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Identification of Mycobacterium tuberculosis in Pulmonary and Extrapulmonary Specimens: A Comparative Analysis from Suspected TB Patients

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A B S T R A C T

Background: Tuberculosis (TB) is a deadly disease caused by Mycobacterium tuberculosis (MTB) and continues to pose a significant challenge to public health departments globally. TB infected millions of people annually. Timely and accurate diagnosis is crucial for effective treatment and halting its spread. Timely and accurate diagnosis is crucial for effective treatment and halting its spread.

Objective: The current study was undertaken to determine the prevalence of tuberculosis (TB) in clinical samples collected from hospitalized patients who were suspected of having pulmonary tuberculosis (PTB) or extrapulmonary tuberculosis (EPTB).

Methodology: The present research was conducted using samples from individuals suspected of having pulmonary and extrapulmonary tuberculosis (TB) who sought care at the Medicine department of Lady Reading Hospital in Peshawar, Pakistan, between January 2021 and December 2021. GeneXpert MTB/RIF testing was applied to all samples received by this department, providing results for both MTB detection and rifampicin resistance. Demographic and clinical data were extracted from the patients' medical records.

Results: Among 1170 suspected TB cases, 41.02% tested positive for Mycobacterium tuberculosis, with males comprising 75% of positive cases. The average age was 45.60 years, and the average hospital stay was 12.89 days. Sputum was the most common sample source (73%). Pulmonary TB accounted for 79.16% of cases, with 44% showing concurrent PTB among extrapulmonary TB cases. Chest imaging revealed notable findings, with a "tree-in-bud" appearance significantly associated with pulmonary TB.

Conclusion: The epidemiology and characteristics of tuberculosis (TB) among suspected cases. Males were predominantly affected, with 41.02% testing positive for Mycobacterium tuberculosis. Radiological findings, notably the "tree-in-bud" appearance, were significant in diagnosing pulmonary TB.

Keyword: Tuberculosis; Pulmonary TB; Extrapulmonary TB; Diagnostic Techniques

Introduction

Tuberculosis (TB) remains one of the most significant global health challenges, particularly in low-and middle-income countries, despite decades of efforts to control its spread. Mycobacterium tuberculosis (MTB), the causative agent of TB, infects millions of individuals worldwide annually, leading to significant morbidity and mortality. Pulmonary TB, characterized by the infection of the lungs, is the most common form of TB. However, MTB can also infect other organs, resulting in extrapulmonary TB, which poses diagnostic and therapeutic challenges due to its diverse clinical presentations and varied anatomical locations. EPTB makes up about 15% to 20% of all TB cases, and it's even more common in people with weakened immune systems.[1] Detecting and treating EPTB can be tricky because there are fewer germs, and sometimes doctors need to do invasive tests to collect samples. If TB isn't detected and treated quickly, it's more likely to spread to others. As per the latest report from the World Health Organization (WHO), tuberculosis (TB) claimed the lives of approximately 1.3 million individuals in 2022, with 167,000 of them being co-infected with HIV. Globally, TB ranks as the second most fatal infectious disease, trailing only behind COVID-19, surpassing even HIV/AIDS. In the same year, an estimated 10.6 million people worldwide contracted TB, comprising 5.8 million men, 3.5 million women, and 1.3 million children. Multidrug-resistant TB (MDR-TB) continues to pose a significant public health crisis and a threat to health security, with only around 40% of individuals with drug-resistant TB receiving treatment in 2022.[2]

The identification of MTB in both pulmonary and extrapulmonary specimens from suspected TB patients is crucial for accurate diagnosis, appropriate treatment initiation, and effective disease control strategies. Historically, the diagnosis of TB relied heavily on conventional microbiological methods such as sputum smear microscopy and culture. While these methods remain fundamental in resource-limited settings, they often lack sensitivity, particularly in the case of extrapulmonary TB, where the bacillary load may be low or samples are difficult to obtain.[3,4]

Advancements in molecular diagnostic techniques have revolutionized the detection of MTB in clinical specimens, offering greater sensitivity, specificity, and rapidity compared to traditional methods. Polymerase chain reaction (PCR)-based assays targeting specific regions of the MTB genome enable the direct detection of MTB DNA in clinical samples with high sensitivity and specificity. Additionally, nucleic acid amplification tests (NAATs), such as Xpert MTB/RIF assay, have been endorsed by the World Health Organization (WHO) for the rapid and simultaneous detection of MTB and rifampicin resistance, thus facilitating timely treatment initiation and drug resistance surveillance.[5]

Despite the utility of molecular techniques, challenges persist in the diagnosis of extrapulmonary TB. The paucibacillary nature of extrapulmonary specimens, coupled with the diverse clinical manifestations and anatomical sites involved, often necessitates a multimodal diagnostic approach. Fine-needle aspiration cytology, histopathology, and imaging modalities such as ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI) play pivotal roles in the diagnosis of extrapulmonary TB by providing valuable clinical and radiological insights.[4]

Furthermore, the emergence of drug-resistant TB, including multidrug-resistant (MDR-TB) and extensively drug-resistant TB (XDR-TB), poses additional challenges to TB diagnosis and management. Conventional drug susceptibility testing (DST) methods require prolonged incubation periods and may be unavailable or inaccessible in resource-limited settings. Molecular methods, such as line probe assays and whole-genome sequencing, offer rapid and comprehensive detection of drug resistance mutations, facilitating targeted treatment regimens and reducing the risk of treatment failure and disease transmission.[6]

In Khyber Pakhtunkhwa, prevalence of TB/DR-TB is higher and it is very important to control the prevalence of this disease and for this timely diagnosis is very important. Hence, this study was designed to determine the prevalence of tuberculosis (TB) in clinical samples collected from hospitalized patients who were under suspicion of having either pulmonary tuberculosis (PTB) or extrapulmonary tuberculosis (EPTB).

Objective

The current investigation was carried out to assess the occurrence of tuberculosis (TB) in clinical samples obtained from hospitalized patients who were suspected of having either pulmonary tuberculosis (PTB) or extrapulmonary tuberculosis (EPTB).

Methodology

The present study was conducted at the Medicine Department of Lady Reading Hospital in Peshawar, Pakistan, from January 2021 to December 2021. It included all patients who visited for their diagnosis and treatment of Tuberculosis during this period. The present hospital specializes in diagnosing and treating Tuberculosis (TB) and Drug-resistant TB (DR-TB). For diagnosis, suspected TB cases underwent regular testing using GeneXpert and AFB smear. Additionally, AFB culture and sensitivity testing were conducted for further confirmation and to determine appropriate treatment.

In this study, suspected tuberculosis (TB) cases were

identified based on clinical criteria such as a persistent cough lasting two weeks, fever, significant weight loss (more than three kilograms), or difficulty breathing, along with radiographic evidence suggestive of TB. Various samples including sputum, bronchoalveolar lavage (BAL), pleural fluid, cerebrospinal fluid (CSF), plasma, ascites, abscesses, secretions, and skin specimens were collected from these individuals.

Patients were classified into two groups: pulmonary TB (PTB) and extrapulmonary TB (EPTB). PTB included patients with TB affecting the lungs, pleura, and intrathoracic lymph nodes. Conversely, EPTB comprised cases where TB had spread to organs or tissues outside the thorax, such as tuberculous lymphadenitis or pleural effusion without abnormal lung findings.

Every specimen that was collected was examined using the GeneXpert test, following the guidelines provided by the manufacturer. The procedure involved combining 2 milliliters of GeneXpert MTB/rifampin (RIF) sample reagent with 1 milliliter of the sample that was taken, letting it dissolve for fifteen minutes, and then filling the GeneXpert cartridge with 2 milliliters of this mixture. The necessary reagents for rifampin resistance detection and nucleic acid amplification were included in the cartridge. The GeneXpert machines produced results automatically in around two hours.

Statistical analysis was performed using SPSS software version 26 (SPSS Inc., Chicago, IL, USA), utilizing t-test analysis. A significance threshold of $P < 0.05$ was applied to all analyses. Demographic features, lifestyle factors, and clinical variables were compared between the PTB and EPTB groups.

Before initiating the study, approval was secured from the Institutional Ethical Committee (IEC) of Lady Reading Hospital Peshawar, adhering to ethical guidelines and regulations pertaining to research involving human participants or their personal data.

Results

Out of 1170 study cases of suspected TB, 480 (41.02%) tested positive for the presence of Mycobacterium Tuberculosis (MTB). Among positive cases, 360 (75.0%) were male and 120 (25.0%) were female.

The male-to-female ratio among TB-positive patients was calculated to be 2.4 (360 males to 120 females). Within the pulmonary cases, there were 240 males and 120 females, while among extrapulmonary patients, there were 80 males and 64 females. These numbers demonstrated a statistically significant association ($P < 0.05$) between gender and disease positivity rates.

The mean age of all patients was 45.60 ± 20.22 years, and the average duration of hospitalization among the study participants was 12.89 ± 15.19 days.

Among TB-positive patients, the isolation yield of TB was as follows: 36 (7.5%) were categorized as trace, 84 (17.5%) as very low, 112 (23.3%) as low, 120 (25%) as medium, and 128 (26.6%) as high. Out of these, only 24 (5%) were identified as rifampicin-resistant, while 456 (95%) were sensitive to rifampicin.

Regarding the different body sites sampled from TB-positive patients, 352 (73%) samples were obtained from sputum, 36 (7.5%) from bronchoalveolar lavage (BAL), 24 (5%) from pleural fluid, 20 (4.1%) from cerebrospinal fluid (CSF), 16 (3.3%) from plasma, 12 (2.5%) from ascites, 8 (1.6%) from knee secretions, 8 (1.6%) from lymph node secretions, and 4 (0.8%) from skin samples (Table 1).

As per the defined pulmonary and extrapulmonary criteria, 380 samples (79.16%) were identified as pulmonary TB cases, while 100 samples (20.83%) were

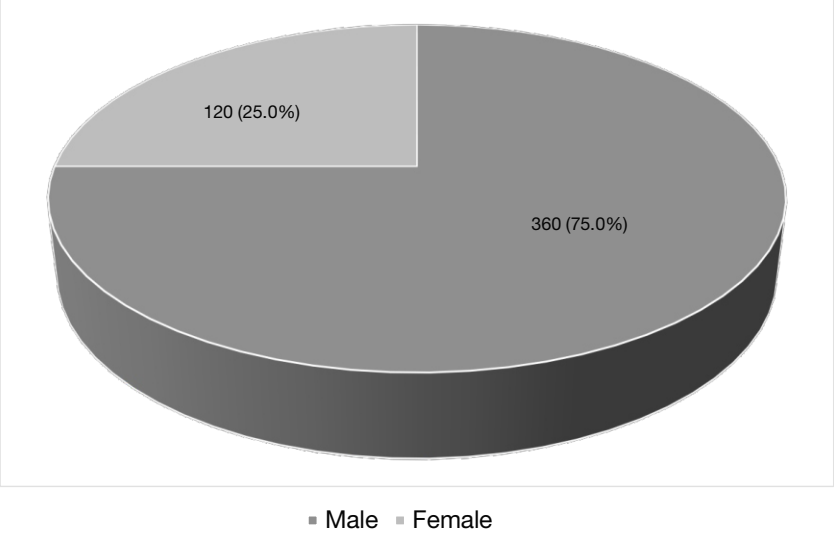

Figure 1. Frequency of positive cases

categorized as extrapulmonary TB. Among the 100 cases of extrapulmonary TB, 44 (44%) were found to have concurrent pulmonary TB. Table 2 presents the clinical, radiographical features, and lifestyle factors associated with patients diagnosed with both pulmonary and extrapulmonary TB in this study.

Among the case studies, various underlying diseases coexist alongside the presence of Mycobacterium tuberculosis (MTB). These underlying diseases encompass not only serious medical conditions but also lifestyle habits such as smoking and addiction, which significantly impact our bodies. It's crucial to recognize that these additional health factors can exacerbate the effects of tuberculosis, complicating treatment and potentially leading to more severe health outcomes. For instance, individuals with chronic conditions like diabetes or HIV/AIDS are particularly vulnerable to tuberculosis due to their compromised immune systems. Similarly, smokers and those addicted to substances experience diminished lung function and weakened overall health, making them more susceptible to TB infection and its complications. Among the study cases, majority of study cases were smokers which are 37.8% in PTB and 48.0% among EPTB. Diabetes Miletus (DM) were found among 36.0% among EPTB cases. While these characteristics indeed impact the body's immune system and susceptibility to disease, it's important to note that no positive significant association has been found between any specific diseases and the occurrence of tuberculosis (Table 3).

Table 1. Body sites according to sample collection for testing

Body Sites for Sample selection	Frequency	Percentage (%)
Sputum	352	73.0
BAL	36	7.5
Pleural Fluid	24	5.0
CSF	20	4.1
Plasma	16	3.3
Ascites	12	2.5
Knee secretion	8	1.6
Lymph node	8	1.6
Skin	4	0.8

Chest imaging was conducted for all study cases, revealing significant findings. Among pulmonary tuberculosis (TB) cases, 34.7% exhibited a "tree-in-bud" appearance on their chest imaging, while 46.3% displayed pulmonary nodules. Additionally, 28.0% of extrapulmonary TB cases showed abnormalities on their imaging scans. Notably, the presence of a "tree-in-bud" appearance on chest imaging was found to have a positive and significant association with the presence of the disease. This suggests that this particular radiological finding may serve as a useful indicator for identifying pulmonary TB cases (Table 4).

Discussion

Tuberculosis (TB) poses a significant global public health challenge, with Mycobacterium tuberculosis (MTB) infecting approximately one third of the world's population and remaining a leading cause of mortality worldwide. While TB traditionally affects the lungs, there is a growing incidence of extrapulmonary TB (EPTB), indicating the organism's ability to disseminate to various organs. EPTB accounts for 10% to 42% of adult TB cases, influenced by factors such as race, age, immune status, underlying health conditions, and MTB strain genotype.[7] It can manifest independently or alongside pulmonary disease, affecting any organ and presenting diverse clinical symptoms, necessitating a heightened clinical suspicion for accurate diagnosis. Extrapulmonary tuberculosis (EPTB) is a notable aspect of TB pathology, demonstrating the disease's capacity to affect organs beyond the lungs. While pulmonary TB remains preva-

Table 2. Different factors and findings responsible for occurrence of diseases

Characteristics	Pulmonary TB (n=380), (%)	Extrapulmonary PTB (n=100), (%)	P-value
Demographic			
Gender (male/female)	240/120	80/64	< 0.001
Age (years)	49.5	43.5	< 0.001
Mean of hospital stay (days)	15.1	13.7	0.029
Symptoms			
Chronic cough	304 (80.0)	32 (32.0)	0.003
Hemoptysis	76 (21.03)	12 (12.0)	0.241
Decreased appetite	220 (57.8)	44 (44.0)	0.211
Decreased weight	248 (65.2)	56 (56.0)	0.021
Fever	280 (73.6)	52 (52.0)	0.011
Respiratory distress	236 (62.1)	32 (32.0)	0.212
Chest pain	124 (32.6)	28 (28.0)	0.050
Back pain	24 (6.3)	00 (0.0)	1.000
Night sweats	144 (37.8)	44 (44.0)	0.211
Fatigue	156 (41.0)	48 (48.0)	0.014
Ascites	28 (7.3)	24 (24.0)	1.000
Enlarged lymph nodes	32 (8.4)	44 (44.0)	0.247
Urinary symptoms	40 (10.5)	24 (24.0)	0.021
Abdominal pain	88 (23.1)	32 (32.0)	0.891
Headache	16 (4.2)	24 (24.0)	0.521
Neurological symptoms	8 (2.1)	16 (16.0)	0.382
History of imprisonment	76 (20.0)	28 (28.0)	1.000
Living in endemic areas	80 (21.0)	44 (44.0)	0.727
Injecting addiction	84 (22.1)	12 (12.0)	0.066

lent, EPTB's emergence highlights the systemic nature of MTB infection. The incidence of EPTB varies widely among TB patients, influenced by demographic and clinical factors. Its diverse clinical presentations underscore the importance of maintaining vigilance in clinical practice, ensuring timely diagnosis and management for optimal patient outcomes.

The World Health Organization (WHO) Global Report states that in 2022, tuberculosis (TB) claimed the lives of 1.3 million individuals globally, with 167,000 of those cases occurring in individuals co-infected with HIV. TB ranks as the second most deadly infectious disease worldwide, following COVID-19 and surpassing HIV/AIDS. The report estimates that 10.6 million people contracted TB in 2022, comprising 5.8 million men, 3.5 million women, and 1.3 million children. Notably, multidrug-resistant TB (MDR-TB) persists as a significant public health concern and a threat to health security. Regrettably, only around 40% of individuals diagnosed with drug-resistant TB were able to access treatment in 2022. Pakistan is among the top-ranking countries with higher TB and DR-TB cases. Control of this diseases is of very important as it killed millions of people each year and also infect same number of people each other. Timely diagnosis is one of the main factors which play important role in control and achieved successful outcome of TB and MDR-TB. Detecting tuberculosis (TB) and multidrug-resistant tuberculosis (MDR-TB) is essential for successful treatment and containment of the illness. Diagnosis generally initiates with a comprehensive medical history and physical evaluation, focusing on symptoms like persistent cough, fever, night sweats, and weight loss. Laboratory examinations are instrumental in confirming TB infection, with sputum smear microscopy being the most prevalent method. This procedure involves scrutinizing a sputum sample under a microscope to detect the presence of Mycobacterium tuberculosis bacteria. Additionally, molecular tests like nucleic acid amplification tests (NAATs) can rapidly detect TB-specific genetic material, offering quicker diagnosis. For suspected cases of MDR-TB, further testing involving culture and drug susceptibility testing (DST) is essential to identify resistance patterns against first-line TB drugs. Advanced diagnostic tools such as X-rays, CT scans, and even molecular genotyping techniques may also be employed to aid in accurate diagnosis and appropriate management of both TB and MDR-TB cases. Early and precise diagnosis is paramount in curbing the spread of TB and preventing the emergence of drug-resistant strains. GeneXpert is a revolutionary molecular diagnostic platform widely used for the detection of tuberculosis (TB) and drug-resistant TB. Developed by Cepheid, GeneXpert offers rapid and accurate results by simultaneously amplifying and detecting specific nucleic acid sequences of Mycobacterium tuberculosis in clinical samples. This technology has significantly improved TB diagnosis, particularly in settings with limited laboratory infrastructure, as it requires minimal hands-on time and provides results within a few hours. GeneXpert's ability to detect drug resistance, especially to rifampicin, a key indicator of multidrug-resistant TB (MDR-TB), has been instrumental in guiding appropriate treatment regimens and curbing

Table 3. Different underlying disease found among study cases

Underlying Diseases	Pulmonary TB (n=380), (%)	Extrapulmonary PTB (n=100), (%)	P-value
HIV Positive	68 (17.8)	24 (24.0)	0.581
Smoking	144 (37.8)	48 (48.0)	0.121
Addicted	88 (23.1)	32 (32.0)	0.811
Diabetes	48 (12.)	36 (36.0)	0.211
Chemotherapy	12 (3.1)	00 (0.0)	1.000
Immunosuppressive Drugs	28 (7.3)	16 (16.0)	0.599
Malnutrition	8 (2.1)	00 (0.0)	0.398
Malignancy	24 (6.3)	8 (8.0)	0.211
Loss of Conscientious	24 (6.3)	12 (12.0)	1.000
Edema	48 (12.6)	12 (12.0)	0.699

Table 4. Findings of chest imaging among study cases

Findings of Chest Imaging	Pulmonary TB (n=380), (%)	Extrapulmonary PTB (n=100), (%)	P-value
Infusion	56 (14.7)	28 (28.0)	0.039
Pneumothorax	24 (6.3)	00 (0.0)	1.000
Tree in Bud Appearance	132 (34.7)	16 (16.0)	< 0.001
Consolidation	68 (17.8)	12 (12.0)	0.212
Collapse	40 (10.5)	4 (4.0)	1.000
Ground-glass Appearance	40 (10.5)	00 (0.0)	1.000
Centri nodular	16 (16.8)	6 (24)	0.081
Lymph Node Lymphadenopathy	14 (14.7)	4 (16)	1.000
Pulmonary nodules	44 (46.3)	5 (20)	0.079
Bronchiectasis	7 (7.3)	2 (8)	0.201
Emphysema	5 (5.2)	3 (12)	1.000
Atelectasis	7 (7.3)	3 (12)	1.000
Cavitation	26 (27.3)	6 (24)	0.002
Miliary TB	6 (6.3)	11 (44)	1.000
Structural disorders of the lungs	10 (10.5)	4 (16)	0.918

the spread of drug-resistant strains.[8]

In diagnosing tuberculosis (TB) and multidrug-resistant tuberculosis (MDR-TB), a range of clinical specimens are utilized to detect Mycobacterium tuberculosis and assess drug susceptibility. Sputum samples stand as the cornerstone, obtained through deep coughing and examined via smear microscopy, culture, and molecular tests like GeneXpert. Bronchoalveolar lavage (BAL) fluid, acquired during bronchoscopy, proves vital when lower respiratory tract involvement requires assessment. Pleural fluid, collected via thoracentesis, aids in diagnosing pleural TB. Cerebrospinal fluid (CSF) analysis through lumbar puncture is pivotal for TB meningitis suspicion. Tissue biopsy offers histopathological insights, crucial for confirming TB and identifying drug resistance. Blood may be used for serological tests, although less commonly for TB diagnosis. Gastric aspirates serve in pediatric TB diagnosis and in individuals unable to produce sputum. These specimens are also pivotal for drug susceptibility testing, guiding effective management of MDR-TB cases.[9]

The current research reveals that 41.02% of the cases examined exhibited positive results for the presence of MTB. Previous studies have explored the incidence and prevalence of M. tuberculosis in clinical samples. For instance, a study in Ahvaz, Iran, conducted in 2012, reported a detection frequency of 26% using PCR and 16% using culture methods. In another study by Seyoum et al. conducted in Ethiopia in 2014, involving 480 pulmonary specimens, the frequency of M. tuberculosis was 12.5%,[11] significantly lower than observed in our investigation.

In our current investigation, various body sites were sampled from TB-positive patients, with the following distribution: 352 samples (73%) were obtained from sputum, 36 samples (7.5%) from bronchoalveolar lavage (BAL), 24 samples (5%) from pleural fluid, 20 samples (4.1%) from cerebrospinal fluid (CSF), 16 samples (3.3%) from plasma, 12 samples (2.5%) from ascites, 8 samples (1.6%) from knee secretions, 8 samples (1.6%) from

lymph node secretions, and 4 samples (0.8%) from skin specimens. The distribution of TB-positive patient samples across various body sites in the present study reveals insights into the diverse manifestations of the disease. The majority of samples, constituting 73%, were sourced from sputum, reflecting its primary role as the main diagnostic specimen for pulmonary TB. This high proportion underscores the importance of respiratory secretions in TB diagnosis, aligning with the disease's predominant pulmonary presentation. However, the allocation of samples across other sites such as bronchoalveolar lavage (BAL), pleural fluid, cerebros-pinal fluid (CSF), and plasma illustrates the multifaceted nature of TB, which can affect extrapulmonary sites, including the pleura, central nervous system, and bloodstream. The varying proportions across these sites highlight the necessity of considering both pulmonary and extrapulmonary presentations in TB diagnosis and management.

Furthermore, the distribution of samples from less common sites such as ascites, knee secretions, lymph node secretions, and skin underscores the systemic nature of TB dissemination and its potential to affect diverse anatomical locations. Although these sites represent a smaller fraction of the total samples, their inclusion in the study emphasizes the need for clinicians to maintain a broad differential diagnosis when encountering patients with suspected TB, especially those presenting with atypical symptoms or extrapulmonary manifestations. These findings underscore the importance of comprehensive diagnostic approaches that encompass various body sites, enabling healthcare providers to accurately diagnose TB regardless of its presentation, thereby facilitating prompt initiation of appropriate treatment and control measures.

The study's findings regarding the prevalence of smoking and diabetes mellitus (DM) among tuberculosis (TB) patients shed light on potential risk factors influencing disease susceptibility. The significant proportion of smokers among both pulmonary TB (PTB) and extrapulmonary TB (EPTB) cases, at 37.8% and 48.0%, respectively, under-scores the well-established association between smoking and increased vulnerability to TB infection.[12] Smoking compromises lung function and weakens the immune system, creating an environment conducive to TB acquisition and progression. Similarly, the high prevalence of DM, particularly among EPTB cases at 36.0%, aligns with previous research highlighting the synergistic relationship between diabetes and TB. DM compromises immune function and impairs the body's ability to combat infections, thereby heightening the risk of TB development and exacerbating disease severity. These findings emphasize the importance of targeted interventions to address modifiable risk factors like smoking and diabetes in TB control efforts, aiming to mitigate disease burden and enhance patient outcomes. However, it's crucial to interpret these associations with caution, as the study did not establish a positive significant relationship between specific diseases and TB occurrence. While smoking and DM are known risk factors for TB, their presence among TB patients in this study may reflect broader demographic trends rather than direct causal relationships. Further research is needed to elucidate the complex interplay between these comorbidities and TB susceptibility, considering additional factors such as socioeconomic status, healthcare access, and genetic predispositions. Nonetheless, these findings underscore the importance of comprehensive TB control strategies that address underlying risk factors and promote holistic approaches to disease prevention and management.

The chest imaging findings reported in the study provide valuable insights into the radiological manifestations of pulmonary tuberculosis (TB) and its potential diagnostic implications. The presence of a "tree-in-bud" appearance, observed in 34.7% of pulmonary TB cases, and pulmonary nodules, seen in 46.3% of cases, highlight the diverse spectrum of radiological abnormalities associated with TB infection. These findings align with established literature documenting the characteristic patterns of TB-related lung pathology, including bronchial obstruction leading to the "tree-in-bud" appearance and granulomatous inflammation resulting in pulmonary nodules.[13,14] The high prevalence of these radiological findings underscores the utility of chest imaging as a valuable diagnostic tool in identifying pulmonary TB cases, particularly in settings where microbiological confirmation may be challenging. Furthermore, the significant association observed between the presence of a "tree-in-bud" appearance on chest imaging and the diagnosis of pulmonary TB suggests a potential role for this radiological finding as a diagnostic indicator. The specificity of this finding in identifying TB cases highlights its importance in clinical practice, where chest imaging plays a crucial role in guiding diagnostic and therapeutic interventions. Incorporating the recognition of "tree-in-bud" patterns into diagnostic algorithms may aid in the early identification of pulmonary TB cases, facilitating prompt initiation of appropriate treatment and control measures.[15]

Conclusion

In conclusion, this study point out the epidemiology and characteristics of tuberculosis (TB) among suspected cases. With 41.02% testing positive for Mycobacterium tuberculosis, males were predominantly affected, and gender significantly influenced disease positivity. The mean age was 45.60 years, and hospital stays averaged 12.89 days. While various underlying diseases and lifestyle factors were present among TB patients, no specific associations with TB occurrence were found. Radiological findings, notably the "tree-in-bud" appear-ance, were significant in

diagnosing pulmonary TB. These findings underscore the complexity of TB diagnosis and highlight the need for comprehensive approaches in managing the disease. Further research is needed to understand the interplay between underlying conditions and TB susceptibility for better interventions.

References

1. Gopalaswamy R, Dusthackeer VA, Kannayan S, Subbian S. Extrapulmonary tuberculosis—an update on the diagnosis, treatment and drug resistance. J Resp. 2021;1(2):141-64.
2. Bagcchi S. WHO's global tuberculosis report 2022. Lancet Microbe. 2023;4(1):e20.
3. Azadi D, Motallebirad T, Ghaffari K, Shojaei H. Mycobacteriosis and tuberculosis: laboratory diagnosis. Open Micro J. 2018;12:41.
4. Alam M, Shahzad MI, Pervaiz S, Jamil M, Afzal MW, Mushtaq A. Comparison of Induced Sputum with Bronchoalveolar Lavage Samples for Pulmonary Tuberculosis diagnosis in sputum scarce Patients. Pak J Chest Med. 2020;26(3):140–4.
5. Malik M, Malik MI, Saulat A, Khan JK, Shahzadi N, Ashraf Z. Yield of Xpert MTB/RIF Assay in Extra Pulmonary Specimens of Patients at Tertiary Care Hospital. Pak J Chest Med. 2020;26(1):03–7.
6. Nguyen TN, Anton-Le Berre V, Bañuls AL, Nguyen TV. Molecular diagnosis of drug-resistant tuberculosis; a literature review. Front Micro. 2019;10:794.
7. Santiago-García B, Blazquez-Gamero D, Baquero-Artigao F, Ruíz-Contreras J, Bellon JM, Munoz-Fernandez MA, et al. Pediatric extrapulmonary tuberculosis: clinical spectrum, risk factors and diagnostic challenges in a low prevalence region. J Pediatr Infect Dis. 2016;35(11):1175-81.
8. Naidoo K, Dookie N. Can the GeneXpert MTB/XDR deliver on the promise of expanded, near-patient tuberculosis drug-susceptibility testing? Lancet Infect Dis. 2022;22(4):e121-7.
9. Raja SK, Ullah R, Shah SW, Ambreen S, Khan H, Habib M. Comparative Sensitivity of Smear Microscopy for AFB Versus Gene Xpert/RIF Assay on Endrobronchial Washings of the Sputum Smear Negative/Sputum Scarce Patients with Suspected Pulmonary Tuberculosis. 2020; Pak J Chest Med. 26(4);201–4.
10. Khosravi AD, Alavi SM, Hashemzade M, Abasi E, Seghatoleslami S. The relative frequency of Mycobacterium tuberculosis and Mycobacterium avium infections in HIV positive patients, Ahvaz, Iran. Asian Pac J Trop Med. 2012;5(1):71–74. DOI: 10.1016/S1995-7645(11)60249-6.
11. Seyoum B, Demissie M, Worku A, Bekele S, Aseffa A. Prevalence and Drug Resistance Patterns of Mycobacterium tuberculosis among New Smear Positive Pulmonary Tuberculosis Patients in Eastern Ethiopia. Tuberc Res Treat. 2014:753492. DOI: 10.1155/2014/753492.
12. Burusie A, Enquesilassie F, Addissie A, Dessalegn B, Lamaro T. Effect of smoking on tuberculosis treatment outcomes: A systematic review and meta-analysis. PLoS One. 2020;15(9):e0239333.
13. Tran J, Green O, Modahl L. Chest Manifestations of Mycobacterium Tuberculosis Complex-Clinical and Imaging Features. In Seminars in Roentgenology. 2022;57(1):67-74. WB Saunders.
14. Helke KL, Mankowski JL, Manabe YC. Animal models of cavitation in pulmonary tuberculosis. Tuberculosis. 2006;86(5):337-48.
15. Rana P, Bhatia A, Saxena AK, Sodhi KS. Imaging of Tuberculosis in Children. Contemp Diagn Radiol. 2021;44(21):1-7.