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Clinical Profile and Immunocompromising Conditions among Newly Diagnosed Tuberculosis Patients: A Prospective Observational Study

Niraj Bam[1], Bibek Shrestha[2], Bikash Mishra[2], Amrit Pandey[2]

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[1] Tribhuvan University Teaching Hospital, Kathmandu, Nepal
[2] Maharajgunj Medical Campus, Institute of Medicine, Tribhuvan Univeristy, Kathmandu Nepal

ABSTRACT

Background: In low and middle-income countries, Tuberculosis (TB) continues to be a significant public health challenge. Active disease, atypical presentation, delayed diagnosis, and poor outcomes are more common in immunocompromised patients; however, information on the clinical profile of these patients is limited in Nepal. The objectives of this study are to describe the clinical presentation, profile and immunocompromising status of newly diagnosed tuberculosis patients and to compare the selected clinical features of immunocompromised patients with non-immunocompromised patients.

Methods: This was a prospective observational study conducted from June 2025 to April 2026. One hundred sixty newly diagnosed patients with pulmonary tuberculosis, extrapulmonary tuberculosis, or both were enrolled consecutively.

Results: Among 160 patients, 85 (53.1%) were male, and 94 (58.8%) were from urban areas. The age group of greater than 60 years was the most common (32.5%). Pulmonary TB was the most common type (76.9%), followed by extrapulmonary (20.0%) and combined TB (3.1%). Cough was the most frequent symptom (68.8%), followed by fever (63.7%), weight loss (62.5%), night sweats (53.8%) and loss of appetite (53.1%). In total, there were 102 (63.7%) immunocompromised patients. The most prevalent immunocompromise conditions among all participants were diabetes mellitus (13.1%), severe malnutrition (8.8%) and chronic liver disease (6.9%). Immunocompromised patients were much more likely to have a fever and night sweats.

Conclusion: Most of the newly diagnosed tuberculosis patients had immunocompromising status, especially diabetes mellitus, malnutrition and chronic liver disease. There was a significant association between fever and night sweats with immunocompromised status, thus routine evaluation of underlying immune-impairing diseases in the care of tuberculosis is warranted.

Keywords: Clinical profile; immunocompromised ; tuberculosis.

Correspondence to:
Dr. Niraj Bam
Department of Pulmonology and Critical Care Medicine
Tribhuvan University Teaching Hospital
Kathmandu, Nepal
Email: nirajbam19@gmail.com

BACKGROUND

Despite TB's eradication in most parts of the world, it is still a considerable public health problem in Low Middle Income Countries (LMIC), and its comorbid illness, malnutrition and limited access to health care, in conjunction with the delayed diagnosis, remain a challenge to TB control (1) driven by a combination of social determinants including undernutrition, fragile health systems, conflict-related disruptions, human mobility and displacement, sub-optimal programmatic implementation, and insufficient domestic investment. These programmatic and governance constraints operate within a broader geopolitical context marked by conflict, sanctions, protracted crises, and large-scale

displacement, which further limit countries' ability to deliver uninterrupted TB services. In 2023, the region's TB incidence was estimated at 116 per 100,000 population, with Pakistan alone accounting for about 73% of the regional burden. Despite a multitude of efforts, progress in reducing the TB burden in the EMR remains slow, with high case detection and treatment coverage gaps, low uptake of TB preventive treatment (TPT. Despite the availability of highly effective and affordable anti-tubercular therapy, the burden of TB is still high, resulting in significant morbidity and mortality and the lack of progress towards the End TB Strategy goal (2).

Individuals with reduced host immunity (immunocompromised) will be more susceptible to develop symptoms of active tuberculosis due to their inability to control Mycobacterium tuberculosis (3coughing). Tuberculosis can manifest differently and be more severe in people with diabetes mellitus, HIV infection, long-term corticosteroid use, immunosuppressive therapy, chronic kidney disease, chronic liver disease, malignancy, malnutrition or post-transplant status (4). The clinical picture of TB may be atypical, extra-pulmonary TB, delayed diagnosis and poor prognosis are the features in these patients. The demographics, clinical presentation, type of TB and underlying immunocompromising conditions of the affected patients need to be understood to recognize early signs and treat them appropriately (5). However, limited information exists locally about TB in these immunocompromised people.

This observational study aims to describe the demographic features, clinical presentation, TB-related profile, and immunocompromising conditions of TB patients and compare some of the clinical features of immunocompromised TB patients with those of non-immunocompromised TB patients.

METHODS

The prospective observational study was carried out from June 2025 to April 2026 after approval from the Institutional Review Committee (IRC) with IRC reference number 705 (6-11)E2, 081/ 082 in newly diagnosed TB patients. Ethical approval was obtained before data collection started. The study was to evaluate the clinical profile, TB-related characteristics and immunocompromised status of the TB patients. Patients were included in the study if they were diagnosed with pulmonary tuberculosis, extrapulmonary tuberculosis or both pulmonary and extrapulmonary tuberculosis. Patients with incomplete information to be used for type of TB diagnosis and clinical presentation, and patients with immunocompromised status were excluded.

The sample size was determined by using the single proportion formula where n is the desired sample size. The standard normal value Z was set to be 1.96 (corresponding to a 95% confidence level) and allowable margin of error (d) was 0.05. The proportion (p) was taken as 0.097 (9.7%) representing the prevalence of diabetes among tuberculosis patients reported in a previous local studies (6). This calculation based on the study time led to a final sample size of 160 participants. Eligible patients were recruited in a consecutive manner until the required patient sample size was reached.

A structured proforma was used to collect the data. Demographic factors were age group, sex and place of residence. The variables considered for tuberculosis were the type of tuberculosis and the site of extrapulmonary involvement. Pulmonary TB was classified as tuberculosis of the lung parenchyma, while extrapulmonary TB was classified as TB outside the lungs in any other organ e.g. lymph node, gastrointestinal, meningeal and pleural TB. The clinical presentation included cough, fever, weight loss, night sweats, loss of appetite, hemoptysis, chest pain, breathlessness and swelling of the lymph nodes.

Immunocompromised status was defined as having at least one underlying condition that is known to impair host immunity or increase susceptibility to tuberculosis, such as diabetes mellitus, long-term steroid use, immunosuppressive drug use, chronic liver disease, malignancy, pregnancy, chronic respiratory disease, chronic kidney disease, HIV infection, severe malnutrition or being post-transplant. Data were analyzed using statistical software IBM Statistical Package for the Social Sciences (SPSS) version 30.0 (IBM Corp., Armonk, NY, USA). Frequencies and percentages were used to describe categorical variables. Demographic, tuberculosis-related, and clinical variables were compared to immunocompromised status using Pearson's chi-square test and Fischer Exact Test used. Statistically significant was defined as a p-value of < 0.05.

RESULTS

A total of 160 patients with tuberculosis were included in the study. Most participants were male, and the largest age group was ≥60 years. Pulmonary tuberculosis was the predominant disease presentation, accounting for approximately three-quarters of cases, whereas extrapulmonary tuberculosis was considerably less common. Among patients with extrapulmonary disease, lymphadenopathy was the most frequent site of involvement, followed by gastrointestinal tuberculosis, meningitis, and pleural effusion (Table 1).

Cough was the most common presenting symptom, followed by fever and weight loss. More than half of

the participants also reported night sweats and loss of appetite, whereas chest pain, breathlessness, lymph node swelling, and hemoptysis were less frequently observed (Table 2).

Overall, 102 (63.7%) patients were immunocompromised. Diabetes mellitus was the leading underlying immunocompromising condition, followed by severe malnutrition and chronic liver disease. Other causes, including malignancy, HIV infection, chronic kidney disease, chronic respiratory disease, pregnancy, post-transplant status, and long-term corticosteroid or immunosuppressive therapy, were relatively uncommon (Table 3).

Bivariate analysis showed that immunocompromised status was not significantly associated with age group, sex, residence, type of tuberculosis, or site of extrapulmonary tuberculosis (all $p > 0.05$). However, fever and night sweats were significantly more common among immunocompromised patients than among non-immunocompromised patients (69.6% vs. 53.4%, $p = 0.041$; 60.8% vs. 41.4%, $p = 0.018$, respectively). No significant differences were observed for weight loss, hemoptysis, chest pain, breathlessness, or lymph node swelling between the two groups (Table 4).

Table 1. Baseline demographic and tuberculosis-related profile of study participants

Variable	Category	Frequency (n)	Percentage (%)
Age group	<20 years	4	2.5
	20–30 years	8	5.0
	30–40 years	32	20.0
	40–50 years	39	24.4
	50–60 years	25	15.6
	>60 years	52	32.5
Sex	Female	75	46.9
	Male	85	53.1
Residence	Rural	66	41.3
	Urban	94	58.8
Type of tuberculosis	Pulmonary TB	123	76.9
	Extrapulmonary TB	32	20.0
	Both	5	3.1
Site of extrapulmonary TB	Lymphadenopathy	12	7.5
	Gastrointestinal TB	10	6.3
	Meningitis	8	5.0
	Pleural effusion	7	4.4
	Not applicable	123	76.9

Table 2. Clinical presentation among study participants

Clinical feature	Present (n)	Present (%)
Cough	110	68.8
Fever	102	63.7
Weight loss	100	62.5
Night sweats	86	53.8
Loss of appetite	85	53.1
Chest pain	48	30.0
Breathlessness	41	25.6
Lymph node swelling	27	16.9
Hemoptysis	8	5.0

Table 3. Immunocompromised status and underlying immunocompromising conditions

Variable	Category	n (%)
Immunocompromised status	Yes	102 (63.7)
	No	58 (36.3)
Main immunocompromising condition among immunocompromised participants (n = 102).	Diabetes mellitus	21 (20.6)
	Severe malnutrition	14 (13.7)
	Chronic liver disease	11 (10.8)
	Cancer/Malignancy	9 (8.8)
	Chronic respiratory disease	9 (8.8)
	HIV infection	7 (6.9)
	Immunosuppressive drug use	7 (6.9)
	Pregnancy	7 (6.9)
	Chronic kidney disease	6 (5.9)
	Long-term steroid use	6 (5.9)
	Post-transplant status	5 (4.9)
Type of chronic respiratory disease among participants with chronic respiratory disease (n = 9)	Bronchiectasis	4 (44.4)
	Interstitial lung disease	3 (33.3)
	COPD	2 (22.2)

Table 4. Association of demographic, tuberculosis-related, and clinical variables with immunocompromised status among tuberculosis patients

Variable	Category	Non-immunocompromised n (%)	Immunocompromised n (%)	p-value
Age group	<20 years	3 (5.2)	1 (1.0)	0.569
	20–29 years	4 (6.9)	4 (3.9)	
	30–39 years	11 (19.0)	21 (20.6)	
	40–49 years	15 (25.9)	24 (23.5)	
	50–59 years	8 (13.8)	17 (16.7)	
	≥60 years	17 (29.3)	35 (34.3)	
Sex	Female	27 (46.6)	48 (47.1)	0.951
	Male	31 (53.4)	54 (52.9)	
Residence	Rural	24 (41.4)	42 (41.2)	0.980
	Urban	34 (58.6)	60 (58.8)	
Type of TB	Pulmonary TB	45 (77.6)	78 (76.5)	0.211
	Extrapulmonary TB	13 (22.4)	19 (18.6)	
	Both pulmonary and extrapulmonary TB	0 (0.0)	5 (4.9)	
EPTB site*	Gastrointestinal TB	5 (38.5)	5 (20.8)	0.579
	Lymphadenopathy	5 (38.5)	7 (29.2)	
	Meningitis	2 (15.4)	6 (25.0)	
	Pleural effusion	1 (7.7)	6 (25.0)	
Clinical symptoms	Fever	31 (53.4)	71 (69.6)	0.041
	Weight loss	37 (63.8)	63 (61.8)	0.799
	Night sweats	24 (41.4)	62 (60.8)	0.018
	Hemoptysis	4 (6.9)	4 (3.9)	0.462
	Chest pain	16 (27.6)	32 (31.4)	0.615
	Breathlessness	14 (24.1)	27 (26.5)	0.745
	Lymph node swelling	7 (12.1)	20 (19.6)	0.221

Percentages for EPTB site were calculated among patients with extrapulmonary involvement (13 non-immunocompromised and 24 immunocompromised patients, including those with both pulmonary and extrapulmonary tuberculosis). All other percentages were calculated using the total number of participants within each immunocompromised status group (n=58 and n=102, respectively).

DISCUSSION

In this cross-sectional study of 160 TB patients, about two-thirds were immunocompromised, suggesting a high prevalence of immunocompromising diseases among TB patients. The most prevalent type was pulmonary TB followed by EPTB. The pattern is similar to the international patterns of TB where pulmonary disease is the most frequent clinical presentation of TB, but there is also a growing recognition of extrapulmonary forms, particularly in vulnerable populations including those with impaired immunity (7,8). The CDC also states that TB has a predilection for the lungs, but may also involve other parts of the body; that systemic signs and symptoms of TB, including fever, night sweats, weight loss, and loss of appetite, are present in both pulmonary and extrapulmonary disease (9,10).

Cough, fever, weight loss, night sweats, and loss of appetite were the most common symptoms of our group. This is similar to the previous clinical descriptions of patients with active TB in which cough, fever, night sweats, weight loss, anorexia, chest pain, dyspnea, and hemoptysis are commonly noted (11,12). Cough was the most prevalent symptom observed followed by fever and weight loss. These results confirm the classic TB symptom complex, but also suggest that respiratory symptoms may not be adequate in immunocompromised patients for screening, as systemic symptoms may predominate.

One important conclusion of our study was that TB patients with immunocompromised status were more likely to present with fever and night sweats than were non-immunocompromised patients. Fever and weight

loss was present more in immunocompromised patients as compared to non-immunocompromised patients. This is biologically plausible as host immunity may be compromised and lead to changes in inflammatory response and clinical disease course of TB (13). The literature has also attributed that patients with immune dysfunction might have more severe, chronic, or atypical symptoms of TB (14). A study of TB patients with diabetes reported that diabetic TB patients were more symptomatic, having higher scores of symptoms, such as cough, hemoptysis, dyspnea, fever, night sweats, and weight loss (15).

In our study, diabetes mellitus was the largest group of immunocompromising disorders, severe malnutrition being the second, and chronic liver disease the third. This aligns with the known epidemiological evidence of co-infection of TB and metabolic or nutritional comorbidities (16). Diabetes, HIV infection, and undernutrition are key comorbidities that raise the risk of TB, with undernutrition meaning there is a greater risk of TB and HIV significantly increasing the risk of TB (17).

Our study found no statistically significant association between immunocompromised status and TB type and extrapulmonary TB site despite the high burden of immunocompromised status. This contrasts with some studies that have indicated that HIV and other types of cell-mediated immunity deficiencies were linked to increased extrapulmonary involvement (18–20). In recent years, for instance, there has been a report that HIV infection is associated with greater risk of extrapulmonary TB than pulmonary TB (21). Our cohort did not show a significant association which may be attributed to the relative small size of the extrapulmonary group, the heterogeneity of the immunocompromising conditions and the relative lack of cases with HIV as the primary underlying condition as compared to other underlying conditions such as diabetes.

There is need to routinely assess immunocompromising conditions among TB patients particularly diabetes, malnutrition, HIV, chronic organ disease, malignancy, and immunosuppressive therapy, in view of these results. The early recognition of these conditions could lead to better diagnostic suspicion and individualization of clinical practice among high-risk TB cases, and help clinicians to anticipate atypical presentation. The results obtained are based on the study tables included in the manuscript attached.

CONCLUSION

Immunocompromising conditions were common among newly diagnosed tuberculosis patients, with diabetes mellitus, severe malnutrition and chronic liver disease being the leading underlying conditions. Fever and night sweats were significantly more frequent among immunocompromised patients compared with non-immunocompromised patients. These findings highlight the importance of routine screening for underlying immunocompromising conditions in tuberculosis patients.

Conflict of Interest

The authors declare no conflict of interest.

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