

Original Article

Detection of Mycobacterium Tuberculosis in Extrapulmonary Specimens and Drug Sensitivity Pattern in a Tertiary Level Chest Disease Hospital of Bangladesh

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Abstract

Background: Extra-pulmonary tuberculosis (EPTB) is a growing public health concern, and data on drug resistance in EPTB are limited.

Objective: To detect Mycobacterium Tuberculosis in extrapulmonary specimens and to find out identity the pattern of drug sensitivity among extrapulmonary specimens

Methods: This cross-sectional study was conducted at the NTRL (National Tuberculosis Reference Laboratory) of the National Institute of Diseases of Chest and Hospital (NIDCH), Bangladesh, from January 2024 to December 2024. This study included 100 patients suspected of suffering from extrapulmonary Mycobacterium Tuberculosis infection. Clinical specimens were obtained from these extrapulmonary sites and were subjected to the GeneXpert test to detect the presence of Mycobacterium TB. Drug sensitivity patterns were tested in the samples that yielded positive results.

Results: The Mean age of the patients was 39.25 ± 17.99 years. Most of the patients were 21 – 40 years old. The majority of the patients were male (64.0%). The male-to-female ratio was 1.78:1. The most common extrapulmonary sample tested was pleural fluid. Mycobacterium Tuberculosis was detected in 28.0% of the samples. Extrapulmonary Mycobacterium tuberculosis was predominant among the younger patients. The mean age of patients with EPTB was significantly lower than that of patients without EPTB (29.53 ± 16.27 vs 43.08 ± 17.27 ; $p \leq 0.001$). Sensitivity to first and second-line anti-tubercular drugs was evaluated in the extrapulmonary specimens that tested positive. Both first-line anti-tubercular drugs (Isoniazid) and second-line anti-tubercular drugs (Aminoglycosides, Kanamycin, fluoroquinolones, and Ethionamide) were found to be sensitive in 85.7% of cases and resistant in 14.3% of cases respectively.

Conclusion: EPTB remains a significant health problem, particularly affecting male and young men with a substantial proportion demonstrating drug resistance.

Keywords: Extrapulmonary Tuberculosis, drug sensitivity pattern, Bangladesh.

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Introduction:

Tuberculosis (TB), caused by Mycobacterium tuberculosis, is still a primary global health concern, despite breakthroughs in detection and treatment. Every year, over 10 million new cases of tuberculosis are detected, resulting in over a million fatalities.¹ The term “extrapulmonary tuberculosis” (EPTB) refers to tuberculosis that affects organs other than the lungs.²

While pulmonary tuberculosis remains the most common form, EPTB is increasing globally due to the dissemination of Mycobacterium tuberculosis.^{3,4} EPTB constitutes 15-20% of all TB cases, reaching up to 50% in HIV-positive individuals.⁵ Accurate diagnosis and appropriate treatment

are essential for effective patient management and transmission prevention.^{2,6}

Drug-resistant TB is a global concern. However, the overall prevalence of TB has been steadily decreasing since 2004, due to World Health Organization (WHO) initiatives under the End TB strategy.⁷ Despite worldwide efforts, there is no strategy evidence that the prevalence of multidrug-resistant (MDR) tuberculosis is decreasing.⁸

Because of nonspecific clinical presentation, paucibacillary clinical specimens, and a lack of appropriate diagnostic equipment, extrapulmonary tuberculosis poses a challenge to clinicians. One of the causes of poor response in extrapulmonary tuberculosis is resistance.⁹⁻¹²

Despite regional differences, a few studies have revealed that drug-resistant tuberculosis is less common in EPTB in comparison to pulmonary tuberculosis (PTB).^{13,14} However, there is limited information available about the current state of anti-TB drug resistance in Bangladesh in EPTB.

This study aimed to find out mycobacterium tuberculosis in extrapulmonary specimen and drug sensitivity patterns in a tertiary level chest disease hospital of Bangladesh effectiveness in diagnosing EPTB, focusing on the susceptibility patterns of Mycobacterium tuberculosis isolated from EPTB specimens.

Methodology:

This laboratory-based cross-sectional study was conducted at the NTRL, located in NIDCH, Mohakhali, Dhaka, Bangladesh, a tertiary-level chest disease hospital equipped with microbiological analysis facilities for extrapulmonary samples. A total of 100 patients' extrapulmonary samples from January to December of 2024 were analyzed, who were suspected of suffering from EPTB. All samples were collected aseptically. Patients should be 18 on above and genders were included. The samples were decontaminated using the N-acetyl-L-cysteine-sodium hydroxide (NALC-NaOH) procedure and then centrifuged at $3,000 \times g$ for 15 minutes. Samples were subjected to nucleic acid amplification tests (NAATs), specifically the GeneXpert MTB/RIF assay, to detect Mycobacterium tuberculosis complex DNA. Drug susceptibility testing (DST) was performed on culture-positive isolates using the percentage method on LJ medium or an automated MGIT 960 system. First-line (isoniazid) and second-line (aminoglycosides, kanamycin, fluoroquinolones, and ethionamide) antitubercular drug sensitivity were assessed.

All test results were documented in a standardized manner. Descriptive statistics were utilized to assess the proportion of EPTB detection and drug resistance patterns. Statistical analysis was performed using SPSS version 25. Name of the IRB committee approved the study protocol.

Results:

A total of 100 patients' test results for extrapulmonary samples, along with their demographics, were analyzed.

Table 1. Demographic profile of the study subjects (N=100)

| | Frequency (n) | Percentage (%) |
|-------------|---------------|----------------|
| Age (years) | | |
| ≤20 | 12 | 12.0 |
| 21 - 30 | 23 | 23.0 |
| 31 - 40 | 25 | 25.0 |
| 41 - 50 | 17 | 17.0 |
| >50 | 23 | 23.0 |
| Mean ± SD | 39.25 ± 17.99 | |
| Gender | | |
| Male | 64 | 64.0 |
| Female | 36 | 36.0 |

The mean age of the study subjects was 39.25 ± 17.99 years. Most of the patients were 21 – 40 years old. The majority of the patients were male (64.0%). The male-to-female ratio was 1.78:1

Table 2: Types of Extrapulmonary samples tested (N=100)

| Type of sample tested | No of samples tested | Positive test(n %) |
|-----------------------|----------------------|--------------------|
| Pleural fluid | 41 | 7 (17.1) |
| Pus | 12 | 5 (41.7) |
| Lymph node | 21 | 13 (61.9) |
| Wound swab | 2 | 1 (50.0) |
| Gastric lavage | 2 | Not detected |
| CSF | 2 | Not detected |
| Urine | 4 | Not detected |
| Other Tissue | 7 | 1 (14.3) |
| Tissue from the | 1 | Not detected |
| Lumber vertebra | | |
| Ulcer materials | 3 | Not detected |
| Wound discharge | 1 | Not detected |
| Supraclavicular | 1 | 1 (100.0) |
| lymph node | | |
| Ascitic fluid | 3 | Not detected |

The most common extrapulmonary sample tested was pleural fluid (41 samples) with a positive MTB detection rate of 17%. The second most common sample tested was the lymph node (21) via fine-needle aspiration biopsy (FNAB/FNA). It yielded positive results of MTB detection in 13 cases (61%). Pus was the third most common sample (12) with a positive result in 5 cases (41%).

Table 3: Detection of Mycobacterium Tuberculosis in Extrapulmonary specimens (N=100) Association of mean age with detection of mycobacterium tuberculosis in EPTB specimen.

| | Frequency (%) | Mean age \pm SD | p-value |
|------------------|---------------|-------------------|---------|
| MTB Detected | 28 (28.0%) | 29.53 \pm 16.27 | 0.001 |
| MTB not detected | 72 (72.0%) | 43.08 \pm 17.27 | |

Frequency of extrapulmonary Mycobacterium Tuberculosis was 28.0% among the tested samples.

The majority of patients (23.23%) with positive test results belonged to 21-30 year. The mean age of the detected patients was significantly lower than that of the tested negative samples (29.53 \pm 16.27 vs 43.08 \pm 17.27; $p = 0.001$). These was significant difference in mean age between patient detected with MTB patients not detected with MTP (29.53 \pm 16.27 vs 43.08 \pm 17.27; $p = 0.001$).

Table 4: Drug sensitivity pattern among positive Extrapulmonary specimens (N=28) (multiple responses)

| | Sensitive n(%) | Resistant n(%) |
|------------------------|-------------------|-------------------|
| Isoniazid (INH) | 24 (85.7) | 4 (14.3) |
| Fluoroquinolones (FLO) | 24 (85.7) | 4 (14.3) |
| Aminoglycosides (Amin) | 24 (85.7) | 4 (14.3) |
| Kanamycin (Kan) | 24 (85.7) | 4 (14.3) |
| Capreomycin (CAP) | 24 (85.7) | 4 (14.3) |
| Ethionamide (ETHIO) | 24 (85.7) | 4 (14.3) |

Sensitivity to both first-line and second-line anti-tubercular drugs was assessed in extrapulmonary specimens. First-line anti-tubercular drugs (Isoniazid) were found to be sensitive in 85.7% of cases and resistant in 14.3% of cases. Second-line anti-tubercular drugs (Aminoglycosides, Kanamycin, Capreomycin, Fluoroquinolones, and Ethionamide) were found to be sensitive in 85.7% of cases and resistant in 14.3% of cases respectively.

Discussion:

Extrapulmonary tuberculosis poses a diagnostic challenge to clinicians. Our study found that the mean age of patients was 39.25 \pm 17.99 years, with the majority consisted of the 21–40-year age group (Table I). This aligns with global trends, where EPTB is more common in young and middle-aged adults.¹³ A significant observation was the male preponderance (64%), with a male-to-female ratio of 1.78:1

(Table I), consistent with earlier studies demonstrating increased TB susceptibility in males due to biological, occupational, and healthcare-seeking behavioral factors.¹⁵

100 extrapulmonary samples were tested; however, the most common extrapulmonary sample was pleural fluid (41 samples), with a positive MTB detection rate of 17%. The second most common sample tested was the lymph node (21) (FNAB/FNA). It yielded positive results of MTB detection in 13 cases (61%). Pus was the third most common sample (12) with a positive outcome in 5 cases (41%) (Table 3). A previous study by Mostofa Kamal et al¹⁶ in Bangladesh reported that pleural fluid MTB detection was 10% where pleural fluid was the predominant sample, where they used AFB microscopy. Our case detection rate is higher (17% vs 10%).¹⁶ The possible explanation is that in our study, we used GeneXpert, which is a molecular study and more sensitive.

The overall detection rate for EPTB is 28%, demonstrating that, while pulmonary TB remains the most common form, EPTB is a considerable burden, particularly in high-TB-burden areas.¹⁷ In the study by Prima et al.¹⁸, GeneXpert detected 22.03% of positive samples for Mycobacterium tuberculosis in extrapulmonary samples. Baghbanbashi et al.¹⁹ detected 14.0% Tb in EPTB samples.

Our study found that younger individuals are more frequently affected by EPTB, with a mean age of 29.53 \pm 16.27 years. It is considerably lower in comparison to non-detected cases (43.08 \pm 17.27 years; $p \leq 0.001$). This suggests that younger individuals may have a higher risk of developing EPTB, presumably due to stronger immune responses, which result in localized (extrapulmonary) manifestations rather than pulmonary disease.²⁰

The study evaluated both first-line and second-line anti-tubercular drugs in EPTB specimens, yielding crucial findings: Isoniazid (first-line drug) showed 85.7% sensitivity and 14.3% resistance. This suggests that first-line medicines are still effective in treating the majority of EPTB infections.²¹ However, the 14.3% resistance rate raises new concerns about drug-resistant EPTB, calling for routine drug susceptibility testing (DST) in high-risk populations.²² Kandhakumari and Stephen discovered isoniazid resistance in 5.6% of EPTB patients.²³ Resistance to isoniazid was found to be higher in another Indian study (31%).⁹

Aminoglycosides, including Kanamycin and Capreomycin, as well as Fluoroquinolones and Ethionamide (second-line medications), all showed 85.7% sensitivity and 14.3% resistance. The same resistance rates between first- and second-line medications indicate that there is no major cross-

resistance in this cohort, which is beneficial for treatment regimens.²⁴ Resistance to ethionamide was found to be high (38%).⁹ Kanamycin was resistant in 13.12% cases.²⁵

However, the presence of resistance to second-line drugs underscores the need for expanded DST and individualized therapy in EPTB management²⁶

Recommendation

Because EPTB is more common in younger people, improved diagnostic techniques (such as GeneXpert and liquid culture) should be prioritized in this population group. Routine DST should be used to detect resistance early and avoid treatment failure. The increased frequency in males suggests the need for targeted awareness initiatives and improved healthcare access for men in high-burden environments.

Conclusion

This study found that EPTB constitutes a considerable health issue, especially among younger individuals and males, with a notable percentage exhibiting resistance to essential anti-tuberculosis medications.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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