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Original Article

Assessing the Prevalence of Extrapulmonary TB in Pulmonary TB with Demographic and Clinical Profile Across Different Populations

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ABSTRACT

Introduction: *Tuberculosis (TB) remains a significant global health threat, with pulmonary TB being the most common form.* ***Objective:*** *The study aims to determine the prevalence of EPTB in individuals diagnosed with pulmonary TB (PTB) across various populations.* ***Methods & Materials:*** *A retrospective analysis was conducted at a hospital's Department of Medicine (from January 2022 to December 2024). 200 participants were recruited, with confirmed pulmonary TB diagnoses based on positive sputum tests, cultures, or Gene Xpert. Individuals suspected of but not confirmed to have pulmonary TB, those lacking complete EPTB data, or those with missing demographic information were excluded.* ***Results:*** *This study compared characteristics of two groups diagnosed with TB. Significant differences were found in age distribution (p=0.0321), history of TB contact (p=0.0017), and white blood cell count (p=0.0059), suggesting distinct profiles between the groups. No significant variations were observed in gender (p=1.000), socioeconomic status*

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(p=0.7367), type of TB (p=0.5103), or hemoglobin level (p=0.3853). Gene Xpert and chest X-rays were the primary diagnostic tools for both groups, though their distribution differed significantly (p=0.016). Chest X-ray findings (cavitation, consolidation, fibrosis) did not show significant variations. However, lymphocyte count differed significantly (p=0.0379) between the groups. Treatment outcomes also differed significantly (p=0.0332), with Group B having a higher rate of treatment failure and loss to follow-up. Further research is needed to explore these factors. ***Conclusion:*** *This study identified significant differences in age, prior TB exposure, and white blood cell count between patient groups. Gender, socioeconomic background, TB type, and hemoglobin levels did not differ statistically.*

Keywords: *Pulmonary TB, Extrapulmonary TB, ZN Staining, Culture, Gene Xpert, Lymphocyte*

INTRODUCTION

Tuberculosis (TB) is a bacterial infection that primarily affects the lungs, posing a significant global public health threat. In addition to its impact on the lungs, TB can also have effects on other areas of the body, resulting in what is known as extrapulmonary TB (EPTB). It is important to consider the prevalence of extrapulmonary tuberculosis (EPTB) in pulmonary TB cases in different populations to develop effective control strategies. Tuberculosis continues to be a significant global health issue, resulting in illness and death on a global scale. It is estimated that approximately one-third of the global population is latently infected with Mycobacterium tuberculosis[1].

TB commonly impacts the lungs (pulmonary TB, PTB) but can also affect various other areas (extrapulmonary TB, EPTB), including the pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges, and more[2–5]. TB is a disease that affects multiple systems and can present in various ways. In clinical practice, a patient can have both PTB and EPTB[6,7].

It is a challenging task to treat pulmonary tuberculosis (PTB) concurrently with extrapulmonary tuberculosis (EPTB), and the treatment strategy for some PTB concomitant with EPTB may differ from that of single PTB or EPTB[8]. The percentage of individuals who have extra-pulmonary tuberculosis (EPTB) in comparison to those who have pulmonary tuberculosis (PTB) varies and is dependent on the related diseases, ethnicity, and countries[9,10].

As an illustration, the prevalence of EPTB is higher in HIV-positive individuals compared to those who are not HIV-positive[11,12]. In cases of pulmonary tuberculosis, extrapulmonary tuberculosis (EPTB) is significant because it poses diagnostic issues (vague symptoms that mirror other diseases), therapeutic considerations (possibly different regimens), and public health implications (precise prevalence statistics for improved interventions and resource allocation).

OBJECTIVE

The objective of this study is to assess the occurrence of Extrapulmonary tuberculosis (EPTB) in individuals diagnosed with pulmonary tuberculosis (PTB) across various populations.

MATERIALS AND METHODOLOGY

Between January 2022 and December 2023, a retrospective observational study was carried out in the Department of Medicine at a hospital affiliated with a tertiary medical college. Within this period 200 patients were admitted in the medicine ward. A purposive sampling method was used during the study. For inclusion, a verified diagnosis of pulmonary tuberculosis was necessary, which could be achieved by known procedures such as positive sputum smear microscopy, culture, or Gene Xpert diagnostics. On the other hand, persons who were suspected of having pulmonary tuberculosis but there was no confirmation of the diagnosis, individuals who lacked comprehensive EPTB data, and those who lacked demographic information were excluded from the study.

Data collection and data analysis:

The checklist is comprised of four separate elements. The initial section covered demographic information, including age, gender, socio-economic status, and history of contact with tuberculosis. The second section of the report discusses the various types of tuberculosis and the distribution of extrapulmonary involvement sites in patients with pulmonary tuberculosis. The third part of the discussion examines the diagnostic tools utilized for PTB, the investigation profile of our study cases, and the hematological profile of our study cases. The fourth section of our study delves into the treatment outcomes of our cases. The data was entered into SPSS 23. The significance criterion was set at a level of 0.05.

RESULTS

In group A, most 21 cases (40.38%) were in between 25-29 years, 11 cases (21.15%) were in between 30-34 years, and another 11 cases were in between 40-44 years. Only 9 cases (17.31%) cases were in between 35-39 years. In group B, most 60 cases (40.54%) were in between 25-29 years, 11 cases (21.15%) were in between 30-34 years, and another 11 cases were in between 40-44 years. Only 9 cases (17.31%) were between 35-39 years. the p-value is 0.0321. So, there is a statistically significant difference in the distribution of age groups between Group A and Group B. The mean age was 30 ± 2.08 years, and in group B, the mean age was 38 ± 4.72 years. In group A, 38 cases(73.08%) were male and only 14 (26.92%) were female. In group B, 97 cases (65.54%) were male and the rest 36 cases(24.32%) were female. The p-value is 1.000. so there is no statistically significant difference between the observed number of males and females in group A and group B.

The majority of cases in group A (55.77%) were from a low socio-economic background, while 40.38% were from the middle class. The remaining 3.85% came from a high socio-economic status. The majority of cases in group B (52.70%) were classified as low socio-economic status,

while 40.54% were classified as middle class. The remaining 6.76% were classified as high socio-economic status. The p-value obtained is 0.7367, indicating that there is insufficient evidence to support the claim that the distribution of socioeconomic status differs significantly between the two groups (**Table I**).

Table – I: Basic Socio-Demographic Profile of Our Study Cases

Socio-demographic profile	With concurrent PTB and EPTB (n=52)	Without concurrent PTB and EPTB (148)	*p*-value
25-29	21(40.38)	60 (40.54)	0.0321
30-34	11(21.15)	41 (27.70)	
35-39	9(17.31)	29 (19.59)	
40-44	11(21.15)	18 (12.17)	
Mean Age(years)	30 ± 2.08	38 ± 4.72	
Gender			
Male	38(73.08)	97(65.54)	1.000
Female	14(26.92)	36(24.32)	
Socio-economic Status			
Low	29(55.77)	78(52.70)	0.7367
Middle	21(40.38)	60(40.54)	
High	2(3.85)	10(6.76)	

Among the individuals in group A, 35 cases tested negative for TB contact, while 17 cases tested positive for TB contact. Among the individuals in group B, 130 cases did not have any contact with tuberculosis, while 18 cases did have a positive history of tuberculosis contact. The obtained p-value of 0.0017 indicates a statistically significant difference in the history of TB contact between the two groups (**Table II**).

Table II: History of TB Contact in Our Study Cases

History of TB Contact	With Concurrent PTB and EPTB (n=52)	Without Concurrent PTB and EPTB (148)	*p*-value
No	35(67.31)	138 (93.24)	0.0017
Yes	17(32.69)	17 (6.76)	

Within group A, the majority of cases (92.31%) were classified as new cases, while a small percentage (7.69%) were relapse cases. Notably, there were no instances of return after loss to follow-up. Group B had a total of 129 new cases

(87.16%), 17 relapse cases (11.49%), and 2 cases (1.35%) marked as return after loss to follow-up. The p-value obtained from our analysis is 0.5103, indicating that there is no statistically significant difference in the types of tuberculosis observed in our study cases (**Table III**).

Table – III: Types of TB in Our Study Cases

Types of TB	With Concurrent PTB and EPTB (*n*=52)	Without Concurrent PTB and EPTB (148)	*p*-value
New case	48(92.31)	129 (87.16)	0.5103
Relapse	4(7.69)	17 (11.49)	
Return after loss to follow-up	-	2 (1.35)	

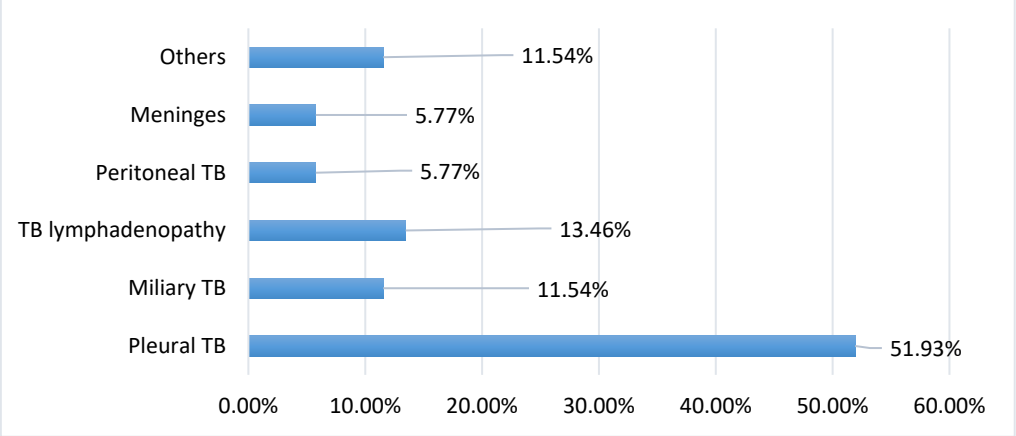

Figure – 1: Distribution of Extrapulmonary Involvement Sites in Patients With Pulmonary Tuberculosis

Figure 1 shows that the majority of cases (51.93%) had pleural TB, followed by 13.46% with lymphadenopathy, and 11.54% with Miliary TB. Three cases (5.77%) exhibited involvement of both meningeal and peritoneal Tb. Out of the total cases, 6 (11.54%) presented with various types of TB.

The majority of cases in group A (48.07%, 25 cases) were diagnosed using both Gene xpert and Chest X-ray. Additionally, 5 cases (9.62%) tested positive for Sputum for Gene xpert, 5 cases (9.62%) tested positive for ZN staining, and 17 cases (32.69%) underwent other diagnostic tests. The majority of cases in group B (46.62%, 69 cases) were diagnosed using both Gene xpert and Chest X-ray. Sputum testing for Gene xpert yielded positive results in 40 cases (27.03%), while ZN staining was positive in 15 cases (10.13%). Additionally, 24 cases (16.22%) underwent other diagnostic tests. The p-value is 0.016. There is a notable disparity in the distribution of diagnostic tests between groups A and B, which holds statistical significance (**Table IV**).

Table IV: Tools Used in The Diagnosis of PTB

Tools used in the Diagnosis of PTB	With concurrent PTB and EPTB (*n*=52)	Without concurrent PTB and EPTB (148)	*p*-value
ZN staining	5(9.62)	15(10.13)	0.016
Gene xpert	5(9.62)	40(27.03)	
Both xpert and X-Ray	25(48.07)	69(46.62)	
Others	17(32.69)	24(16.22)	

The table provides an overview of the findings observed in the chest X-ray. The majority of cases in group A did not exhibit cavitation (88.46%, 50 cases), while a small percentage did (11.54%, 2 cases). In group B, cavitation was not observed in the majority of cases (91.22%, or 135 cases), while only a small number of cases (8.78%, or 13 cases) showed evidence of cavitation. The calculated p-value of 0.3915 indicates that there is no statistically significant difference in cavitation. Consolidation was not observed in the majority of cases in group A (69.23%, 36 cases), while it was present in 16 cases (30.77%). Consolidation was not observed in the majority of cases in group B, with only a small percentage showing evidence of it. The p-value of 0.5960 indicates that there is no statistically significant difference in consolidation.

The majority of cases in group A did not exhibit fibrosis (82.69%, 43 cases), while a smaller number of cases (17.31%) showed the presence of fibrosis (9 cases). Fibrosis was not observed in 112 cases (75.68%) of group B, while it was present in 36 cases (24.32%). The p-value of 0.3957 indicates that there is no statistically significant difference in fibrosis (**Table V**).

Table – V: Investigation Profile in Our Study Cases

Investigation Profile	With concurrent PTB and EPTB (*n*=52)	Without concurrent PTB and EPTB (148)	*p*-value
Chest x-ray P/A view			
Cavitation Present	2(11.54)	13(8.78)	0.3915
Cavitation Absent	50 (88.46)	135(91.22)	
Consolidation			
Present	16(30.77)	38(25.68)	0.5960
Absent	36(69.23)	110(74.32)	
Fibrosis			
Present	9(17.31)	36 (24.32)	0.3957
Absent	43(82.69)	112 (75.68)	

The hematological profiles are listed in Table 6. Within group A, 31 cases exhibited a hemoglobin level exceeding 10g/dl, while 21 displayed a below 10g/dl. Group B had 100 cases with a hemoglobin level above 10g/dl, while 48 cases had a hemoglobin level below 10g/dl. The p-value is 0.3853, so there is no statistically significant difference in hemoglobin level. Most cases in group A had a WBC count greater than 4000/mm3, while a smaller number had a WBC count less than 4000/mm3. Within group B, the majority of the 135 cases exhibited a WBC count exceeding 4000/mm3, while a smaller subset of 13 cases had a WBC count below 4000/mm3. The p-value is 0.0059, so there is a statistically significant difference in WBC level. Within group A, there were 30 cases with a lymphocyte count exceeding 1500/mm3, while 22 cases had a lymphocyte count below 1500/mm3.

Group B had 110 cases with a lymphocyte count greater than 1500/mm3, while 38 cases had a lymphocyte count lower than 1500/mm3. The p-value is 0.0379, so there is a statistically significant difference in lymphocyte count (**Table VI**).

Table – VI: Hematological Profile in Our Study Cases

Hematological Profile	With Concurrent PTB and EPTB (n=52)	Without Concurrent PTB and EPTB (148)	*p*-value
Hemoglobin Level			
<10 g/dl	21	48	0.3853
>10g/dl	31	100	
WBC count			
<4000/mm3	13(25)	13(8.78)	0.0059
>4000/mm3	39(75)	135(91.22)	
Lymphocyte count			
<1500/mm3	22(42.31)	44(29.73)	0.0379
>1500/mm3	30(57.69)	104(70.27)	

The results for group A are presented in Table VII. A total of 36 cases were successfully treated, while 4 cases unfortunately did not respond to treatment. Additionally, 7 cases were lost during the follow-up process, and 5 cases unfortunately resulted in fatalities. Group B had 108 cases that were cured, 20 cases that experienced treatment failure, 18 cases that were lost to follow-up, and 2 cases that unfortunately resulted in death. The p-value of 0.0332 suggests statistical significance (**Table VII**).

Table VII: Treatment outcome in our study cases

Treatment outcome	With Concurrent PTB and EPTB (*n*=52)	Without Concurrent PTB and EPTB (148)	*p*-value
Cured	36 (69.23)	108 (72.98)	0.0332
Treatment failure	4 (7.69)	20 (13.51)	
Lost to follow-up	7 (13.46)	18 (12.16)	
Died	5 (9.62)	2 (1.35)	

DISCUSSION

The majority of cases in group A were found to be in the age range of 25-29 years, accounting for 40.38% of the total. Additionally, 21.15% of cases fell within the 30-34years age range, with another 11 cases falling within the 40-44 years range. A total of 9 cases, accounting for 17.31% of the total, fell within the age range of 35-39 years. Within group B, the majority of cases (40.54%) fell within the age range of 25-29 years. Additionally, 21.15% of cases were found in the age range of 30-34 years, with another 11 cases falling within the 40-44 years range. A total of 9 cases, accounting for 17.31% of the total, fell within the age range of 35-39 years. The p-value is 0.0321. Based on the data, there is a notable disparity in the age distribution between Group A and Group B. In group A, the average age was 30 ± 2.08 years, while in group B, the average age was 38 ± 4.72 years. Among the individuals in group A, the majority (73.08%) were male, while a smaller proportion (26.92%) were female. Among the cases in group B, the majority (65.54%) were male, while the remaining cases (24.32%) were female. The *p*-value is equal to 1.000. There is no statistically significant difference in the observed number of males and females between group A and group B. A significant proportion of cases in group A (55.77%) were attributed to individuals from a low socio-economic background, with 40.38% originating from the middle class. Only 3.85% of the remaining population belonged to a high socio-economic status. A significant portion of cases in group B (52.70%) fell under the low socio-economic status category, with 40.54% classified as middle class. Only 6.76% of the remaining individuals were categorized as having a high socio-economic status. The obtained p-value of 0.7367 suggests that there is not enough evidence to support the assertion that there is a significant difference in the distribution of socioeconomic status between the two groups. The socio-demographic values align with a comparable study[13].

Out of the individuals in group A, 35 cases were found to have no TB contact, while 17 cases were found to have tested positive for TB contact. Out of the individuals in group B, 130 cases had no contact with tuberculosis, while 18 cases had a positive history of tuberculosis contact. The p-value of 0.0017 suggests a significant difference in the history of TB

contact between the two groups. The history of Tb contact bears a resemblance to another study[14].

The majority of cases in group A were classified as new cases, with a small percentage being relapse cases. It is worth mentioning that there were no cases of participants failing to follow up after experiencing a loss. Group B experienced a significant number of new cases, with 129 individuals (87.16%) being affected. Additionally, there were 17 cases (11.49%) of relapse, and 2 cases (1.35%) were classified as return after loss to follow-up. The analysis yielded a p-value of 0.5103, suggesting that there is no significant difference in the types of tuberculosis observed among the study cases. The findings of our study indicate that pleural TB was the most common type of cases observed, accounting for 51.93% of the total. This was followed by cases of lymphadenopathy, which accounted for 13.46%, and cases of Miliary TB, which accounted for 11.54%. Three cases (5.77%) showed the presence of both meningeal and peritoneal tuberculosis. Of all the cases, 6 (11.54%) exhibited different forms of TB. The distribution of Tb was found to be similar to that of a separate study[15].

Almost half of the cases in group A (48.07%, 25 cases) were diagnosed using both Gene xpert and Chest X-ray. In addition, 5 cases (9.62%) yielded positive results for Sputum for Gene xpert, while another 5 cases (9.62%) tested positive for ZN staining. Furthermore, 17 cases (32.69%) underwent alternative diagnostic tests. Both Gene xpert and Chest X-rays were used to diagnose the majority of cases in group B (46.62%, 69 cases). Positive results were obtained in 40 cases (27.03%) through Sputum testing for Gene xpert, while ZN staining yielded positive results in 15 cases (10.13%). In addition, 24 cases (16.22%) also underwent additional diagnostic tests. The obtained p-value is 0.016, indicating statistical significance. There is a significant difference in the distribution of diagnostic tests between groups A and B, which is statistically significant. The diagnostic investigation yielded results that were consistent with those of a separate study[16].

Our study presents a comprehensive summary of the observations made in the chest X-ray. Most cases in group A did not show cavitation, with 88.46% (50 cases) not exhibiting this condition. However, a small percentage of cases, 11.54% (2 cases), did show cavitation. The majority of cases in group B did not exhibit cavitation (91.22%, or 135 cases), with only a small number of cases (8.78%, or 13 cases) showing evidence of cavitation. The *p*-value of 0.3915 suggests that there is no significant difference in cavitation. The majority of cases in group A (69.23%, 36 cases) did not show consolidation, whereas it was observed in 16 cases (30.77%). The majority of cases in group B did not exhibit consolidation, with only a small percentage providing evidence of it. The *p*-value of 0.5960 suggests that there is no significant difference in consolidation from a statistical standpoint.

A significant proportion of cases in group A did not display fibrosis, with 82.69%

(43 cases) falling into this category. Conversely, a smaller subset of cases (17.31%, 9 cases) exhibited fibrosis. In group B, fibrosis was absent in 112 cases (75.68%), while it was present in 36 cases (24.32%). The p-value of 0.3957 suggests that there is no significant difference in fibrosis from a statistical standpoint. The chest x-ray findings aligned with the results of a separate study[16].

In group A, 31 cases had a hemoglobin level above 10g/dl, while 21 cases had a hemoglobin level below 10g/dl. Group B consisted of 100 cases with a hemoglobin level above 10g/dl, while 48 cases had a hemoglobin level below 10g/dl. The obtained p-value of 0.3853 indicates that there is no statistically significant difference in the hemoglobin level. Most cases in group A exhibited a WBC count exceeding 4000/mm3, with a smaller subset showing a count below 4000/mm3. In group B, most of the 135 cases showed a white blood cell (WBC) count higher than 4000/mm3, whereas a smaller group of 13 cases had a WBC count below 4000/mm3. Based on the p-value of 0.0059, it can be concluded that there is a significant difference in the white blood cell (WBC) level. In group A, 30 cases had a lymphocyte count above 1500/mm3, while 22 cases had a lymphocyte count below 1500/mm3. Group B had a total of 110 cases with a lymphocyte count exceeding 1500/mm3, whereas 38 cases exhibited a lymphocyte count below 1500/mm3. Based on the obtained p-value of 0.0379, it can be concluded that there exists a statistically significant difference in the lymphocyte count. The hematological profile observed in this study is consistent with the results of a previous study conducted in a similar study[17].

Out of the total number of cases, 36 were effectively treated, while 4 cases did not show any response to the treatment. In addition, there were 7 cases lost during the follow-up process, and 5 cases unfortunately resulted in fatalities. Group B had a total of 108 cases that achieved successful treatment outcomes, while 20 cases experienced treatment failure. Additionally, 18 cases were lost to follow-up, and unfortunately, 2 cases resulted in mortality. The obtained p-value of 0.0332 indicates a statistically significant finding. The treatment outcome was found to be comparable to that of another study[16].

Conclusion

Our analysis revealed significant variations in age distribution, prior exposure to TB (TB contact history), and white blood cell count between the groups. Notably, there were no statistically significant differences observed in gender, socioeconomic background, type of TB, or hemoglobin level. Interestingly, while both groups primarily utilized Gene Xpert and chest X-ray for diagnosis, the distribution of these tests differed significantly. Furthermore, chest X-ray findings, including cavitation, consolidation, and fibrosis, showed no significant variations. However, lymphocyte count did exhibit a marked difference between the groups. Treatment outcomes also displayed a significant disparity, with Group B experiencing a higher rate of treatment failure and loss to follow-up.

These findings highlight the need for further investigation into the factors contributing to these discrepancies.

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