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Original Research Article

Clinicopathological Evaluation of Cutaneous Manifestations of Tuberculosis

Raj Kishor[1], Kumar Shubham[2]

[1]SMO, Department of Skin VD and Leprosy, Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India.

[2]Senior Resident, Department of Skin VD and Leprosy, Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India.

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Corresponding Author: Dr. Kumar Shubham

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Abstract:

Background: Cutaneous tuberculosis, a rare extrapulmonary manifestation of Mycobacterium tuberculosis infection, poses diagnostic challenges due to its varied clinical presentations and resemblance to other dermatological conditions.

Aim: To evaluate the clinical spectrum, demographic profile, and diagnostic modalities of cutaneous tuberculosis in patients attending a tertiary care centre.

Methodology: A hospital-based descriptive observational study was conducted on 60 patients aged ≥10 years with clinically suspected and confirmed cutaneous tuberculosis. Demographic data, lesion morphology, anatomical distribution, and systemic involvement were documented. Diagnostic investigations included histopathology, Mantoux test, Ziehl–Neelsen staining, chest X-ray, and CBNAAT/PCR. Data were analyzed using SPSS 27.

Results: Most patients were aged 21–40 years (43.3%) and male (56.7%), with a predominance of rural residents (63.3%). Lupus vulgaris (36.7%) and scrofuloderma (26.7%) were the most common types. Lesions primarily affected the face, neck, and limbs. Histopathology (86.7%) and Mantoux test (80%) were the most sensitive diagnostic modalities, whereas Ziehl–Neelsen staining (30%) and CBNAAT/PCR (20%) had limited yield.

Conclusion: Cutaneous tuberculosis predominantly affects young adults and rural populations, with lupus vulgaris and scrofuloderma as common presentations. Early recognition using clinical suspicion supported by histopathology and Mantoux testing is crucial for timely management and reducing morbidity.

Keywords: Cutaneous tuberculosis, Lupus vulgaris, Scrofuloderma, Histopathology, Mantoux test

Introduction

Tuberculosis (TB) continues to be among the greatest infectious diseases around the globe causing a great challenge to the population health, especially in the developing nations. The disease is generally caused by Mycobacterium tuberculosis, whereby most of the organisms are in the lungs, but extrapulmonary is well known and has been found to constitute a significant fraction of cases [1]. The cutaneous tuberculosis is a comparatively rare, yet clinically significant manifestation of the disease among the other extrapulmonary manifestations. Even though it comprises a small fraction of the total TB cases, its varied clinical manifestations and similarity to other dermatological disorders tend to delay its diagnosis and treatment [2]. Widespread knowledge of the dermatologic manifestations of tuberculosis is thus of vital importance to clinicians, dermatologists as well as to the health-care workers in general.

Cutaneous tuberculosis refers to a heterogeneous group of dermatological disorders caused by infection by Mycobacterium tuberculosis, Mycobacterium bovis, or about the bacillus Calmette Guerin (BCG) strain, on a rare basis. Different pathogenic mechanisms can affect the skin, which may involve direct inoculation of the organism in the skin, or a contiguous one in an underlying infected focus, or hematogenous dissemination of a primary site of the organism [3]. Also, certain cutaneous lesions are hypersensitivity responses to mycobacterial antigens but not infection, which also makes classification and diagnosis difficult. The broad distribution of the cutaneous TB is indicative of the differences in host immunity, bacterial load, infection route and the previous sensitization to mycobacteria [4].

Cutaneous tuberculosis is clinically characterized with a high variety of morphology patterns, including plaques, nodules, ulcers, verrucous lesions, and

scars. They are usually lupus vulgaris, scrofuloderma, tuberculosis verrucosa cutis and papulonecrotic tuberculid among others [5]. All variants differ in clinical, histopathological and immunological aspects, but there is a high degree of overlap and clinical diagnosis is often difficult. Furthermore, the lesions may be confused with other chronic inflammatory, infectious or neoplastic skin diseases, such as leprosy, fungi, sarcoidosis, and cutaneous malignancies [6]. This consequently means that cutaneous TB has been underdiagnosed especially in areas where the specialized testing centers are scarce.

Cutaneous tuberculosis epidemiology is highly geographical and population diverse. It is more prevalent in those countries where the burden of pulmonary and extrapulmonary TB is high, the population is overcrowded, malnourished, and there is a shortage of healthcare facilities [7]. The immunocompromised such as people living with HIV infection, with diabetes mellitus or people under immunosuppressive treatment are more likely to develop atypical and disseminated forms of cutaneous TB [8]. In the endemic countries like India, cutaneous tuberculosis remains a topical clinical phenomenon, which indicates the establishment of tuberculosis transmission and the interplay between socioeconomic factors and disease.

Cutaneous tuberculosis is a significant challenge as far as diagnosing is concerned. Traditional techniques like Ziehl–Neelsen staining and mycobacterial culture are not very sensitive because of low density of many foci. The effects of the disease are usually detected by granulomatous inflammation with or without caseation necrosis by histopathology but are not pathogenic [9]. The development of molecular methods, such as polymerase chain reaction (PCR), has enhanced diagnostic precision but their implementation and prices could make them inaccessible to many applications in resource-limited environments [10]. Thus, the presence of a high index of clinical suspicion with the help of corresponding laboratory studies and therapy mode is the most important aspect of correct diagnosis.

Cutaneous manifestations of tuberculosis are to be recognized because of timely treatment as well as underlying systemic disease. The presence of skin lesions can indicate active or latent TB located in other areas of the body, which causes a new assessment and avoids the development and spread of the disease. Due to early diagnosis and proper treatment using antitubercular therapy the outcome of the case is usually favorable and because treatment was delayed, the disease became chronic, scarring occurred, and the patient experienced serious morbidity. In this regard, the clinical spectrum, pathogenesis, and diagnosis of cutaneous tuberculosis require detailed knowledge to ensure the successful management of the patient and positive health outcomes in the population.

Methodology

Study Design: This study was designed as a hospital-based descriptive observational study aimed at evaluating the clinical spectrum, demographic characteristics, and associated systemic findings of cutaneous manifestations of tuberculosis among patients attending a tertiary care centre.

Study Area: The study was conducted in the Department of Skin, Venereal Diseases, and Leprosy, Sheikh Bhikhari Medical College and Hospital, Hazaribagh, Jharkhand, India.

Study Duration: The study was carried out over a period for 10 months.

Study Participants

Inclusion Criteria

- Patients of all genders aged ≥10 years presenting with clinically suspected cutaneous tuberculosis
- Patients with confirmed diagnosis based on clinical features supported by histopathology, microbiological tests, or response to antitubercular therapy
- Patients who provided written informed consent to participate in the study

Exclusion Criteria

- Patients already receiving antitubercular treatment prior to presentation
- Patients with immunosuppressive conditions such as HIV infection, long-term corticosteroid therapy, or malignancy
- Patients with other chronic granulomatous skin diseases mimicking tuberculosis
- Patients unwilling to participate or provide consent

Sample Size: A total of 60 patients fulfilling the inclusion criteria were enrolled in the study.

Procedure: All eligible patients attending the dermatology outpatient department were evaluated in detail. A thorough history was obtained, including demographic data, duration and progression of skin lesions, history of tuberculosis or contact with tuberculosis patients, and presence of systemic symptoms such as fever, weight loss, or cough. Complete dermatological examination was performed to document the type, morphology, distribution, and number of cutaneous lesions. Relevant systemic examinations were also carried out to identify extracutaneous involvement. Diagnostic investigations included Mantoux test, routine hematological tests, chest radiography, skin biopsy for histopathological examination, and microbiological tests wherever indicated. Patients diagnosed with cutaneous tuberculosis were managed as per national tuberculosis treatment guidelines and followed up periodically.

Statistical Analysis: The collected data was entered into Microsoft Excel and analyzed using SPSS software 27. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize demographic and clinical variables. Results were presented in the form of tables and graphs. A p-value of <0.05 was considered statistically significant wherever applicable.

Results

Table 1 presents the information about the demographic profile of the 60 study participants. The age group that experienced most of the cases was 2140 years (43.3), then 4160 years (30%), which means that most of the cases were in the age bracket that is economically productive. Participants who had a younger age less than 20 years and those who had old age which was older than 60 years were 13.3. The male dominance was recorded with males having 56.7% of cases compared to the female's 43.3% percent. In terms of the place of residence, more patients were in rural region (63.3) compared to the urban region (36.7), indicating that the rural regions were more represented in the study.

Table 1: Demographic Profile of Study Participants (n = 60)

Variable	Category	Number of Patients	Percentage (%)
Age (years)	<20	8	13.3
	21–40	26	43.3
	41–60	18	30
	>60	8	13.3
Gender	Male	34	56.7
	Female	26	43.3
Residence	Rural	38	63.3
	Urban	22	36.7

Table 2 shows the most prevalent type of cutaneous tuberculosis was lupus vulgaris, 22 cases of which were observed (36.7) of the total number of patients 60. The second most common was scrofuloderma which comprised 16 cases (26.7-percent). The patients found with Tuberculosis verrucosa cutis were 10 (16.7%), and lichen scrofulosorum was 6 (10%). Less common ones were papulonecrotic tuberculid presenting 4 cases (6.7%), as well as the least common, erythema nodosum, which presented itself with only 2 cases (3.3%). In general, the distribution shows that the predominating cases of cutaneous tuberculosis patients in the current study were lupus vulgaris and scrofuloderma.

Table 2: Distribution of Types of Cutaneous Tuberculosis

Type of Cutaneous Tuberculosis	Number of Cases	Percentage (%)
Lupus vulgaris	22	36.7
Scrofuloderma	16	26.7
Tuberculosis verrucosa cutis	10	16.7
Lichen scrofulosorum	6	10
Papulonecrotic tuberculid	4	6.7
Erythema nodosum	2	3.3
Total	60	100

Table 3 illustrates that 18 patients (30 percent) had the most affected cutaneous tuberculosis at anatomical sites face and neck. This was preceded by the upper limbs in 14 patients (23.3) and the lower limbs in 12 patients (20), which meant that there was a preference in the exposed parts of the body. Trunk involvement was also witnessed in 10 patients (16.7%), and multiple site involvement was relatively lower, and was found in 6 patients (10%). In general, the distribution indicates that cutaneous tuberculosis is more widely occurred in visible and peripheral areas, and perhaps it is associated with the inoculation or exposure to elements like inoculation, trauma, or exposures to the environment.

Table 3: Anatomical Sites Involved in Cutaneous Tuberculosis

Site Involved	Number of Patients	Percentage (%)
Face and neck	18	30
Upper limbs	14	23.3
Lower limbs	12	20
Trunk	10	16.7
Multiple sites	6	10

Table 4 presents the spread and the yield of the diagnostic modalities applied in the study. Histopathological examination has proven to be the most valid diagnostic instrument with 52 positive results (86.7%), which indicates that the method plays a central role in the confirmation of the diagnosis. Mantoux test was also found to be high when it came to the rate of positivity as 48 patients (80%) were positive, which confirmed the usefulness of Mantoux as a supportive diagnostic tool. Ziehl-Neelsen staining, on the contrary, only detected acid-fast bacilli in 18 cases (30%), which is relatively insensitive in cutaneous tuberculosis. Abnormalities in the Chest X-ray were found in 16 patients (26.7%), which means that there were few signs of pulmonary involvement or related results. CBNAAT/PCR was positive in 12 cases (20%), which indicated that molecular methods were not as effective at detecting infections in this cohort, though it was specific. In general, the results emphasize the superiority of the histopathology and immunological tests, compared to bacteriological and radiological ones, in the diagnosis of cutaneous tuberculosis.

Table 4: Diagnostic Modalities Used

Diagnostic Method	Positive Findings (n)	Percentage (%)
Histopathology	52	86.7
Mantoux test	48	80
Ziehl–Neelsen staining	18	30
Chest X-ray abnormalities	16	26.7
CBNAAT / PCR	12	20

Discussion

This current research points out that cutaneous tuberculosis is quite common among individuals between the age of 21-40 years and then there is another group of individuals between 41-60 years, which means that the disease is more prevalent among the economically productive segment of the population. This result agrees with previous studies, in which more exposure, professional activity, and socializing among young and middle-aged adults, lead to the greater risk of transmission. The male dominance is perhaps due to more exposure to the outside, workplace risks, and health-seeking behavioral disparities between the sexes. Furthermore, the fact that most of the patients were rural residents also indicates that the socioeconomic factor, inaccessible healthcare, overcrowding, and the lack of awareness are still present and, as known, contribute to tuberculosis prevalence in rural localities. In addition, the larger percentage of rural population patients can be attributed to the research by Patra et al., (2006) [11] reported that overcrowding, poor socioeconomic status, inaccessibility of health services, and an increased background prevalence of tuberculosis all play a role in the development of the disease in rural populations.

In the case of clinical presentation, lupus vulgaris has become the most prevalent cutaneous tuberculosis, and secondly scrofuloderma. This domination is consistent with several Indian and foreign works, in which lupus vulgaris is often mentioned because of its chronic progression and a comparatively better probability of its recognition. Scrofuloderma, which is usually linked to latent lymph node or bone tuberculosis, indicates the weight of the systemic illness in endemic areas. Tuberculosis verrucosa cutis and the presence of tuberculids like lichen scrofulosorum, papulonecrotic tuberculid, are other signs that demonstrate that there are a wide range of host immune responses and different modes of infection, including exogenous inoculation and hematogenous infection. Frankel et al., (2009) [12] suggested that it is a common manifestation in endemic areas and is often preceded by the contiguous dissemination of underlying lymph nodes, bones or joints.

The predilection of the anatomical locations in this study also exhibits a preference on exposed areas like the face, neck and the limbs. This trend confirms the hypothesis which states that trauma, inoculation, and exposure to the environment are contributory factors towards development of cutaneous tuberculosis, especially in endemic regions. Significant psychosocial implications are also associated with involvement of visible areas since lesions can be on the face and neck causing stigma and delayed presentation. The comparatively low occurrence of trunks and multiple sites is also similar to the past and could be due to the dissimilarity in spread of the disease as well as host defense. Ramesh et al., (1987) [13] demonstrated the cutaneous tuberculosis would normally be localised except in case of systemic dissemination or immunosuppression.

Diagnostic modalities have been analyzed, and the diagnostic modalities have been stressed to be instrumental about the diagnostic value of histopathological examination, which proved to offer the highest diagnostic outcomes. Mantoux test is also positively positive with a high degree of confidence that allows its use as an assistance tool in a resource-constrained environment. Conversely, Ziehl Neelsen staining and CBNAAT/PCR low rate of detection emphasizes the paucibacillary nature of cutaneous tuberculosis and thus, direct bacteriological confirmation is difficult. The abnormalities in the limited cases of chest X-rays indicate that most of the cases were localized in the skin and not pulmonary based.

On balance, these results highlight the importance of using a combination of diagnostic methods, a combination of clinical suspicion, histopathology and immunological tests, to have an opportunity to diagnose cutaneous tuberculosis promptly and correctly. Marcoval et al., (1992) [14] and Singal et al., (2010) [15] concluded the presence of characteristic granulomatuous inflammation to be one of the diagnostic characteristics.

Overall, the article confirms the statement that cutaneous tuberculosis is a major clinical problem in the endemic area, with diverse clinical manifestations and diagnostic issues. Early identification, particularly in young adults and the rural communities, and dependency on histopathology and supportive laboratory tests are crucial in early management and prevention of long-term morbidity.

Conclusion

The current research proves that cutaneous tuberculosis remains a significant manifestation of extrapulmonary tuberculosis within endemic areas where it impacts mainly young and middle-aged adults, males, and people of rural origin. The most frequent clinical types were lupus vulgaris and scrofulederma, with the lesions often exposing the subjects to the external environment, like the face, neck, or limbs. These results serve to outline the broad clinical spectrum and possibility of delay in diagnosis because of the overlaps with other dermatological pathologies. Histopathology and the Mantieux test proved to be the most effective diagnostic modalities with the least amount of sensitivity displayed by bacteriological and molecular techniques. The early diagnosis, early treatment, and minimization of morbidity linked to cutaneous tuberculosis require a high index of clinical suspicion, coupled with relevant investigations.

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