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Cutaneous Manifestations of Tuberculosis: A Prospective Observational Study from a Tertiary Care Centre

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KEYWORDS

Cutaneous tuberculosis, lupus vulgaris, scrofuloderma, tuberculid, granulomatous inflammation.

ABSTRACT:

Introduction: Cutaneous tuberculosis (CTB) represents an uncommon manifestation of extrapulmonary tuberculosis, particularly in endemic regions. Its diverse clinical presentations and paucibacillary nature often pose diagnostic challenges, leading to delays in recognition and treatment.

Objectives: To evaluate the clinical spectrum, histopathological characteristics, and therapeutic response of cutaneous manifestations of tuberculosis in patients attending a tertiary care centre..

Methods:A prospective observational study was conducted in the Department of Dermatology at a tertiary care hospital over a three-month period. Forty adult patients with confirmed pulmonary or extrapulmonary tuberculosis presenting with cutaneous lesions suggestive of CTB were included. Detailed demographic and clinical data were recorded. Skin biopsies were performed for histopathological evaluation, and microbiological investigations including Ziehl–Neelsen staining were undertaken where indicated. All patients received standard anti-tubercular therapy, and treatment response was assessed during follow-up..

Results: The majority of patients were in the 31–60-year age group, with a male predominance (26/40, 65%). Lupus vulgaris was the most common clinical variant (12/40, 30%), followed by scrofuloderma (9/40, 22.5%) and tuberculids (7/40, 17.5%). Lesions most frequently involved the face (14/40, 35%) and neck (8/40, 20%). Histopathological examination revealed granulomatous inflammation in all cases, with caseating granulomas observed in 32 patients (80%). Acid-fast bacilli positivity was demonstrated in 28 patients (70%). Following initiation of anti-tubercular therapy, complete clinical improvement was noted in 28 patients (70%), while 9 patients (22.5%) showed partial response.

Conclusions: Cutaneous tuberculosis demonstrates varied clinical morphology and should be considered in patients presenting with chronic dermatological lesions in tuberculosis-endemic settings. Clinicopathological correlation facilitates early diagnosis, and timely initiation of anti-tubercular therapy results in favorable therapeutic outcomes.

1. Introduction

Tuberculosis continues to be a major public health problem, particularly in developing countries such as India. Despite advances in diagnosis and treatment, TB remains one of the leading causes of infectious disease-related morbidity and mortality worldwide [1]. While pulmonary tuberculosis constitutes the majority of cases,

extrapulmonary tuberculosis accounts for approximately 15–20% of all TB cases, with higher prevalence in immunocompromised individuals [2].

Cutaneous tuberculosis (CTB) represents a small proportion of extrapulmonary TB, accounting for about 1–2% of cases [3]. Despite its rarity, CTB is of considerable clinical importance due to its diverse presentations, chronic course, and association with systemic disease. The skin may be involved through direct inoculation, contiguous spread from underlying structures, hematogenous dissemination, or as an immunological hypersensitivity reaction, referred to as tuberculids [4].

The clinical manifestations of CTB are influenced by host immunity, bacillary load, and route of infection. Lupus vulgaris is the most common form, presenting as slowly progressive plaques or nodules, frequently involving the face and neck [5]. Scrofuloderma arises due to direct extension from underlying tuberculous lymph nodes or bones, while tuberculids represent immune-mediated reactions occurring in patients with an internal focus of tuberculosis [6].

Diagnosis of CTB is often challenging due to its variable morphology and low yield of acid-fast bacilli on staining. Histopathological examination plays a crucial role, typically revealing granulomatous inflammation with or without caseation [7]. Early diagnosis is essential, as cutaneous lesions may serve as markers of underlying systemic TB.

2. Objectives

This study was undertaken to analyze the clinical spectrum, histopathological findings, and treatment response of cutaneous tuberculosis in a tertiary care setting.

Methods

Study Setting

This study was conducted in the Department of Dermatology at Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India. The institution is a tertiary care teaching hospital catering to both urban and rural populations and functions as a referral centre for tuberculosis management in the region.

Study Design and Reporting Compliance

This was a prospective observational study carried out over a period of three months from August to October 2025. The study was designed and reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for observational studies.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of Rohilkhand Medical College and Hospital, Bareilly (Approval No: IEC/RMCH/24/2025/APR; Date of Approval: 12 August 2025). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (2013 revision). Confidentiality of patient information was strictly maintained, and data were anonymized prior to analysis.

Patient Consent Agreement

Written informed consent was obtained from all participants before enrollment in the study. Patients were informed about the purpose of the study, procedures involved, potential risks and benefits, and their right to withdraw at any stage without affecting their treatment. Privacy and confidentiality were ensured throughout the study period.

Type of Sampling and Reasons for Selection

A convenience sampling technique was employed. All eligible adult patients presenting with confirmed pulmonary or extrapulmonary tuberculosis and associated cutaneous lesions during the study period were consecutively recruited. This approach was adopted due to feasibility constraints and the limited duration of the study.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients aged 18 years and above
- Confirmed diagnosis of pulmonary or extrapulmonary tuberculosis
- Presence of cutaneous lesions clinically suggestive of tuberculosis
- Provision of written informed consent

Exclusion Criteria

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- Patients with non-tuberculous dermatological conditions
- Patients with incomplete clinical data
- Pediatric patients (below 18 years of age)
- Patients unwilling to provide consent

Data Collection Instruments and Procedures

A structured and pre-designed clinical proforma was used to collect demographic and clinical data, including age, gender, occupation, comorbidities, type of tuberculosis, duration of illness, and prior treatment history.

A detailed dermatological examination was performed in all patients under adequate illumination. Lesions were assessed for morphology, number, size, color, surface characteristics, anatomical distribution, progression, ulceration, discharge, scarring, and associated lymphadenopathy. Based on clinical findings, lesions were categorized into specific variants of cutaneous tuberculosis.

Skin biopsy specimens were obtained from representative active lesions under aseptic precautions after administration of local anesthesia. Specimens were fixed in 10% buffered formalin and processed for histopathological examination. Sections were stained with hematoxylin and eosin (H&E) and evaluated for epithelioid granulomas, Langhans giant cells, and caseation necrosis. Ziehl–Neelsen staining was performed to detect acid-fast bacilli (AFB) where indicated.

All patients were treated with standard anti-tubercular therapy (ATT) comprising rifampicin, isoniazid, pyrazinamide, and ethambutol as per national tuberculosis control program guidelines. Follow-up visits were scheduled to monitor therapeutic response and adverse effects.

Accuracy, Reproducibility, and Quality Control

Histopathological slides were independently reviewed by two experienced pathologists to ensure diagnostic consistency. Laboratory procedures followed standardized operating protocols. Data entry was verified by two independent investigators to minimize transcription errors. Clinical photographs were taken where feasible to document lesion progression and treatment response.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 23. (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic and clinical variables. Categorical variables were expressed as frequencies and percentages. Owing to the observational and descriptive nature of the study, inferential statistical tests were not applied. A p-value <0.05 was considered statistically significant where applicable.

3. Results

A total of 40 adult patients presenting with cutaneous manifestations of tuberculosis were included in the study during the defined study period. All participants had confirmed pulmonary or extrapulmonary tuberculosis with associated dermatological involvement.

Demographic and Clinical Characteristics

The majority of patients were in the middle-age group, with most cases occurring between the third and sixth decades of life. There was a slight male predominance in the study population. A substantial proportion of patients were engaged in occupations involving outdoor or manual labor.

Pulmonary tuberculosis was the most commonly associated systemic form, while a smaller proportion of patients had extrapulmonary involvement. A minority of patients reported comorbid conditions such as diabetes mellitus, hypertension, or HIV infection. Most patients presented within six months of onset of dermatological symptoms, although delayed presentation beyond six months was also observed in a subset of cases.

Clinical Spectrum of Cutaneous Tuberculosis

Multiple clinical variants of cutaneous tuberculosis were observed. Lupus vulgaris represented the most frequently encountered presentation. Other variants included scrofuloderma, tuberculids, papulonecrotic tuberculosis, miliary tuberculosis, and verrucous tuberculosis.

Lesions varied in morphology and included plaques, nodules, ulcerative lesions, and sinus-forming tracts. Chronicity and slow progression were common features across most variants.

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The distribution of clinical variants is illustrated in Figure 1.

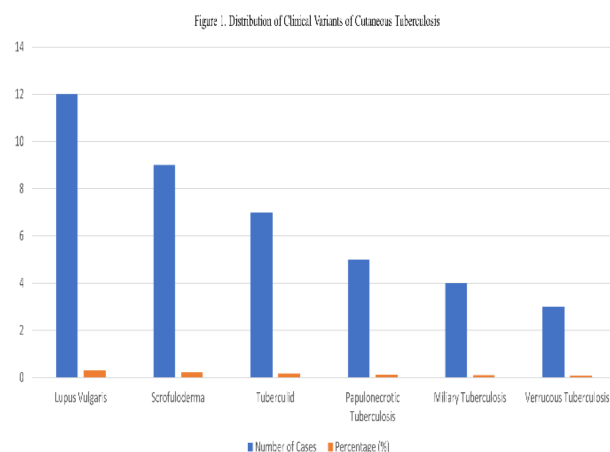

Figure 1. Distribution of Clinical Variants of Cutaneous Tuberculosis

Anatomical Distribution

The face was the most frequently involved anatomical site, followed by the neck and extremities. Truncal involvement was less common, and genital involvement was observed in a small number of cases.

Some patients presented with localized disease, while others exhibited involvement of multiple sites. Regional lymphadenopathy was noted in selected cases, particularly in patients with scrofuloderma.

Histopathological Findings

Histopathological examination of biopsy specimens demonstrated granulomatous inflammation in all cases. Epithelioid cell granulomas with Langhans-type giant cells were consistently observed.

Caseation necrosis was identified in a majority of specimens, while non-caseating granulomas were observed in a smaller proportion. Ziehl–Neelsen staining demonstrated acid-fast bacilli in selected cases.

Microbiological confirmation was limited in some patients due to the paucibacillary nature of the lesions.

Treatment Outcomes

All patients received standard anti-tubercular therapy according to national treatment guidelines. Follow-up assessments demonstrated clinical improvement in the majority of cases.Complete resolution of lesions, with or without residual scarring, was observed in most patients. Partial regression of lesions was noted in some cases. A small number of patients demonstrated minimal response during the follow-up period.

Treatment response distribution is presented in Figure 2.

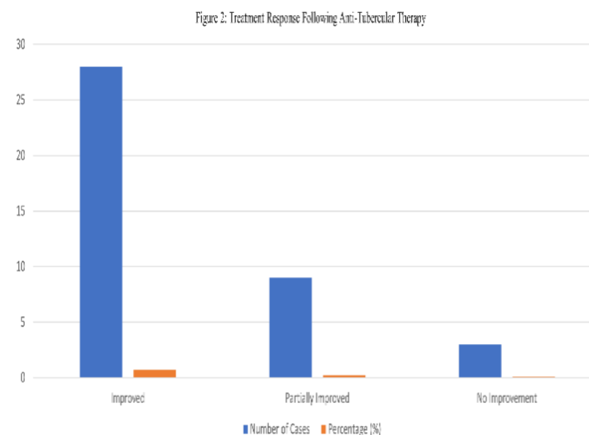

Figure 2: Treatment Response Following Anti-Tubercular Therapy

Key Findings

The most common clinical variant observed was lupus vulgaris. Granulomatous inflammation was a universal histopathological feature. The majority of patients demonstrated favourable clinical response following standard anti-tubercular therapy.

Discussion

Cutaneous tuberculosis (CTB) represents a relatively uncommon but clinically important manifestation of extrapulmonary tuberculosis, particularly in countries with a high disease burden such as India. Although the overall proportion of cutaneous involvement remains low compared with pulmonary disease, recent global and national reports continue to highlight the sustained burden of tuberculosis and the need for vigilance in atypical presentations [1,23]. The varied morphological spectrum and paucibacillary nature of CTB often contribute to diagnostic delay.

In the present study, lupus vulgaris emerged as the predominant clinical variant. This observation is consistent with recent Indian hospital-based studies conducted between 2021 and 2024, which have similarly reported lupus vulgaris as the most frequently encountered form in tertiary care settings [6,7,30]. The chronic, slowly progressive course of this variant often results in delayed presentation. Contemporary Indian literature also notes the frequent involvement of exposed areas such as the face and neck, likely due to

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hematogenous dissemination and local vascular factors [6,22].

Scrofuloderma was the next commonly encountered variant in our cohort. Recent Indian studies have described a comparable pattern, particularly in association with underlying tuberculous lymphadenitis [7,18]. Its occurrence underscores the importance of evaluating deeper anatomical structures in patients presenting with nodules, ulcers, or sinus tracts. Failure to recognize underlying systemic involvement may result in incomplete management and persistent disease.

Tuberculids constituted a smaller subset of cases in this study. Current evidence describes tuberculids as immunologically mediated hypersensitivity reactions occurring in individuals with an internal focus of tuberculosis and relatively preserved immune status [11,25]. Because these lesions are typically paucibacillary, microbiological confirmation is often challenging. Recent literature emphasizes that diagnosis relies heavily on clinicopathological correlation and response to therapy rather than direct bacillary detection [16,24].

Histopathological evaluation played a central role in confirming diagnosis. The presence of epithelioid granulomas, with or without caseation necrosis, remains a key diagnostic hallmark. Recent publications have reaffirmed that histopathology continues to be indispensable, especially in resource-limited settings where advanced molecular testing may not be routinely available [5,19]. Although molecular techniques such as PCR and GeneXpert have improved diagnostic sensitivity in extrapulmonary tuberculosis, their role in cutaneous disease remains adjunctive [24,28]. The relatively limited detection of acid-fast bacilli in cutaneous lesions reported in contemporary studies reflects the inherently paucibacillary nature of many CTB variants [16].

Clinical response to standard anti-tubercular therapy was generally favorable in this study. Similar therapeutic outcomes have been reported in recent Indian and international literature, reinforcing the effectiveness of multidrug therapy when initiated promptly [8,27]. Suboptimal or delayed responses described in other studies have been attributed to factors such as late presentation, irregular treatment adherence, drug resistance, or associated comorbidities including diabetes mellitus and immunosuppression [20,27,31].

An important implication of this study is the critical role of dermatologists in early recognition of systemic tuberculosis. Recent Indian data emphasize that cutaneous lesions may occasionally represent the initial manifestation of underlying disease, providing an opportunity for timely diagnosis and systemic evaluation [18,30,32]. Early intervention not only improves dermatological outcomes but also contributes to broader tuberculosis control efforts in endemic regions.

Despite providing meaningful insights into the clinical and histopathological spectrum of CTB, this study has certain limitations, including a relatively small sample size, single-center design, and limited follow-up duration. Larger multicentric studies incorporating molecular diagnostics and longer follow-up would help further clarify epidemiological trends and long-term treatment outcomes.

Cutaneous tuberculosis, though uncommon, should be considered in patients presenting with chronic dermatological lesions, especially in TB-endemic areas. Clinicopathological correlation and early initiation of anti-tubercular therapy lead to favorable outcomes and reduced morbidity.

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