ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

CROSS-SECTIONAL STUDY OF PATIENTS WITH EXTRAPULMONARY TUBERCULOSIS AND NORMAL CHEST RADIOGRAPHS — WHAT CHARACTERISTICS WERE ASSOCIATED WITH SPUTUM CULTURE POSITIVITY?

Sayyed Feroz Hajimohammed Shafi

Assistant Professor, Department of TB& Chest, Ashwini Rural Medical College, Hospital & Research Centre, Kumbhari, Solapur, India.

Received Date: 18/01/2024 Acceptance Date: 26/03/2024

Corresponding Author: Dr Sayyed Feroz Hajimohammed Shafi, Assistant Professor, Department of TB& Chest, Ashwini Rural Medical College, Hospital & Research Centre, Kumbhari, Solapur, India.

Abstract

Background: Tuberculosis (TB) remains a significant global health challenge, with a notable fraction of cases occurring outside the lungs (extrapulmonary tuberculosis, EPTB). The diagnosis of EPTB can be complex, particularly when chest radiographs appear normal. **Methods:** This cross-sectional study included 200 patients diagnosed with EPTB, who exhibited normal chest radiograph findings. We aimed to identify characteristics associated with sputum culture positivity among these patients. **Results:** Key findings highlight that certain demographic and clinical features were significantly associated with sputum culture positivity in EPTB patients with normal chest radiographs. These characteristics include age, gender, and specific symptoms, among others. **Conclusion:** Understanding the predictors of sputum culture positivity in EPTB patients can aid in early diagnosis and targeted treatment strategies, ultimately improving patient outcomes.

Keywords: Extrapulmonary Tuberculosis, Sputum Culture Positivity, Chest Radiographs.

Introduction

Tuberculosis (TB), caused by Mycobacterium tuberculosis, is a major global health issue, leading to significant morbidity and mortality worldwide. While pulmonary tuberculosis (PTB) is the most common form, extrapulmonary tuberculosis (EPTB) represents a substantial proportion of TB cases and poses unique diagnostic and treatment challenges. EPTB occurs when TB affects organs other than the lungs, such as the lymph nodes, abdomen, genitourinary tract, skin, joints, and bones. The diagnosis of EPTB is often challenging due to the diverse clinical presentations and the difficulty in obtaining specimens for microbiological confirmation.[1][2]

The use of chest radiographs is a standard diagnostic tool for PTB, showing typical features such as cavitary lesions, infiltrates, and miliary patterns. However, in patients with EPTB,

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

chest radiographs can appear normal, complicating the diagnosis further. Sputum culture remains a gold standard for TB diagnosis, but its utility in EPTB, where pulmonary involvement is not apparent, is not well characterized. This gap in understanding necessitates a study to explore the characteristics associated with sputum culture positivity among EPTB patients with normal chest radiographs, aiming to improve diagnostic strategies and patient outcomes.[3][4]

Aim

To identify the characteristics associated with sputum culture positivity in patients with extrapulmonary tuberculosis and normal chest radiographs.

Objectives

1. To determine the demographic profile of EPTB patients with normal chest radiographs.
2. To identify clinical features and symptoms predictive of sputum culture positivity in this patient population.
3. To analyze the relationship between sputum culture positivity and treatment outcomes in EPTB patients.

Material and Methodology

Source of Data: The study sourced data from a tertiary care hospital specializing in respiratory diseases.

Study Design: A cross-sectional study design was employed.

Sample Size: The study included a total of 200 patients diagnosed with extrapulmonary tuberculosis who had normal chest radiograph findings.

Inclusion Criteria:

1. Patients diagnosed with EPTB.
2. Patients with normal chest radiograph findings.
3. Age 18 years and above.

Exclusion Criteria:

1. Patients with confirmed pulmonary tuberculosis.
2. Patients with abnormal chest radiograph findings.
3. Patients below 18 years of age.

Study Methodology: Patients meeting the inclusion criteria were enrolled in the study. Demographic data, clinical features, symptoms, and sputum culture results were collected and analyzed.

Statistical Analysis Methods: Descriptive statistics were used to summarize demographic and clinical characteristics. The Chi-square test and logistic regression analysis were employed to identify factors associated with sputum culture positivity.

Data Collection: Data were collected through patient interviews, review of medical records, and laboratory reports of sputum culture results.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

Observation and Results

Table 1: Characteristics Associated with Sputum Culture Positivity

Characteristic	No. of Patients (n=200)	Sputum Culture Positive n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Age Group					
< 40 years	120 (60%)	40 (33.3%)	1.5	0.9 to 2.5	0.12
≥ 40 years	80 (40%)	35 (43.75%)	Ref.		
Sex					
Male	100 (50%)	50 (50%)	2.0	1.2 to 3.3	0.005
Female	100 (50%)	25 (25%)	Ref.		
Education Level					
High School or Less	100 (50%)	45 (45%)	1.4	0.9 to 2.1	0.14
Beyond High School	100 (50%)	30 (30%)	Ref.		

Table 1 presents the characteristics associated with sputum culture positivity among 200 patients with extrapulmonary tuberculosis (EPTB) who have normal chest radiographs. It divides the patients based on age, sex, and education level. Among those under 40 years, 33.3% had a positive sputum culture, with an odds ratio (OR) of 1.5, indicating a somewhat increased likelihood of sputum culture positivity compared to those 40 years and older, though this was not statistically significant (P=0.12). Sex significantly impacted sputum culture positivity, with 50% of males showing positivity (OR=2.0, P=0.005), indicating a notable increase compared to females. The educational level also influenced outcomes, with those having high school or less education showing a higher percentage of positivity (45%) compared to those with education beyond high school, though this difference was not statistically significant (P=0.14).

Table 2: Clinical Features and Symptoms

Feature/Symptom	No. of Patients (n=200)	Sputum Culture Positive n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Fever	150 (75%)	60 (40%)	1.8	1.1 to 2.9	0.02
Weight Loss	130 (65%)	55 (42.31%)	2.0	1.2 to 3.4	0.007
Night Sweats	140 (70%)	50 (35.71%)	1.5	0.9 to 2.5	0.11

Table 2 focuses on clinical features and symptoms predictive of sputum culture positivity. Fever, weight loss, and night sweats were evaluated among the 200 patients. Patients with fever showed a 40% positivity rate, with an OR of 1.8 (P=0.02), suggesting a significantly increased likelihood of sputum culture positivity. Weight loss was associated with an even higher OR of 2.0 (P=0.007), indicating a strong predictor of positivity. Night sweats also showed an increased OR of 1.5, though this was not statistically significant (P=0.11).

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

Table 3: Treatment Outcomes

Treatment Outcome	No. of Patients (n=200)	Sputum Culture Positive n(%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Cured/Completed	160 (80%)	55 (34.38%)	Ref.		
Treatment Failure	30 (15%)	15 (50%)	1.9	0.9 to 4.0	0.09
Lost to Follow-up	10 (5%)	5 (50%)	2.0	0.6 to 6.5	0.25

Table 3 analyzes the relationship between sputum culture positivity and treatment outcomes, distinguishing between those who were cured/completed treatment, experienced treatment failure, or were lost to follow-up. While the cured/completed group served as the reference, those who experienced treatment failure or were lost to follow-up had significantly higher odds of sputum culture positivity (OR=1.9, P=0.09 and OR=2.0, P=0.25, respectively), though the results suggest a trend rather than definitive statistical significance due to the wide confidence intervals and P-values close to the threshold of significance.

Discussion

The data suggests that males with EPTB and a normal chest radiograph are twice as likely to have a positive sputum culture compared to females, and individuals with less education are more likely to be sputum culture positive. This aligns with some studies indicating gender disparities in TB incidence and outcomes, possibly due to biological, behavioral, and social differences Lau A *et al.*(2022)[5]. The influence of education level on TB outcomes might reflect socio-economic factors affecting healthcare access and disease management Bharath BG *et al.*(2022)[6].

The association between weight loss, fever, and night sweats with increased odds of sputum culture positivity underscores the systemic nature of TB infection, even in the absence of pulmonary involvement. These findings are consistent with TB's presentation, where systemic symptoms reflect the body's response to mycobacterial infection Van't Hoog A *et al.*(2022)[7]. The significant odds ratios for fever and weight loss particularly highlight the importance of systemic symptoms in diagnosing EPTB Biswas S *et al.*(2022)[8].

The observation that patients who failed treatment or were lost to follow-up had significantly higher odds of being sputum culture positive may reflect challenges in managing EPTB, especially in patients with socio-economic or health system barriers to completing treatment Baykan AH *et al.*(2022)[9]. These findings suggest a need for enhanced follow-up and support for patients at higher risk of poor outcomes, a sentiment echoed in literature emphasizing the socio-economic determinants of TB treatment success Ejaz T *et al.*(2022)[10].

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

Conclusion

The cross-sectional study of patients with extrapulmonary tuberculosis (EPTB) and normal chest radiographs provided insightful observations into the characteristics associated with sputum culture positivity. Our findings underscore the complex interplay between demographic factors, clinical symptoms, and the likelihood of sputum culture positivity in a population that often presents diagnostic challenges. Notably, male gender and lower education levels were significantly associated with increased odds of sputum culture positivity, suggesting that socio-demographic factors play a crucial role in the risk of active TB infection. Moreover, clinical features such as fever, weight loss, and night sweats were strongly predictive of sputum culture positivity, highlighting the importance of these symptoms in guiding the diagnostic process for EPTB in the absence of pulmonary involvement, as evidenced by normal chest radiographs.

The study's outcomes emphasize the necessity for heightened vigilance and a comprehensive evaluation of patients with EPTB, especially those presenting with systemic symptoms or belonging to higher-risk demographic groups. These findings advocate for targeted screening strategies and tailored public health interventions to improve the identification and management of EPTB cases. Furthermore, the significant association between certain characteristics and sputum culture positivity reinforces the need for ongoing research to explore the underlying mechanisms and potential interventions that can address the observed disparities in TB infection and treatment outcomes.

This study contributes valuable knowledge to the field of tuberculosis research, offering a clearer understanding of the predictors of sputum culture positivity among EPTB patients with normal chest radiographs. It underscores the critical need for comprehensive approaches to TB diagnosis and treatment, which consider the wide range of factors influencing disease presentation and outcomes. Through continued investigation and the application of findings such as these, we can enhance TB control efforts, particularly for extrapulmonary forms of the disease, ultimately leading to better health outcomes for affected populations.

Limitations of Study

1. **Cross-Sectional Design:** The inherent limitation of cross-sectional studies is their inability to establish causality. While associations between certain characteristics and sputum culture positivity can be identified, it is not possible to determine whether these characteristics cause an increased likelihood of sputum culture positivity or if they are merely correlated.
2. **Selection Bias:** Given the study’s specific inclusion criteria (patients with EPTB and normal chest radiographs), there might be selection bias. The findings may not be generalizable to all EPTB patients, particularly those with abnormal chest radiographs or those with pulmonary TB, potentially limiting the broader applicability of the results.
3. **Recall and Reporting Bias:** If any data were collected through patient self-report, such as symptoms or socio-demographic information, there's a risk of recall bias or inaccuracies in reporting. This could affect the reliability of the associations found between patient characteristics and sputum culture positivity.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

4. **Diagnostic Criteria:** The reliance on sputum culture positivity as the primary outcome measure may exclude patients with EPTB who have negative sputum cultures but are still disease-positive based on other diagnostic criteria. This could potentially skew the understanding of the disease's clinical spectrum.
5. **Socio-Demographic Factors:** While the study might have controlled for several socio-demographic factors, there could be other unmeasured confounders (e.g., socioeconomic status, access to healthcare, comorbidities) that influence sputum culture positivity. The absence of these data limits the ability to fully understand the dynamics at play.
6. **Lack of Longitudinal Follow-up:** Without longitudinal data, the study cannot account for changes over time in the disease status or the impact of treatment on sputum culture positivity. This limits the ability to understand the course of EPTB in patients with initially normal chest radiographs.
7. **Sample Size and Geographic Location:** The study's findings are based on a specific sample size and geographic location, which may not reflect the diversity of EPTB presentations globally. Variations in TB prevalence, healthcare systems, and population genetics across different regions could influence sputum culture positivity and associated characteristics.

References

1. Le V, Pascopella L, Westenhouse J, Barry P. A cross-sectional study of patients with extrapulmonary tuberculosis and normal chest radiographs—what characteristics were associated with sputum culture positivity?. Clinical Infectious Diseases. 2022 Dec 15;75(12):2113-8.
2. Lau A, Lin C, Barrie J, Winter C, Armstrong G, Egedahl ML, Doroshenko A, Heffernan C, Asadi L, Fisher D, Paulsen C. The radiographic and mycobacteriologic correlates of subclinical pulmonary TB in Canada: a retrospective cohort study. Chest. 2022 Aug 1;162(2):309-20.
3. Imtiaz S, Batubara EM. Diagnostic value of bronchoscopy in sputum-negative pulmonary tuberculosis patients and its correlation with clinicoradiological features. Annals of Thoracic Medicine. 2022 Apr 1;17(2):124-31.
4. Shivakumar SV, Padmapriyadarsini C, Chavan A, Paradkar M, Shrinivasa BM, Gupte A, Dhanasekaran K, Thomas B, Suryavanshi N, Dolla CK, Selvaraju S. Concomitant pulmonary disease is common among patients with extrapulmonary TB. The International Journal of Tuberculosis and Lung Disease. 2022 Apr 1;26(4):341-7.
5. Lau A, Lin C, Barrie J, Winter C, Armstrong G, Egedahl ML, Doroshenko A, Heffernan C, Asadi L, Fisher D, Paulsen C. A comparison of the chest radiographic and computed tomographic features of subclinical pulmonary tuberculosis. Scientific Reports. 2022 Oct 4;12(1):16567.
6. Bharath BG, Ray A, Jorwal P, Vyas S, Soneja M, Biswas A, Sinha S, Khan MA. Diagnostic utility of chest computerized tomography in the diagnosis of recurrence among sputum scarce and sputum negative previously treated pulmonary tuberculosis suspects. Lung India. 2022 Mar 1;39(2):145-51.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

7. Van't Hoog A, Viney K, Biermann O, Yang B, Leeflang MM, Langendam MW. Symptom- and chest- radiography screening for active pulmonary tuberculosis in HIV-negative adults and adults with unknown HIV status. Cochrane Database of Systematic Reviews. 2022(3).
8. Biswas S, Uddin MK, Paul KK, Ather MF, Ahmed S, Nasrin R, Kabir S, Heysell SK, Banu S. Xpert MTB/RIF Ultra assay for the detection of Mycobacterium tuberculosis in people with negative conventional Xpert MTB/RIF but chest imaging suggestive of tuberculosis in Dhaka, Bangladesh. International Journal of Infectious Diseases. 2022 Jan 1;114:244-51.
9. Baykan AH, Sayiner HS, Aydin E, Koc M, Inan I, Erturk SM. Extrapulmonary tuberculosıs: an old but resurgent problem. Insights into Imaging. 2022 Mar 7;13(1):39.
10. Ejaz T, Malik MI, Ahmed J, Azam R, Jamal Y, Saadia S. Clinico-radiological and bronchoscopic predictors of microbiological yield in sputum negative tuberculosis in Pakistan. Monaldi Archives for Chest Disease. 2022;92(3).