an active tuberculosis patient. Tuberculosis needs medical treatment for a long period, which may reach between nine months to two years in some cases, compared to other diseases.

Antibiotics have become a barrier in developed countries in the treatment of disease, but one antibiotic may generate immunity, so the patient is given a group of drugs for a period of not less than six months and up to twelve months.

In general, some cases that do not take the initial doses of treatment as regularly scheduled, and may not absorb the drugs properly, because the bacteria become resistant to some or all of the drugs effectively, which requires more different types of drugs for a long period of treatment.

Studies have shown that the most important risk factor associated with anti-tuberculosis drugs is the history of antibiotic treatment, and due to the complications and damages resulting from the treatment, the cure rate is more than 90%.

For example, some antibiotics harm the liver and kidneys and cause peripheral nerves to become lethargic. Potential side effects of anti-tuberculosis drugs include skin rashes, skin allergies, jaundice, joint pain, blurred vision, dizziness, imbalance, and hearing loss.

In addition, some studies indicate the occurrence of some side effects of tuberculosis drugs, such as changing the color of urine to brown or orange, and disturbance in vision, and indicated the necessity of doing optometry before treatment so that the doctor can monitor any change in eye health over time

Stopping taking medications suddenly or taking them carelessly from time to time causes serious problems, the first of which increases the chance of recurrence of infection and relapses, and secondly, it returns to the arena with bacteria that are resistant to drugs and drugs, which is a condition in which antimicrobial drugs are unable to “kill it” and the problem of drug resistance began to escalate.

Patients are admitted to the hospital for treatment in the following cases

1. Patients who are severely ill and need clinical rest.
2. Patients with immunocompromised tuberculosis.
3. Patients who suffer from social problems, psychological conditions, and drug and alcohol addicts.
4. Patients who need surgical intervention.

The treatment of tuberculosis began the most important drugs used in treatment are as follows:

1. ifampicin
2. Isoniazid
3. ethambutol
4. pyrazinamide
5. streptomycin
6. Thioacetazone
7. Capreomycin
8. cyclomerize
9. ethionamide.
10. Viomycin.
11. kanamycin.

Ways to prevent pulmonary tuberculosis:

The most important ways to prevent the disease are limited to the following points:

1- Isolating the patient, reporting and treating him.
2- Giving preventive medications to inactive patients who have proven positive by skin test.
3- Providing medical and laboratory capabilities and x-ray devices, in order to examine patients, contacts, and suspects, and early treatment.
4- Improving social and living conditions (rest, good nutrition, and a healthy atmosphere).

5- Immunization with a single dose inside the skin with a vaccine prepared from an attenuated bacterial strain isolated from cows and named after its discoverer bacillus of Calmette and Guerin BCG.
6- It is forbidden to eat raw milk and its unpasteurized products, with the necessity of pasteurizing the milk intended for consumption.
7- Early medical examination when feeling a cough for more than two weeks and a rise in temperature.
8- Early vaccination with BCG vaccine for newborns.
9- A medical and chest examination for all arrivals to the country.
10- Good ventilation, avoiding crowded places as much as possible, covering the nose while coughing and sneezing, and not spitting on the ground.
11- Examination of contacts of patients helps to discover many new cases.[20]

Results and Discussion

Cases were collected by filling out questionnaire from patients in national center for disease control in Tripoli, the time period from May to July 2023. There are 35 samples were collected from patient's sputum and blood. Distribution of sample according to sex as tabulated in Table 1.

Table 1: Distribution of sample according to sex.

sex	No of patient	%
Male	**29**	**83 %**
female	**6**	**17 %**
total	**35**	**100%**

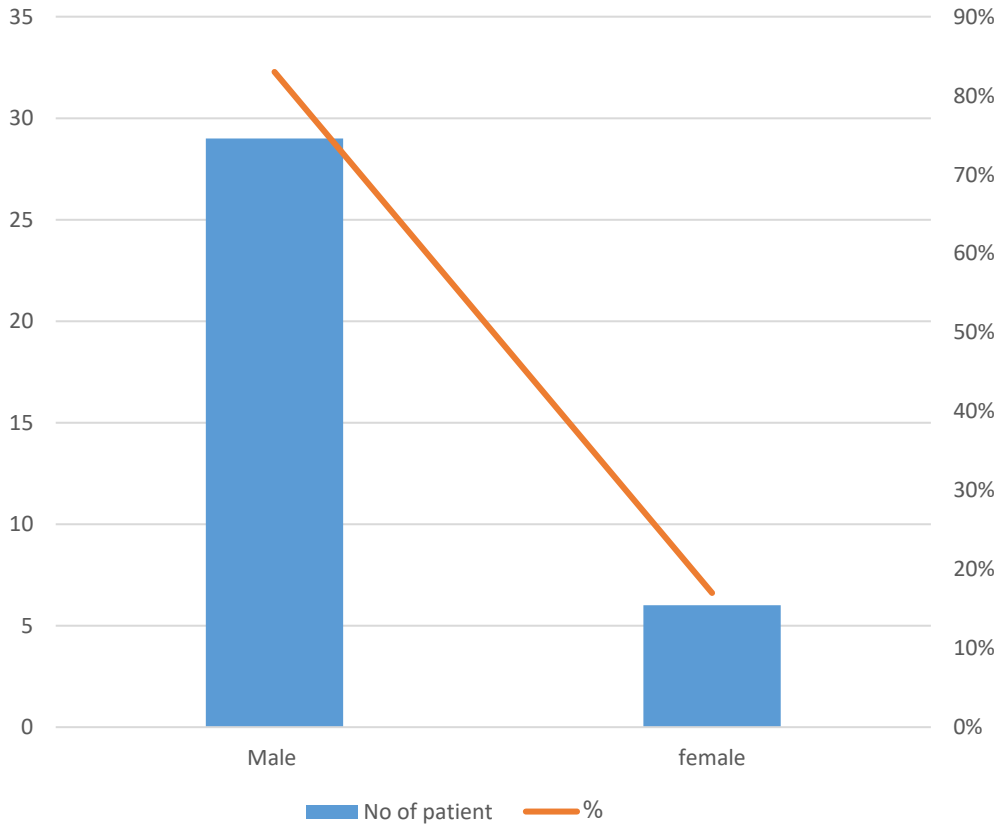

Figure 11: Distribution of sample according to sex

The infection rate of males was more than that of female. 6 female patient which is 17% of total of number 35, while 29 male patient which is 83% of total of number 35. Distribution of sample according to age as presented in Table 2.

Table 2 distribution of sample according to age

Age	No of patient	%
21 – 30	**1**	**3 %**
31 – 40	**7**	**20 %**
41 – 50	**22**	**63 %**
51 – 60	**3**	**9 %**
61 – 70	**2**	**6 %**
total	**35**	**100 %**

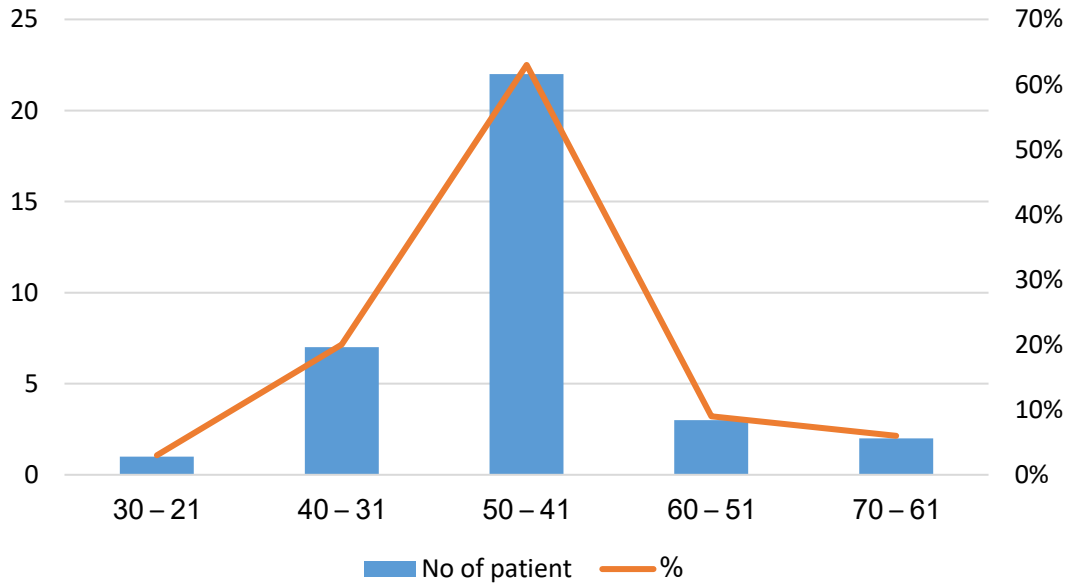

Figure 12: distribution of sample according to age

Through the table, we notice that the number of cases in the age group

(21 – 30) years is only one case, or 3 %, and the age group (31 – 40) years is 7 cases, or 20 %, and the age group (41 -50) years is 22 cases, or 63 %, and the age group (51 -60) years is 3 cases, or 9 %, while the age group (61 - 70) years is 2 cases, or 6 %.

Distribution of cases based on smoking

Table 3: Distribution of cases based on smoking

smoking	cases	%
Yes	29	83 %
No	6	17 %
total	35	100 %

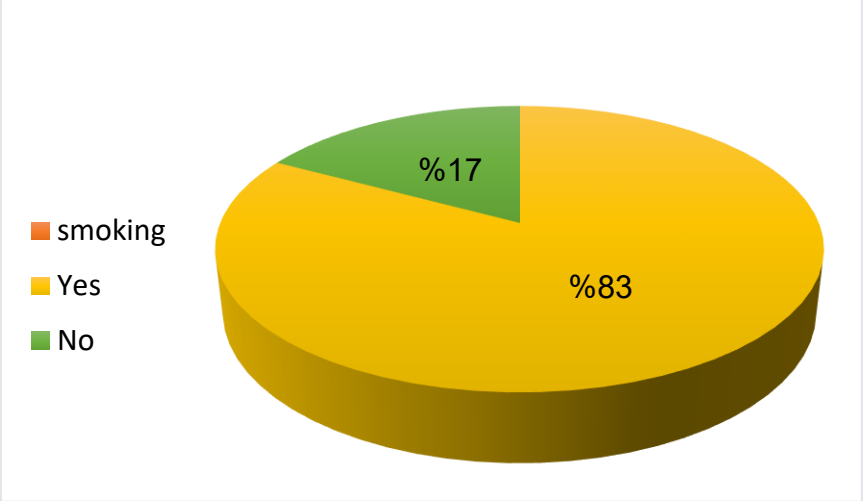

Figure 13: distribution of cases based on smoking

Through the result, we note all male cases of tuberculosis were smokers, 29 cases, or 83 %

Distribution of cases according to type of tuberculosis

Table 4 distribution of cases according to type of tuberculosis

Type of tuberculosis	cases	%
Active tuberculosis	25	71%
Latent tuberculosis	10	29%
total	35	100%

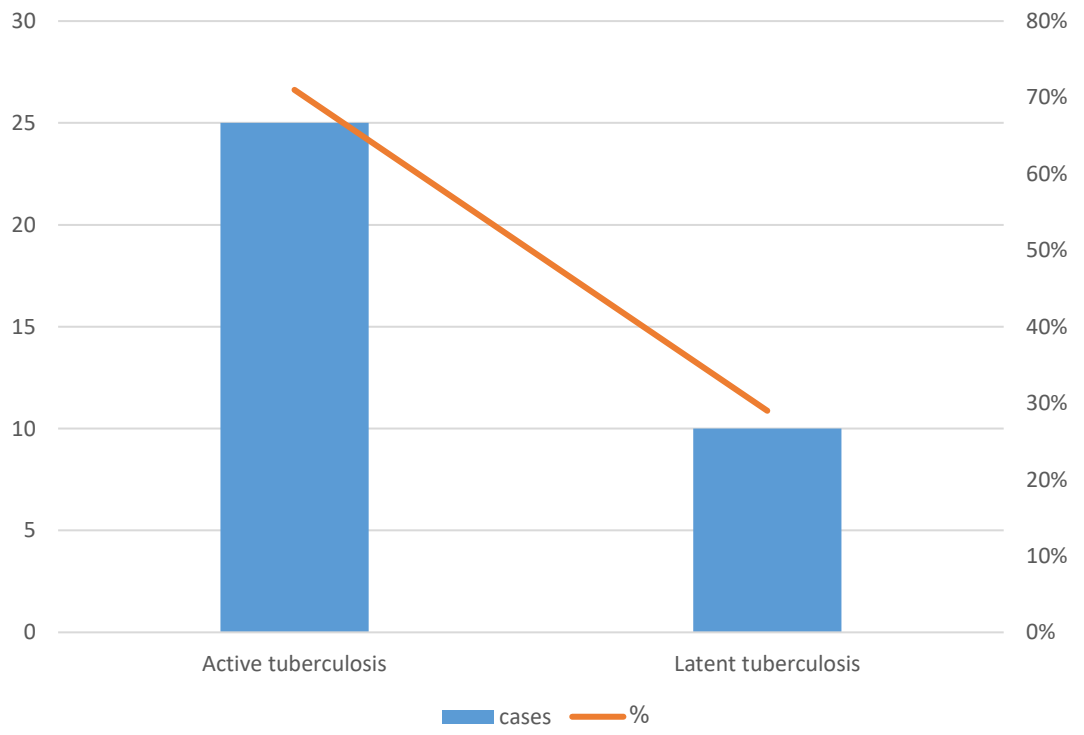

Figure 14: distribution of cases according to type of tuberculosis

Through the results, we note 25 or 71 % cases were active tuberculosis, while 10 cases or 29% were latent tuberculosis. The distribution of cases according to the resistance of bacteria to antibiotic's as in Figure 15.

Table 5: Distribution of cases according to the resistance of bacteria to antibiotic

Type of bacteria	cases	%
resistant	10	29%
Non - resistance	25	71%
total	35	100%

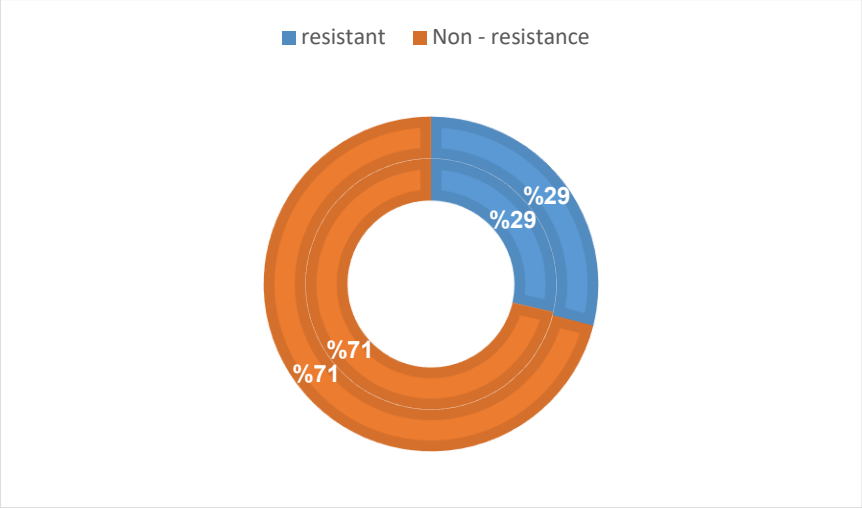

Figure 15: distribution of cases according to the resistance of bacteria to antibiotic

Through the results, we note 25 or 71 % cases were nonresistance to antibiotic, while 10 cases or 29% were resistance to antibiotic ass in Table 6. Distribution of cases based on diagnosis method as in Figure 16.

Table 6: Distribution of cases based on diagnosis method.

diagnosis	cases	%
blood	13	37%
sputum	15	43%
X ray	7	20%
total	35	100%

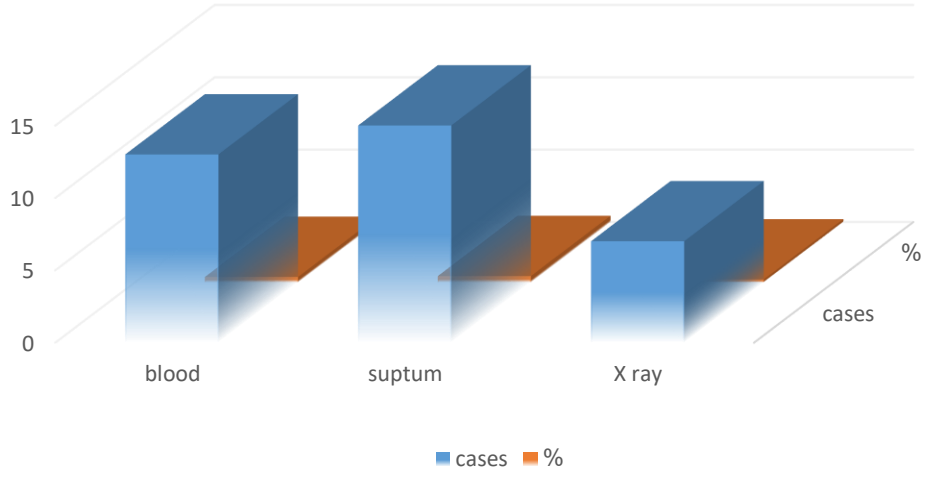

Figure 16: Distribution of cases based on diagnosis method

Through the results, we note 13 cases or 37% were diagnosed by blood, and 15 cases or 43 % were diagnosed by sputum, while 7 cases or 20 % were diagnosed by x-ray as in Table 7. Distribution of cases according to nationality as in Figure 17.

Table 7 distribution of cases according to nationality

nationality	caces	%
libyan	27	77%
Non - Libyan	8	23%
total	35	100%

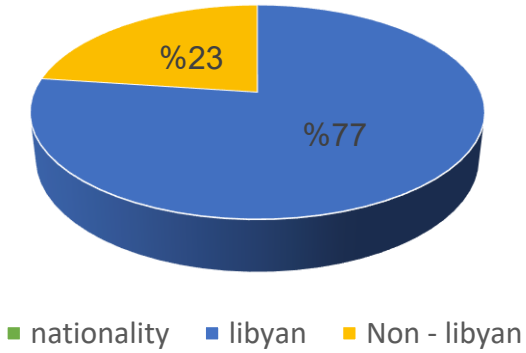

Figure 17: distribution of cases according to nationality

Through the results, we note 27 or 77% cases of Libyan, and 8 or 23% cases of non – Libyan as in Table 8. The Distribution of cases according to presence of other diseases as in Figure 18.

Table 8 distribution of cases according to presence of other diseases

disease	cases	%
diabetic	15	43 %
Kidney failure	12	34 %
AIDS	8	23 %
total	35	100 %

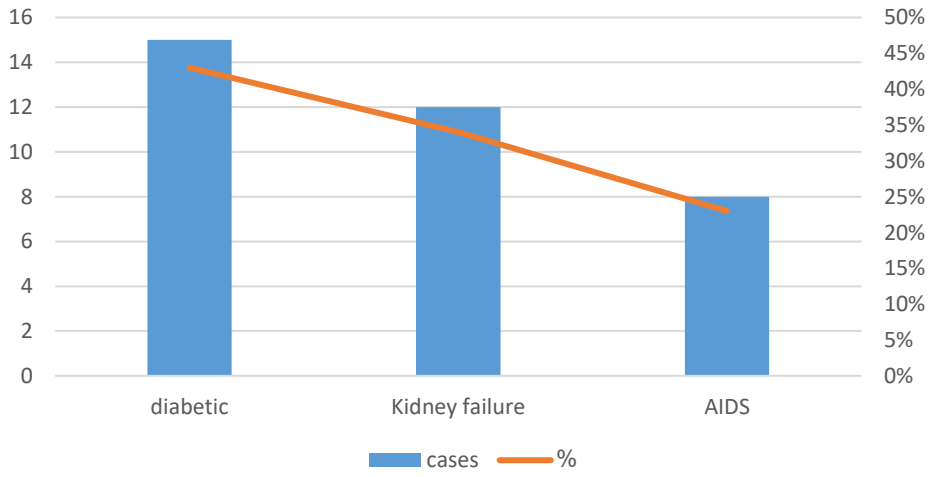

Figure 18: Distribution of cases according to presence of other diseases

Through the results, we note 15 cases were infected with diabetic or 43 %, while 12 cases were infected with kidney failure or 34 % and 8 non- Libyan cases with AIDS or 23 %.

Conclusion

Tuberculosis has reemerged as a major public health concern and is the second deadliest infectious disease worldwide. Understanding the pathophysiology of this contagious airborne disease, from the primary infection to primary progressive (active) disease or latency, is important. Understanding the pathophysiology will help critical care nurses be aware of the causes of the classic signs and symptoms for tuberculosis. Many different diagnostic tests can be used to evaluate a patient with suspected tuberculosis, and the stage or progression of the disease markedly affects the results. Even in critical care, each nurse has an opportunity to contribute to the control of tuberculosis by learning about the signs and symptoms of the disease, risk factors specific to critical care patients, and the appropriate actions to take should such a case occur. The more nurses know about tuberculosis, the more they can contribute to minimizing its transmission, making early diagnoses, and preventing increases in morbidity and mortality due to this disease.

References

1. Amere, G. A., Nayak, P., Salindri, A. D., Narayan, K. M. V., & Magee, M. J. (2018). Contribution of smoking to tuberculosis incidence and mortality in high-tuberculosis-burden countries. *American Journal of Epidemiology, 187*(9), 1846–1855.
2. Bagcchi, S. (2023). WHO's Global Tuberculosis Report 2022. *The Lancet Microbe, 4*(1), e20.
3. Bates, M., Marais, B. J., & Zumla, A. (2015). Tuberculosis comorbidity with communicable and noncommunicable diseases. *Cold Spring Harbor Perspectives in Medicine, 5*(11), a017889.
4. Chakaya, J., Petersen, E., Nantanda, R., Mungai, B. N., Migliori, G. B., Amanullah, F., ... & Zumla, A. (2022). The WHO Global Tuberculosis 2021 Report – not so good news and turning the tide back to End TB. *International Journal of Infectious Diseases, 124*(S1), S26–S29.
5. Dheda, K., Perumal, T., Moultrie, H., Perumal, R., Esmail, A., Scott, A. J., ... & Pooran, A. (2022). The epidemiology, pathogenesis, transmission, diagnosis, and management of multidrug-resistant, extensively drug-resistant, and incurable tuberculosis. *The Lancet Respiratory Medicine, 10*(5), 482–496.
6. Furin, J., Cox, H., & Pai, M. (2019). Tuberculosis. *The Lancet, 393*(10181), 1642–1656.
7. Global Tuberculosis Network. (2023). *Drug-resistant tuberculosis: A survival guide for clinicians* (3rd ed.).
8. Harries, A. D., Kumar, A. M. V., Satyanarayana, S., Thekkur, P., Lin, Y., Dlodlo, R. A., & Zachariah, R. (2021). Addressing chronic comorbidities in tuberculosis. *The International Journal of Tuberculosis and Lung Disease, 25*(5), 349–350.
9. Horton, K. C., MacPherson, P., Houben, R. M. G. J., White, R. G., & Corbett, E. L. (2016). Sex differences in tuberculosis burden and notifications in low- and middle-income countries: A systematic review and meta-analysis. *PLOS Medicine, 13*(9), e1002119.
10. Karam, M., Alameddine, M., Al Hilali, M., & Yamout, R. (2021). The burden of tuberculosis in crisis-affected populations: A systematic review. *The Lancet Infectious Diseases, 21*(10), e317–e325.
11. Knight, G. M., McQuaid, C. F., Dodd, P. J., & Houben, R. M. G. J. (2021). Global burden of latent tuberculosis infection: A re-estimation using mathematical modelling. *PLOS Medicine, 18*(10), e1003797.
12. Lönnroth, K., Jaramillo, E., Williams, B. G., Dye, C., & Raviglione, M. (2009). Drivers of tuberculosis epidemics: The role of risk factors and social determinants. *Social Science & Medicine, 68*(12), 2240–2246.
13. MacNeil, A., Glaziou, P., Sismanidis, C., Maloney, S., & Floyd, K. (2020). Global epidemiology of tuberculosis and progress toward meeting global targets—Worldwide, 2018. *Morbidity and Mortality Weekly Report, 69*(11), 281–285.

14. McQuaid, C. F., McCreesh, N., Read, J. M., Sumner, T., Houben, R. M. G. J., White, R. G., & Harris, R. C. (2020). The potential impact of COVID-19-related disruption on tuberculosis burden. *European Respiratory Journal, 56*(2), 2001718.

15. Ministry of Health, Libya. (2022). *National strategic plan for tuberculosis control 2023-2027*. Tripoli, Libya: Author.

16. Nahid, P., Mase, S. R., Migliori, G. B., Sotgiu, G., Bothamley, G. H., Brozek, J. L., ... & Lauzardo, M. (2019). Treatment of drug-resistant tuberculosis. An official ATS/CDC/ERS/IDSA clinical practice guideline. *American Journal of Respiratory and Critical Care Medicine, 200*(10), e93–e142.

17. Pai, M., Kasaeva, T., & Swaminathan, S. (2022). Covid-19's devastating effect on tuberculosis care — A path to recovery. *New England Journal of Medicine, 386*(16), 1490–1493.

18. Reid, M. J. A., Arinaminpathy, N., Bloom, A., Bloom, B. R., Boehme, C., Chaisson, R., ... & Goosby, E. (2019). Building a tuberculosis-free world: The Lancet Commission on tuberculosis. *The Lancet, 393*(10178), 1331–1384.

19. Uplekar, M., Weil, D., Lonnroth, K., Jaramillo, E., Lienhardt, C., Dias, H. M., ... & Raviglione, M. (2015). WHO's new end TB strategy. *The Lancet, 385*(9979), 1799–1801.

20. Viney, K., Cavanaugh, J., Kienene, T., Harley, D., Kelly, P. M., Sleigh, A., ... & O'Connor, J. (2021). Tuberculosis and diabetes mellitus in the Republic of Kiribati: A case-control study. *Tropical Medicine and Infectious Disease, 6*(2), 74.

21. World Health Organization. (2023). *Global tuberculosis report 2023*. World Health Organization.

22. World Health Organization. (2024). *WHO consolidated guidelines on tuberculosis: Module 4: Treatment - Drug-resistant tuberculosis treatment, 2023 update*. World Health Organization.